



MONTANA UNIVERSITY SYSTEM

Office of the Commissioner of Higher Education

MUS Math Pathways Report

*Aligning Mathematics Pathways Across the Montana University System:
Reducing Barriers, Improving Transfer and Dual Enrollment Alignment, and Supporting
Student Success*

Prepared by the MUS Math Pathways Taskforce 2.0 ~ 2025–2026

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Mathematics Courses Referenced in This Report

| Course | Title |
|-----------------|-------------------------------------------------------------------------------------|
| M105 | Contemporary Mathematics |
| M111 | Technical Mathematics |
| M114 | Extended Technical Mathematics |
| M115 | Probability and Linear Mathematics |
| M120 | Math with Healthcare Applications |
| M121 | College Algebra |
| M140 | College Math for Healthcare |
| M141 | Mathematics for Business and Social Science |
| M143 | Finite Mathematics |
| M161 | Survey of Calculus |
| M162 | Applied Calculus |
| M1XX | Modeling with Functions and Data (new, pending Common Course Numbering designation) |
| STAT 216 | Introduction to Statistics |

Executive Summary

The MUS Math Pathways Taskforce 2.0 was formally charged by the Office of the Commissioner of Higher Education (OCHE) to evaluate, redesign, and implement aligned mathematics pathways across the Montana University System. This report presents the Taskforce's process, the evidence gathered, and the resulting recommendations for system-wide mathematics pathway alignment.

This work builds on the 2015 Math Pathways initiative, which documented the barrier that a universal College Algebra requirement posed to non-STEM students and formalized the concept of multiple, purpose-built mathematics pathways. In the years since, the national landscape of mathematics education has shifted substantially: co-requisite models have replaced traditional developmental sequences, data literacy has become a nearly universal requirement across professional fields, and campuses have responded to evolving academic program needs by creating new courses. Without a coordinating framework, however, those campus-level responses have produced inconsistencies in course numbers, prerequisites, and program requirements that create real barriers for transfer and dual enrollment students, particularly as dual enrollment course taking continues to rise. Without common gateway level math courses in the same academic programs across MUS campuses, transfer students and dual enrollment students would have to take additional math courses, which increases time and cost to degree.

The Taskforce conducted a comprehensive analysis of the mathematics courses required by each meta-major across the MUS, at the AA, AS, AAS, BA, BS, and BSN levels, cataloguing mathematics requirements at every institution. This analysis revealed meaningful inconsistencies in gateway math courses in five primary areas: Business, Social Sciences, Nursing and Allied Health, Industrial Technology, and the prerequisite structure for STAT 216. Following the program mapping, the Taskforce surveyed faculty experts in each partner discipline, asking directly what mathematical

skills and competencies their students need for success in their programs and careers. Survey results were analyzed, draft recommendations developed, and discipline faculty were invited into direct dialogue to refine those drafts.

This work was faculty-driven, evidence-based, and conducted in close partnership with discipline experts across the system. At every step, the Taskforce was guided by two complementary commitments: the responsibility of participating in a unified university system and the equally important obligation to honor the autonomy of each campus and its faculty. These are not competing values; they are both essential to sustainable, meaningful reform.

The recommendations in this report are targeted adjustments, not wholesale redesigns. Most existing courses and structures remain unchanged. The STEM pathway through M121 (College Algebra) requires no changes at any institution. M105 retains its role as the quantitative literacy course for humanities and liberal arts. STAT 216 remains the gateway statistics course. M140 continues in its current role. Campus autonomy over course delivery, pedagogy, and local implementation is fully preserved. What changes is the alignment across institutions: which courses serve which programs and which prerequisites reflect actual student needs. The goal is that students moving across the Montana University System do not lose academic ground because of inconsistencies that exist for historical rather than pedagogical reasons. Students stacking credentials from certificates through associate and bachelor's degrees should have a coherent mathematics pathway from start to finish.

