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Mathematics
PATHWAYS

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A Statewide Effort in Arkansas to Align Mathematics Pathways to Non-STEM Programs of Study

This summary is part of the Charles A. Dana Center's "Notes from the Field" series, which highlights examples of innovative practices from colleges, universities, and systems.

Many institutions implementing and scaling mathematics pathways are faced with the challenge of enrolling students in relevant gateway math courses that are aligned to their programs of study. One reason for this challenge is the need for gateway mathematics courses to transfer *and* apply to programs of study reliably and predictably across institutions. The unknown outcome of *whether* a mathematics course will successfully transfer *and apply to a degree* often leads students to take College Algebra—regardless of its alignment or misalignment to their goals—because it is viewed as the "safest" option.

When faculty and policy agencies in Arkansas understood the impact of transfer and applicability[1] on students, they committed to state-level action and coordination to address the problem. In an effort to increase student success in mathematics and increase overall degree completion at a large scale, various Arkansas stakeholders set into motion strategic policy action to provide statewide guidance and alignment of non-STEM mathematics courses to programs of study.

TAKEAWAYS

- *A focus on student success and completion impelled faculty in Arkansas to commit to a statewide effort to align mathematics courses to programs of study.*
- *Mathematics faculty and policy leaders understood and used their state's policy mechanism to address applicability as a barrier to student success.*
- *Faculty drove the process with active support from the state policy agency, and used multiple opportunities and platforms to support broad engagement.*

Background

For more than a decade, the state of Arkansas has been rethinking the relevance of mathematics course requirements across all institutions of higher education. Motivated by the report *A Common Vision for Undergraduate Mathematical Sciences Programs in 2025*,[2] the Arkansas Department of Higher Education (ADHE) defined ambitious, long-term objectives to increase enrollment, graduation rates, and attainment rates of underserved student groups. In 2015, the Arkansas Math Pathways Task Force (AMPTF) was charged to develop expectations and processes that resulted in each public higher education institution in the state to offer mathematics pathways that would increase student success, allow more students the opportunity to complete degree programs, and increase transferability of credits between institutions of higher education. Mathematics faculty from every public two-year and four-year institution in the state was represented on the task force. The Charles A. Dana Center provided technical assistance, resources, and tools to support this work through the Mathematics Pathways to Completion (MPC)[3] project.

In 2017, the AMPTF released its *Arkansas Math Pathways Task Force Recommendations*.[4] The report identified specific recommendations and strategies to dramatically improve higher education outcomes in developmental and gateway mathematics courses. To begin work on the task force recommendations, the AMPTF assigned recommendations to working groups. The Common Math Requirements Steering Committee was charged with planning and implementing Recommendation #2: *Academic disciplines identify math competencies needed for specific programs of study and use competencies to recommend a common transferable math course requirement for each program of study*. (Statistics, College Algebra, Quantitative Reasoning, Calculus)[5]

Challenges

As with many institutions across the nation, institutions in Arkansas traditionally use College Algebra as the default gateway mathematics course for a majority of programs of study, despite the fact that it was designed to prepare students for Calculus and was not intended to be a terminal mathematics course.[6] Data revealed that across Arkansas's four-year institutions, only 8% of degree programs eventually required Calculus, yet 58% of programs of study required College Algebra.[7]

"If we can put College Algebra back to what it's meant to be [a pre-requisite for Calculus], then there will be a greater understanding about the fact it is not really the class we need our students to take because most students are not Calculus-bound."

Dr. Deborah Korth
University of Arkansas, Fayetteville

The mathematics faculty responsible for publishing the 2017 AMPTF report identified a challenge with this new Quantitative Literacy (QL) course. They stated that the single, largest barrier to scaling alternative mathematics pathways in Arkansas was the "lack of agreement and consistency among [partner] disciplines and specific programs of study as to what the transferable math course requirement should be."[8] Challenges, such as uncertainty about transferability and advising into the right pathway, low student enrollment in QL, lack of campus buy-in for QL, and how to align program requirements across Arkansas's institutions, persisted even though an alternative mathematics pathways was developed. Implementing and scaling efforts would require more action to guide institutions.

Solutions

Initiating this work, the Common Math Requirements Steering Committee created a detailed survey instrument to identify mathematical skills most relevant to students majoring in non-STEM fields. With strong support from ADHE, the committee sought input from department chairs/heads for all programs that did not require students

to take Calculus. A total of 370 survey responses were collected from across every public college and university in Arkansas. The results made a strong case that Quantitative Literacy and Introduction to Statistics topics were more closely aligned to those deemed relevant by department chairs/heads than did topics covered in College Algebra. This work is described in detail in *Forging Relevant Mathematics Pathways in Arkansas*.[9]

> *"We believe faculty in disciplines that do not require Calculus should not require students to take College Algebra. Instead, students should be required to take Quantitative Literacy or Introduction to Statistics, which are courses more relevant to their degree programs, future careers, and civic responsibilities."*
>
> Korth et al., 2017

While the Common Math Requirements Steering Committee was doing its work, conversations about alignment to mathematics courses were taking place between institutions. At their annual meeting in July, department chairs/heads from institutions across the state discussed mathematics pathways implementation, remediation challenges, and the fact that QL—rather than College Algebra—was increasingly becoming recognized as the more appropriate course for many students.

Around the same time, the ADHE began a thorough, statewide examination of alignment issues related to QL courses across all programs of study. Math faculty experts were included in the reviews and numerous conversations related to alternatives to College Algebra were ongoing throughout both two-year and four-year institutions.

