

Recommendation #1: All public institutions of higher education in Arkansas adopt multiple math pathways as needed based on the math course requirements of the programs of study offered at their institution.

What is the strategy?

- All public institutions of higher education in Arkansas adopt college level algebra, statistics, and quantitative reasoning (or literacy) pathways as needed based on the math course requirements of the programs of study offered at their institutions.
- Have Governor, Arkansas Department of Higher Education (ADHE), and Arkansas Higher Education Coordinating Board (AHECB) publicly encourage adoption of multiple math pathways.

Why does this recommendation need to be implemented?

- There is a growing consensus, including within the mathematics community (i.e., ASA, MSA, MAA, SIAM), that students need different mathematics skills depending on their programs of study. Too many students are not well served by the traditional algebra-based calculus sequence. In particular the traditional sequence is not the best default option for students given clear evidence that only a relatively small percentage of students are required to take Calculus for their programs of study.
- College Algebra was designed to prepare students for Calculus, and was never intended to be a terminal math course.
- Only 8% of programs of study at four-year colleges in Arkansas eventually require calculus, yet 58% of programs of study require College Algebra. (Source: ADHE data)

Who needs to do what?

- The Arkansas Math Pathways Task Force needs to develop a document that shows the commonalities of the three different transferable math courses for departments considering a change in their current math requirement.
- Chief Academic Officers, Deans and math faculty need to seek institutional commitment to adopt college level algebra, statistics and quantitative reasoning pathways as needed by their institutions unique programs of study offerings.
- Math faculty need to participate in trainings and professional development activities provided by the Dana Center, with input from the Task Force and others, to help learn how to design and teach needed mathematics pathways.
- The Task Force will ask the Governor to publicly endorse adoption of multiple math pathways. Spring 2017.
- ADHE and AHECB will recommend and encourage adoption of multiple math pathways. Spring 2017.
- Institutions will be asked to sign a letter of commitment to adopt multiple math

pathways. Summer 2017.

- ADHE will post degree plans, including math requirements, of all higher education institutions on the ADHE website.

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)

What is the strategy?

- Have faculty from academic disciplines at every two year and four year college identify the math competencies needed to be successful in completing specific programs of study, and use those competencies to identify and recommend a common transferable math course with specific competencies for programs of study within each discipline.
- Create a Common Math Requirements Steering Committee to oversee the work.
- Possibly begin with the high enrollment programs of study (e.g., sociology, psychology, etc).
- Have Governor, ADHE, and AHECB publicly encourage adoption recommended common math requirements.

Why does this recommendation need to be implemented?

- The single biggest barrier to scaling new math pathways at institutions across the state, according to the Arkansas Math Pathways Task Force members, is a lack of agreement and consistency among disciplines and specific programs of study as to what the transferable math course requirement should be. Universal adoption across all public institutions of higher education in Arkansas of a common transferable math course with specific competencies for each program of study will eliminate multiple challenges identified by the task force to scaling new math pathways (i.e., uncertainty related to transfer and advising, low student enrollment, lack of campus buy-in for new math pathways adoption, and how pathways at each institution will be determined).

Who needs to do what?

- Arkansas Math Pathways Task Force members will select a sub-group of members to serve on a Common Math Requirements Steering Committee. Sept 2016.
- ADHE will invite faculty from academic disciplines to complete a survey to identify math competencies for each discipline, which then can be used to identify and recommend a common transferable math course requirement for specific programs of study. Survey to be released in Spring 2017.
- ADHE and AHECB will recommend and encourage adoption of recommended common math course requirements among public institutions of higher education in Arkansas. Spring 2017.
- The Task Force will ask the Governor to publicly endorse adoption of recommended common math course requirements. Spring 2017.
- Institutions will be asked to sign a letter of commitment to adopt the recommended common math course requirements. Summer 2017.

Recommendation #3: All public institution of higher education adopt a co-requisite approach to preparing underprepared students for their required college-level math courses.

What is the strategy?

- Integrate remedial support directly with credit-bearing math courses for most students.
- Focus remedial support only on topics necessary for success in credit-bearing course.
- Have Governor, ADHE, and AHECB publicly encourage adoption of co-requisite approaches.

Why does this recommendation need to be implemented?