Summary of Recommendations

The following table summarizes the changes recommended across each meta-major area. These are targeted alignments, not system-wide overhauls.

| Meta-Major Area | Current State (Varies by Campus) | Recommended Pathway | Key Change |
|-------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Social Sciences | M105, M115, or M121 depending on institution, plus STAT 216 or discipline-specific statistics | STAT 216 as sole math requirement; M105 as prerequisite if needed based on placement | Eliminate misaligned algebra requirements; STAT 216 covers all 21 top-priority outcomes at 100% faculty agreement (see Table 1 in Social Sciences section for representative outcomes) |
| Nursing (4-year) | M140 or M121 (inconsistent system-wide) | M140 preferred; M121 accepted as alternative | M140 covers the top 4 nursing-identified outcomes. Campuses not currently offering M140 may continue with M121, which provides sufficient mathematical preparation for nursing students. |
| Nursing (2-year) | M115, M140, M121, or M120 for LPN | M140 preferred; M121 accepted as alternative; M120 accepted for LPN | M140 allows stackability from 2-year to 4-year pathways. M140 with co-requisite support is preferred for LPN; M120 is an option where M140 co-req is not feasible and the credential is terminal. |
| Allied Health | Inconsistent; varies by program and campus | M105 or M140, based on program certification needs | M140 for calculation-intensive programs (radiologic technology, paramedicine); M105 for programs needing general quantitative literacy (surgical technology). |

| | | | |
|---------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Business | M105, M115, M121, M141, or M143 depending on institution, plus STAT 216 | New unified course: “Modeling with Functions and Data” (M1XX) + STAT 216 | Replace the current patchwork of math courses for Business at different MUS institutions with one purpose-built unified course (M1XX) covering financial math and functions; serves as prerequisite for M161/M162 for students needing calculus. |
| Industrial Technology (Trades) | M111, M114 (no gen-ed credit); M105 where used; inconsistent learning outcomes across campuses | Revamped M111 with aligned CCN outcomes, general-education credit, and asynchronous online version for dual enrollment | Align M111 across MUS to match the content trades faculty identified (high faculty agreement, 75–100%, on applied measurement, geometry, trigonometry, and dimensional analysis); add gen-ed credit; build online DE version for rural access. |
| STAT 216 Prerequisite | M115 at UM, MC, and FVCC; M105 or none everywhere else | M105 as maximum allowable prerequisite; students may place directly into STAT 216 through appropriate placement | Align all MUS institutions. With M115 shifting to serve the business pathway, it is no longer appropriate as a statistics prerequisite. |
| STEM Pathway | M121 (College Algebra) | No change required | The STEM pathway through M121 remains unchanged at all institutions. |

Building on the 2015 Math Pathways 1.0 Foundation

The First Wave: What the [2015 Report](#) Accomplished

In November 2015, the Montana University System presented its initial Math Pathways Report to the Board of Regents. That report represented the first systematic examination of mathematics requirements across MUS institutions and documented how requiring College Algebra for all students regardless of program was creating barriers to completion, particularly for those in non-STEM fields. The 2015 report distinguished between STEM and non-STEM pathways, showed that M121 had the highest enrollment of any gateway math course and a 45% failure rate (5,262 of 11,658 enrollments from Fall 2009 to Spring 2015), and recommended the development of alternative pathways, most notably what would become M105 (Contemporary Mathematics), for students in the humanities and liberal arts.

That work was significant. It gave campuses both the rationale and the encouragement to create alternative math options. Several MUS institutions developed or expanded M105 offerings, and the concept of multiple pathways became embedded in system thinking about mathematics education. The 2015 initiative reflected the first wave of a national movement, driven by organizations such as the Charles A. Dana Center, the Carnegie Foundation for the Advancement of Teaching, and Complete College America, which had identified math placement and completion barriers as among the most consequential equity issues in higher education.

What Has Changed Since 2015

The decade since the first MUS pathways report has brought transformative changes to both the landscape of mathematics education and the needs of students.

The co-requisite revolution. Nationally, co-requisite support models have largely replaced traditional developmental course sequences. Instead of requiring students to complete non-credit remedial sequences of courses below the 100-level before accessing college-level math, co-requisite models provide concurrent support within the gateway course. Data from around the country consistently shows that more underprepared students earn gateway math credit in one semester with co-requisite support than in three years under traditional prerequisite sequences. The evidence on corequisite models is clear: for underprepared students, corequisite math courses increase gateway math course success and decrease time and cost to gateway math course completion.

The mathematical literacy imperative. The importance of data analysis, statistical reasoning, and quantitative literacy has grown across virtually every professional field. This has expanded the range of mathematics pathways needed well beyond the STEM/non-STEM binary of 2015. Business, nursing, allied health, and social sciences all require differentiated mathematical preparation.