The Arkansas Department of Higher Education, Common Math Requirements Steering Committee, and math faculty experts saw an opportunity to build upon the survey, faculty discussions, and ADHE activities to align QL courses to relevant programs of study using the state's policy mechanism of the Arkansas Course Transfer System (ACTS).[10] The ACTS is a legislatively backed system that guarantees course transfer across the state. Key milestones followed:

- **Fall 2017:** The ACTS Math Review Committee was formed, comprising math faculty experts, Common Math Requirements Steering Committee members, and ADHE staff. The committee used the survey results to improve the transfer and applicability of QL between institutions of higher education.
- **Spring 2018:** The ACTS Math Review Committee developed recommendations to guide institutions in their efforts to define and accept QL as the general education requirement.
- **April 2018:** The ADHE director, Dr. Maria Markham, published the QL recommendations list[11] along with an endorsement that two-year and four-year institutional leaders implement the recommendations beginning in the fall.[12]

Recommended QL/MR Fields
Communication, Journalism, and Related Programs
Foreign Languages, Literatures, and Linguistics
English Languages, Literatures, and Linguistics
Liberal Arts and Sciences, General Studies, and Humanities
Homeland Security, Law Enforcement, Firefighting and Related Protective Services
Public Administration and Social Services
Visual and Performing Arts
History
Sociology, Political Science
Elementary Education K-6
Special Education
Middle Level Education (Language Arts & Social Sciences)

Figure 1. Broad non-STEM fields that were identified by the ACTS Math Review Committee to accept QL as general education mathematics requirement.

Institutions that implement these recommendations will support students to receive relevant mathematics course content aligned with their fields of study. Further, they will clarify transferability of the QL course to give students a clearly defined pathway to complete their degree requirements no matter where they begin their studies.

This milestone built on effective partnerships between higher education mathematics faculty and the state agency was reached through the ACTS Math Review Committee's actions and the letter of endorsement by the ADHE director. This QL recommendations letter was delivered to all chief academic officers in the state and will help students achieve their academic dreams. ACTS Math Review Committee members Dr. Deborah Korth, Director of Fulbright Student Success at the University of Arkansas at Fayetteville, and Dr. Linus Yu, Department Head of Mathematics at the University of Arkansas at Fort Smith, noted the accomplishments so far: "The work between the faculty and state work has always been about helping students in Arkansas obtain the quantitative tools they need to be successful in their academic and career goals. Their success ensures a better future for all of us."


Dr. Deborah Korth


Dr. Linus Yu

Next Steps

There is still work to be done to implement the QL recommendations, which are voluntary. Discussions need to be held with departments at the institutional level to encourage full adoption across the state.

The ACTS Math Review Committee also plans to further engage faculty in discussions about mathematics pathways alignment.

- The committee will focus on other programs of study, such as Psychology, Business and Nursing, whose mathematics requirements revealed little consensus during the initial statewide survey.
- The Math Pathways Task Force continues to wrestle with whether QL should remain as a prerequisite college-level mathematics course for statistics.
- The committee plans to support statewide discussion about a possible redesign of College Algebra to focus the course outcomes on preparing students for Calculus.

Endnotes

[1] "Applicability denotes a *student-centered* process to ensure that academic pathways (such as mathematics) are properly aligned with students' academic and career interests and that credits consistently apply to their chosen programs of study." Page 1 from Dana Center Mathematics Pathways. (2018). *Different state approaches to transfer and applicability*. Austin, TX: Charles A. Dana Center at The University of Texas at Austin.

[2] Saxe, K., & Braddy, L. (2015). *A common vision for undergraduate mathematical sciences programs in 2025*. Washington, DC: The Mathematical Association of America. Retrieved from http://dcmathpathways.org/resources/common-vision-undergraduate-mathematical-sciences-programs-2025-final-report-draft

[3] http://dcmathpathways.org/where-we-work/mathematics-pathways-completion-mpc

[4] Arkansas Math Pathways Taskforce. (2017). *Arkansas Math Pathways Taskforce recommendations*. Retrieved from https://dcmathpathways.org/resources/task-force-report-arkansas-math-pathways-task-force-recommendations

[5] Page 2 in Arkansas Math Pathways Taskforce, 2017.

[6] Mathematical Association of America, Committee on the Undergraduate Program in Mathematics. (2004). *Undergraduate programs and courses in the mathematical sciences: CUPM curriculum guide 2004*. Retrieved from http://www.maa.org/sites/default/files/pdf/CUPM/cupm2004.pdf

[7] Arkansas Department of Higher Education data, as cited in Arkansas Math Pathways Taskforce, 2017.

[8] Page 2 in Arkansas Math Pathways Taskforce, 2017.

[9] Korth, D., Yu, L., Watson, C., Strecker, M., & Martin, V. (2018). *Forging relevant mathematics pathways in Arkansas*. Austin, TX: Charles A. Dana Center, The University of Texas at Austin. Retrieved from https://dcmathpathways.org/resources/forging-relevant-mathematics-pathways-arkansas

[10] https://acts.adhe.edu/aboutacts.aspx

[11] https://dcmathpathways.org/resources/arkansas-recommendations-mathematics-course-quantitative-literacymathematical-reasoning

[12] http://dcmathpathways.org/sites/default/files/resources/2018-05/ACTS%20Math%20Review%20Committee%20Recommendation%20Letter_QL.pdf

Contact information

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Credits

All images courtesy of Dr. Deborah Korth and Dr. Linus Yu.

About the Dana Center

The Charles A. Dana Center develops and scales mathematics and science education innovations to support educators, administrators, and policy makers in creating seamless transitions throughout the K–16 system for all students, especially those who have historically been underserved. We focus in particular on strategies for improving student engagement, motivation, persistence, and achievement.

The Center was founded in 1991 at The University of Texas at Austin. Our staff members have expertise in leadership, literacy, research, program evaluation, mathematics and science education, policy and systemic reform, and services to high-need populations.

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