- The three-year graduation rate for students taking developmental math courses is 8%, and the five-year graduation rate is 15%.
- The six-year graduation rate for students taking developmental courses is 22%, and the ten-year graduation rate is 25%.
- Substantial research shows that the longer students are in developmental instruction, the less chance they have of graduating.
- Traditional developmental math course sequences not only take too long, but were not designed to prepare students for statistics and quantitative reasoning pathways. Developmental instruction offerings need to be better tailored to these pathways and the college algebra pathway.
- Recent data clearly show that underprepared students can succeed in college-level math courses with co-requisite instructional support at higher rates and in less time as compared to students in traditional developmental sequences (Bailey et al., 2010; California Acceleration Project, 2015; Rutschow & Diamond, 2015; Sowers & Yamada, 2015; Co-requisite Remediation Pilot Study (Tennessee Board of Regents, 2106; Complete College America, 2016).
- The Tennessee Board of Regents, Co-requisite Remediation Pilot Study (2016) found 63.3% of students in a co-requisite approach received a passing grade in the college level math class, compared to 12.3% under the old model; over a 50 percentage point increase.

Who needs to do what?

- Chief Academic Officers, Deans and math faculty need to get institutional commitment to adopt co-requisite approaches for all math pathways at their institutions.
- Chief Academic Officers, Deans and math faculty should participate in trainings and professional development activities provided by the Dana Center and others to help learn how to design and teach co-requisite approaches.
- Advisors need to learn about co-requisite approaches and the support and success students in these models experience so that they will advise students into these

courses.

- ADHE and AHECB will recommend and encourage adoption of co-requisite approaches. Spring 2017.
- The Task Force will ask the Governor to publicly endorse adoption of co-requisite approaches. Spring 2017.
- Institutions will be asked to sign a letter of commitment to adopt co-requisite approaches. Summer 2017.

Recommendation #4: Provide professional development to: 1) support faculty in designing and teaching required college-level math courses and co-requisite approaches, 2) educate faculty, staff and students about the content and benefits of new math pathways, and 3) help advisors understand and be able to advise students into multiple math pathways, and help registrars implement multiple math pathways including co-requisite approaches.

What is the strategy?

- Provide training and technical assistance to math faculty as needed to support the design and implementation of new math pathways.
- Provide training and/or educational materials so that faculty, staff and students can better understand the content and benefit to students of multiple math pathways.
- Communicate to advisors the purpose of math pathways and the larger context of why math pathways are a critical student success strategy so that advisors are better prepared to advise students into multiple math pathways.
- Create a Faculty Professional Development Steering Committee to work with Dana Center to oversee and procure professional development and technical assistance needs.

Why does this recommendation need to be implemented?

- Arkansas Math Pathways Task Force members have indicated a need for training and technical assistance for math faculty to support the design and implementation of new math pathways.
- Many math and statistics faculty, as well as other faculty and administrators, are not familiar with the content and potential benefit to students of multiple math pathways.
- Arkansas Math Pathways Task Force members have indicated that a significant barrier to the scaling of math pathways at institutions is a lack of understanding by academic advisors regarding the pathways and thus a reluctance to advise students into the pathways.

Who needs to do what?

- Arkansas Math Pathways Task Force members will select a sub-group of members to serve on the Faculty Professional Development Steering Committee.
- Faculty Professional Development Steering Committee will work with faculty and Dana Center to identify professional development needs and activities to meet those needs, and identify and disseminate resources and implement trainings to meet the needs.
- Arkansas Math Pathways Task Force members will disseminate materials and

information about the content and benefits of math pathways at their individual institutions.

Recommendation #5: Provide technical assistance to support faculty and staff in developing multiple measures for student assessment and placement into math pathways.

What is the strategy?

- Identify multiple measures (two or more) that have validity for assessing student's readiness for college level algebra, statistics and quantitative reasoning.
- Support faculty and staff in developing a multiple measures policy for use at their institution.
- Create a Multiple Measures Steering Committee to oversee the work of identifying valid multiple measures and supporting institutional adoption.

Why does this recommendation need to be implemented?

- Research indicates that the use of standardized tests as the single measure for assessing a student's readiness for college can lead to significant miss-placement of students.
- Too many institutions of higher education in Arkansas are still relying on a single standardized test to place students into mathematics courses.
- Arkansas Math Pathways Task Force members have indicated a need for technical assistance to develop multiple measures for placing students into math pathways.