An expanded pathway landscape. Several MUS campuses responded to evolving needs by creating additional courses and pathways. While this campus-level responsiveness is commendable, the absence of a coordinating framework has produced inconsistencies across the system: different course numbers, different prerequisites, and different requirements for the same programs at different institutions, creating barriers for transfer and dual enrollment students.

Increased “swirl” of students across MUS institutions and higher demand for credit mobility. Statewide and nationally, students are increasingly pursuing education options that cross institutional borders, whether from transfer, dual credit, or cross-registration. The MUS intentionally designs academic structures to support credit mobility to reduce duplicative course taking or lost credits, to reduce unintended course taking that is not relevant to degrees, and to reduce time and cost to degrees. Roughly 1 in 6 MUS students transfer within the system. Additionally, MUS students can now cross-register. Transfer, cross-registration, and the rapid growth of dual enrollment all increase the need for clear gateway mathematics pathways within each meta-major. Students need assurance that the course they complete at one MUS campus, or through dual enrollment, will apply toward the same program at another MUS campus.

These changes do not diminish the value of the 2015 work; they build upon it. Math pathways are not a one-time policy fix; they require ongoing stewardship, periodic reassessment, and a commitment to aligning course offerings with the actual needs of students and their programs. This second phase represents the maturation of the 2015 effort: moving from establishing two initial pathways for STEM and non-STEM to further refining and systemwide alignment, from individual campus responses to a coherent shared framework, and from policy rationale to operational infrastructure.

This work is complex. All MUS campuses have their unique academic profiles, programs, and students. Math departments serve these unique needs of multiple departments across MUS institutions. The system is balancing the autonomy of institutions and faculty, the present reality of high transfer rates, the increasing pressures of dual enrollment, and the workforce demands of stackable pathways. The math pathways work represented here operates within this complex environment while remaining oriented to the north star of positive student outcomes.

The Case for Mathematics Pathway Reform

The Dana Center’s mathematics pathways framework identifies five characteristics of high-quality math pathways: alignment between secondary and postsecondary systems; alignment to disciplinary and workforce needs; ensuring student progress toward completion through co-requisite models; student-centered communication and advising; and use of evidence-based curriculum and pedagogy. States and systems that have undertaken coordinated math pathways reform (Texas, California, Tennessee, Colorado, and others) have seen measurable improvements in gateway course completion and degree attainment, particularly among first-generation students and students of color.

The evidence is clear: the single greatest predictor of whether a gateway math course creates a barrier is not its rigor, but alignment between the mathematical content taught and the content the student’s program actually requires. Math pathways are not easier courses. They are better-aligned courses that respect students’ time and academic goals.

Dual Enrollment and K–12 Alignment

Dual enrollment is the fastest-growing segment of the college student population in Montana and nationally. With the recent adoption of the STARS Act, which expands state support for dual enrollment in Montana, high schools will increasingly be incentivized to offer dual enrollment courses. Mathematics is among the most common dual enrollment subjects, making math pathway alignment essential for these students.

When pathways are well-designed, dual enrollment students arrive at college with meaningful credits already applied toward their degree. When pathways are misaligned, those same students discover that the courses they took in high school do not fit their intended degree map, and they must repeat coursework at their own expense. Misaligned prerequisites, campus-specific gateway courses, and lack of clarity about which math course to take are documented causes of that backtracking.

The pathway each meta-major recommends is not just the right pathway for students who begin at an MUS institution; it is the pathway that dual enrollment students should be encouraged to take in high school to arrive college-ready for their intended program of study. A companion one-page pathway guide for K–12 partners is being developed alongside this report to make those connections explicit for high school counselors, advisors, and students.

Strengthening the transition from high school to college mathematics requires collaboration between MUS and its K–12 partners. High school advisors, teachers, and counselors need clear guidance about which mathematics courses align with which college pathways, and standardized placement expectations must be communicated transparently. The 2015 report recommended stronger communication between secondary schools and colleges; the Taskforce 2.0’s work makes that recommendation concrete by defining the specific pathways that K–12 partners can advise into.

Taskforce Charge and Membership

Charge

The Montana University System Office of the Commissioner of Higher Education formally charged the MUS Math Pathways Taskforce 2.0 to evaluate, redesign, and implement aligned math pathways across the system. The Taskforce was asked to balance institutional autonomy with system-wide alignment in order to increase student success in mathematics education, improve timely degree completion, ensure seamless credit transferability between institutions, and align mathematics instruction with disciplinary needs and career readiness.

