

Proposal and rationale for CLAS quantitative reasoning requirement

Proposal:

1. Students should complete a College Algebra course (currently MATH 101 College Algebra or MATH 104 Precalculus Mathematics) or demonstrate their readiness for further study in calculus, statistics, or other quantitative courses through a score on a standardized mathematics exam or mathematics placement exam (currently an ACT math score of 26, an SAT math score of 600, or a mathematics department placement score of 3). See appendix for learning outcomes of College Algebra.
2. Students should complete a quantitative literacy course beyond College Algebra. The course should be approved for the University Core Curriculum, should be at least 3 credits and should have a College Algebra (or higher mathematics) prerequisite. It must satisfy the following learning outcome:

Upon reaching this goal, students will be able to define a problem, analyze numerical information, apply mathematical principles, and integrate quantitative methods into problem solving.

To meet this outcome a course must achieve all of the following:

- a) Focus on solving problems using functions and numerical techniques.
- b) Require students to apply mathematical or statistical principles to organize or process numerical information.
- c) Require students to use specific quantitative methods to solve problems, and choose appropriate methods for given problems.
- d) Evaluate student performance in the tasks above and use this evaluation for a supermajority of the final course grade.

Intent of the requirement

More and more, mathematical and statistical reasoning pervades our society and economy. Our students need to be able to define a problem, analyze numerical information, apply mathematical principles, and integrate quantitative methods into problem solving. They need to make judgments based on data, to grasp quantitative relationships in economic and political discourse, and to think abstractly in order to understand the uses and implications of new technology. The ability to comprehend and apply mathematical principles is critical in the study of natural and social sciences. The aim of studying mathematics, statistics or other quantitative subjects is not just to acquire specific skills from these courses, but to understand underlying concepts and develop abstract reasoning skills in the quantitative realm, which can facilitate the acquisition of new quantitative and analytical skills in the future.

The quantitative reasoning skills our students need go beyond "college algebra"; indeed, the facility with functions and equations developed in college algebra is a

prerequisite to developing these skills. The background for part 2 of the requirement may be demonstrated by completion of a college algebra or precalculus course, or by performance on a college readiness or mathematics placement exam, but it is not developed in other college courses. Quantitative literacy courses that do not build on the college algebra background are not able to develop quantitative and abstract skills at the level required. Courses in disciplines other than mathematics can complete the quantitative reasoning requirement, but they must satisfy the specified learning outcome and assume and use the skills developed in college algebra (or demonstrated by college readiness or mathematics placement exams).

Among Bachelor's degrees at the University of Kansas, the Bachelor of Arts degree in the College of Liberal Arts & Sciences is unique in its commitment to both breadth and depth of knowledge. Students are expected to pursue a plan of study that includes the humanities, fine arts, natural and mathematical sciences, and social sciences. At the same time they will develop expertise in a discipline. They should acquire general knowledge and skills that will enable them to respond to changing demands and responsibilities in the future. They should be able to integrate their knowledge and use it to think critically about a variety of issues. The BA degree is intended to give graduates the greatest flexibility and choice in future study or career. Any other degree program in the University, without an equivalent quantitative reasoning requirement, serves other purposes. The Bachelor of Arts degree would be substantially changed if this quantitative reasoning requirement were waived or changed.

Bachelor of Arts majors in the College of Liberal Arts and Sciences generally do not prepare students for licensure or certification in a particular field. However, many students who begin in the Liberal Arts and Sciences go on to professional schools at the undergraduate, graduate, or certificate level. In many cases, these require specific preparation in mathematics or quantitative subjects.

Background

Our goal is to prepare KU college graduates for the social and economic demands of the 21st century. The importance of quantitative reasoning for all citizens will continue to grow in the future. We cannot predict the technology and the work environment that our students will face twenty or forty years from now. Even though manufacturing jobs once required no mathematical skills and provided a path for those not finishing high school, today, according to a recent npr report (<http://www.npr.org/2012/07/10/155837962/for-manufacturing-jobs-workers-brush-up-on-math>), manufacturing workers need algebra and trigonometry, our level one math requirements. Today, college graduates need more than first-level math skills. A recent report on quantitative literacy from the Mathematical Association of America noted that "sociologists draw inferences from data to understand human behavior; biologists develop computer algorithms to map the human genome; factory supervisors use 'six-sigma' strategies to ensure quality control;

entrepreneurs project markets and costs using computer spreadsheets; lawyers use statistical evidence and arguments involving probabilities to convince jurors.” To reach the necessary level of quantitative reasoning, one must first achieve competency in college algebra. To understand and calculate with the formulas of statistics, for example, one needs significant experience with variables and their functional relationships.

Most degree programs at the University of Kansas, constituting over 90% of current undergraduate enrollment, currently have at least a second-level mathematics requirement.

The proposal is for only a small change in the mathematics requirement that has been in place for approximately 25 years for the BA and BGS in CLAS. The second part of that requirement was referred to as the "second-level math" requirement. Even then, it was not intended to be restricted to courses in the mathematics department. In fact, one course in biology is on the list of approved courses for the current second-level math requirement. This proposal offers one way to simplify the approval for this requirement by allowing a course satisfying Core goal 1, learning outcome 2, to count, if it has a college algebra prerequisite. Currently on the fast track list the following courses satisfy that condition: ASTR 391, MATH 105, 115, 121, 141, 365, and PHSX 114, 211, 213.