Who needs to do what?

- Arkansas Math Pathways Task Force members will select a sub-group of members to serve on a Multiple Measures Steering Committee.
- Multiple Measures Steering Committee will work with the Dana Center, ADHE and possibly engage others such as Community College Research Center to identify multiple measures and support institutions in adopting a multiple measures policy.
- ADHE will publicize the steering committee work and recommend and encourage the adoption of the multiple measures that are identified.

Recommendation #6: Review ACTS language related to recommended pre-requisites for college-level introductory statistics, and identify mathematics skills needed to best prepare for college-level introductory statistics.

What is the strategy?

- Create a Statistics Pre-requisites Steering Committee to review ACTS language related to recommended pre-requisites for college level introductory statistics, especially the language that highly recommends College Algebra as the pre-requisite.
- Steering Committee will identify and recommend math competencies and pre-requisite course(s) so that conflicts in pre-requisites across institutions can be reduced or eliminated.

Why does this recommendation need to be implemented?

- College Algebra was not designed to prepare students for success in college level introductory statistics, and recommending College Algebra as a pre-requisite to college level introductory statistics only reinforces the current problem of the misalignment between the math skills students need and the math skills students are required to learn.
- American Statistical Association does not recommend College Algebra as a pre-requisite to college level introductory statistics.
- Colleges need some flexibility to design more appropriate pathways for statistics, but at the same time institutions need to be encouraged to adopt a similar prerequisite so that conflicting prerequisites across institutions can be avoided.

Who needs to do what?

- Arkansas Math Pathways Task Force members will select a sub-group of members to serve on a Statistics Pre-requisites Steering Committee.
- ADHE needs to recommend to AHECB changes in ACTS policy that reflect the recommendations of the Steering Committee.
- AHECB needs to approve the ADHE recommendation.

Recommendation #7: Develop, identify and disseminate strategies and best practices for transitioning students between math pathways should students change majors and encounter a new math course requirement.

What is the strategy?

- Support institutions to develop strategies to transition students between math pathways should the student's math course requirements change due to a change in the student's chosen program of study.
- Especially important will be strategies to transition students who have completed quantitative reasoning but are required to take college algebra or statistics due to a change in the student's chosen program of study.
- Collect and disseminate strategies and proven practices so that other institutions can learn from the work that has been done.

Why does this recommendation need to be implemented?

- Arkansas Math Pathways Task Force members have expressed concerns about how certain pathways, especially quantitative reasoning, will present challenges for students should they chose another program of study with a different math course requirement.
- Identifying strategies and best practices to transition students into different math pathways will help alleviate some of the concerns of faculty and staff related to adopting multiple math pathways and the challenges such pathways can present for student's who change majors.

Who needs to do what?

- Dana Center will gather information on existing strategies and best practices and share that information with the Arkansas Math Pathways Task Force and all public institutions of higher education in Arkansas.
- ADHE and ACC (Arkansas Community Colleges) should establish and manage a community of practice whereby faculty and staff at all public institutions of higher education can meet to receive training and professional development and continually share strategies and best practices.

Recommendation #8: Gather and disseminate data that indicate the impact of multiple math pathways and co-requisite approaches on student outcomes.

What is the strategy?

- Gather existing evidence from Arkansas and elsewhere of the impact of math pathways and co-requisite approaches so that faculty and staff can access data when needed to support efforts to implement change on campus.
- Develop a framework including data measures to track and evaluate the impact in Arkansas of implementing multiple math pathways including co-requisite approaches.
- Have ADHE generate an annual report using the framework and data measures.

Why does this recommendation need to be implemented?

- Arkansas Math Pathways Task Force members have indicated a desire to have more evidence available to help make the case to colleagues about the need for multiple math pathways and co-requisite approaches.

Who needs to do what?

- Dana Center, ADHE or ACC will gather and present existing data in ways that can be easily used by faculty and staff.
- Arkansas Math Pathways Task Force will work with Dana Center, ADHE and CCRC to develop a framework for tracking and reporting progress on implementation of multiple math pathways and co-requisite approaches.
- ADHE will generate an annual report using the framework.