The Taskforce was specifically charged to:

1. Conduct a comprehensive analysis of existing math pathways at all MUS institutions, including developmental sequences, STEM pathways, non-STEM pathways, and career and technical education requirements.
2. Facilitate collaboration between mathematics faculty and partner disciplines to ensure gateway math courses provide the specific content knowledge and competencies needed for success in various programs of study.
3. Develop standardized, evidence-based math pathways that ensure consistent and predictable transfer of mathematics credits across all MUS institutions, aligned with MUS Placement Policy 301.17.
4. Create a comprehensive MUS Math Pathways Policy with an updateable implementation handbook.
5. Improve K–16 transitions, with special attention to dual enrollment course selection and placement.
6. Recommend policy guidelines for developing new mathematics courses within and outside the Common Course Numbering (CCN) system.
7. Review and revise CCN mathematics learning outcomes, including prerequisite courses, to ensure system-wide consistency.
8. Collaborate with Chief Academic Officers to develop institution-specific implementation plans.
9. Design and deliver professional development for advisors, mathematics faculty, and partner discipline faculty.

Taskforce Members

The Taskforce included mathematics faculty, academic leaders, advisors, and OCHE representatives from across the Montana University System. Membership was intentionally broad to ensure that all institutional contexts (four-year research universities, comprehensive universities, and two-year colleges) were represented in every phase of the work.

Our Process: Six Steps from Evidence to Recommendation

The Taskforce designed a six-step process grounded in evidence and structured to keep discipline experts, mathematics faculty, and advisors at the center of every decision. Math faculty brought knowledge of course content and pedagogical rigor; partner discipline faculty brought knowledge of what their students actually need; advisors brought deep knowledge of existing structures, pain points, and the courses where students succeed or are stopped. All were essential. Chief Academic Officers (CAOs) were kept informed and engaged at every stage, not as passive

recipients, but as active partners in a process that ultimately asks campuses to make concrete changes.

Step 1: Mapping the Current State

The Taskforce began with a comprehensive audit of every degree program in the Montana University System (AA, AS, AAS, BA, BS, BSN, and related credentials) across all institutions, cataloging the mathematics and statistics courses required for each. Each campus verified their own data before any analysis began. The resulting dataset documented over 400 four-year degree programs and concentrations and nearly 300 two-year programs and pathways, capturing required math courses, statistics requirements, articulation pathways, and transfer designations. This dataset became the analytical foundation for everything that followed.

This mapping exercise highlighted key metamajors where misalignment may be creating barriers for student success. Students pursuing the same major at different MUS institutions were frequently required to complete different mathematics courses. A business student might need M105 at one campus and M121 at another; a nursing student might take M140 at one institution and M115 at another. From a transfer perspective, these differences are structural barriers.

Transfer Data: Why Alignment Matters

Transfer is a core part of how students navigate their education in the Montana University System. The five-year transfer data shows that the programs most affected by math pathway misalignment are also among the highest-transfer programs in the system:

| Program Area | Transfer Students (5-yr) | Relevance |
|--------------------------------|--------------------------|----------------------------------------------------|
| Liberal Arts & General Studies | 2,164 | Highest transfer volume in system |
| Registered Nursing | 1,544 | Math alignment directly affects transfer admission |
| Business/Commerce | 816 | Five different math courses required system-wide |
| Allied Health | 674 | Pathway inconsistency across campuses |

Source: MUS Transfer Data by Program, last 5 years. Figures represent students who transferred between MUS institutions.

Step 2: Identifying Areas of Misalignment

With verified data in hand, the Taskforce identified five meta-major areas where misalignment was most pronounced and most consequential for students:

Business: Five different mathematics courses required across the system (M105, M115, M121, M141, or M143 depending on institution).

Social Sciences: Inconsistent requirements mixing algebra-based courses with statistics, when faculty data indicated that statistics alone is what students need.

Nursing: M115, M121, and M140 required inconsistently across campuses despite meaningfully different content coverage; no system-wide agreement on which course best serves nursing students.

Allied Health: Inconsistent requirements varying by program and campus, with no standard pathway reflecting the distinct mathematical needs of calculation-intensive versus general-preparation programs.

Industrial Technology: A structural mismatch between content-aligned non-gen-ed courses (M111/M114) and gen-ed courses (M105) whose core content trades faculty rated at 0% importance.

STAT 216 Prerequisites: Three institutions require M115 as a prerequisite for STAT 216 while all others require M105 or allow direct placement. Because STAT 216 serves as both a gateway math course and a required course across multiple meta-majors, this prerequisite inconsistency is a particular challenge for transfer and dual enrollment students.

Step 3: Surveying Partner Discipline Faculty

In addition to mapping current course requirements, findings from a system-wide faculty survey served as the core evidence base for identifying the right gateway courses in the above metamajors. The survey asked discipline faculty what mathematical skills and competencies are needed in each program and to adequately prepare students for future careers in those fields. Chief Academic Officers identified the appropriate faculty contacts at each institution. The survey was developed by Taskforce math faculty, covering a broad range of mathematical outcomes and asking respondents to indicate which they considered important. Respondents were encouraged to discuss the survey with their faculty colleagues before submitting. Surveys were distributed to faculty in Business, Social Sciences (Psychology, Sociology, Anthropology), Allied Health (Paramedicine, Surgical Technology, Radiologic Technology, Respiratory Therapy), Industrial Technology and Trades, and Nursing (two- and four-year programs). The survey was completed by 53 faculty members systemwide, representing disciplines across Business, Social Sciences, Nursing, Allied Health, and Industrial Technology.

Step 4: Subgroup Analysis

Taskforce subgroups were formed for each meta-major area, with members drawn from campuses of different types and sizes. Each subgroup reviewed current gateway course requirements, examined mathematics skills and competencies survey data, identified patterns in faculty priorities, compared those priorities against existing course offerings, and developed preliminary pathway options. The subgroup structure ensured that recommendations were not driven by a single institutional perspective and that two-year and four-year campus realities were both represented.

Dual enrollment considerations were explicitly incorporated into every meta-major analysis, with particular attention to Common Course Numbering alignment and prerequisite consistency. The mathematics course a student takes in high school under dual enrollment may be the gateway to their entire college math experience; if that course does not align with their eventual program of study, they face immediate backtracking upon college enrollment.

Step 5: Engaging Discipline Experts

Draft pathway recommendations were developed by the subgroups and then shared with partner discipline faculty for review, feedback, and refinement. Mathematics faculty are the experts in course design and content rigor, but discipline faculty are the experts in what students in those

disciplines need. Both sets of expertise are required. Meetings were held with partner discipline representatives across the system. Faculty were invited to challenge the analysis, propose alternatives, and identify implementation concerns.

The industrial technology pathway required the most extensive engagement, including multiple meetings with two-year college disciplinary faculty, math faculty, chief academic officers, and institution Deans/CEOs to pressure-test pathway options against the operational realities of trades programs and dual enrollment delivery.

Step 6: CAO Engagement and Campus Feedback

Chief Academic Officers/Provosts were updated at every stage and served as essential intermediaries between the Taskforce and campus communities. A detailed memo summarizing the process and preliminary recommendations was shared with all CAOs before final drafts were circulated. CAOs reviewed recommendations with their campuses and returned feedback that was incorporated into the final recommendations presented in this report. Separate meetings were held with two-year campus CAOs to address the specific complexities of the industrial technology pathway.

Pathway Recommendations by Meta-Major Area

The following sections present the Taskforce’s recommendations for each meta-major area. Each section summarizes the survey findings that drove the recommendation, the specific pathway change proposed, and implementation considerations. Detailed information and data are available in the individual reports.

Social Sciences

Disciplines surveyed: Psychology, Anthropology, Sociology

Recommendation: STAT 216 (Introduction to Statistics) as the sole mathematics requirement. M105 as a prerequisite only if needed based on placement. No additional mathematics courses should be required beyond STAT 216 and its prerequisite.

Table 1. Top-priority outcomes identified by Social Sciences faculty.

| Learning Outcome | Faculty Agreement | Covered By |
|----------------------------------------------------------------------------------------|-------------------|------------|
| Distinguish between observational studies and statistical experiments | 100% | STAT 216 |
| Represent data graphically and describe distributions | 100% | STAT 216 |
| Calculate and interpret measures of central tendency and spread | 100% | STAT 216 |
| Compute and interpret correlation coefficients; distinguish correlation from causation | 100% | STAT 216 |
| Normal distribution characteristics, z-scores, and probability calculations | 100% | STAT 216 |

| | | |
|----------------------------------------------------------------------------|------|----------|
| Sampling distributions, margin of error, and confidence intervals | 100% | STAT 216 |
| Hypothesis testing and interpretation of P-values | 100% | STAT 216 |
| Critically evaluate numerical and graphical presentations in media | 100% | STAT 216 |
| (Plus 13 additional statistical reasoning outcomes, all at 100% agreement) | 100% | STAT 216 |

Table 2. Coverage of Table 1 outcomes by candidate courses.

| Course | Outcomes Covered | Coverage | Recommendation Status |
|------------------------------------|------------------|-------------|----------------------------------------|
| STAT 216 | 9 of 9 | 100% | Recommended |
| M105 (Contemporary Math) | 0 of 9 | 0% | Not appropriate as primary requirement |
| M115 (Probability and Linear Math) | 0 of 9 | 0% | Not appropriate |
| M121 (College Algebra) | 0 of 9 | 0% | Not appropriate |

When asked to identify additional critical math skills not listed in the survey, Social Sciences faculty wrote in: appropriateness of statistical tests and interpretations, and how to use statistical software. Both reinforce the same message: these disciplines need statistical literacy.

STAT 216 also satisfies general education quantitative reasoning requirements, streamlines transfer across MUS institutions, and directly prepares students to engage with research methods in their discipline. Where departments already offer a discipline-specific statistics course with equivalent rigor and content to STAT 216, that course may serve as an appropriate alternative provided articulation agreements are in place to ensure transferability.

Scope: This recommendation applies to Psychology, Anthropology, and Sociology. Adjacent programs such as Substance Abuse and Addictions Counseling, Communication Studies, and Social Work may continue to use M105 as their mathematics requirement at program faculty discretion. Students in these programs who plan to transfer to a four-year campus or pursue a 2+2 pathway are encouraged to take STAT 216. Interdisciplinary or STEM-aligned degree options (e.g., Psychology with a Neuroscience emphasis) will need to require the mathematics course or courses that satisfy both pathways.

Nursing

Recommendation (4-year programs): M140 (College Math for Healthcare) as the preferred mathematics course to complement STAT 216. M121 (College Algebra) accepted as an alternative. Campuses not currently offering M140 may continue with M121, which provides sufficient mathematical preparation for nursing students. M121 should be accepted as satisfying the requirement, but it should not be interpreted as the preferred course for new nursing pathway design where M140 is available.

Recommendation (2-year programs, excluding Certificate of Applied Science (CAS) healthcare degrees): M140 as the preferred pathway. For LPN programs, M140 with co-requisite support is

preferred; where M140 co-requisite support is not feasible and the credential is terminal, M120 (Math with Healthcare Applications) may be appropriate at program faculty discretion.

The nursing faculty survey results provide clear direction. The four highest-rated outcomes are all explicitly covered in M140: using units accurately, decimals and fractions for healthcare calculations, rational equations for ratios and proportions, and metric/household/apothecary measurement systems. Nursing faculty specifically identified dosage calculations, unit conversions, and dimensional analysis as critical skills, all M140 content.

Table 1. Top-priority outcomes identified by Nursing faculty.

| Learning Outcome | Faculty Agreement | Covered By |
|------------------------------------------------------------------------|-------------------|------------|
| Use units accurately | 100% | M140 |
| Decimals, fractions, percents for healthcare calculations | 88% | M140 |
| Rational equations for ratios/proportions (volume, mass, weight, temp) | 75% | M140 |
| Metric, household, and apothecary measurement systems | 75% | M140 |
| Conclusions from observational vs experimental studies | 75% | STAT 216 |
| Reason using ratio and proportions | 63% | M140 |
| Methods for selecting random samples | 63% | STAT 216 |
| Represent data graphically; describe distributions | 63% | STAT 216 |
| Measures of central tendency and spread | 63% | STAT 216 |

Table 2. Coverage of Table 1 outcomes by candidate pathways.

| Course | Outcomes Covered | Coverage | Recommendation Status |
|-----------------|------------------|----------|-----------------------------------------------------------------|
| M140 + STAT 216 | 9 of 9 | 100% | Recommended |
| M121 + STAT 216 | 4 of 9 | 44% | Accepted as alternative; M121 lacks healthcare-specific content |

M121 covers fewer of the priority outcomes shown above because nursing's top-rated needs are healthcare-specific calculation skills not part of the M121 curriculum. M121's lower direct coverage in Table 2 is offset by its rigor as a calculus-preparation course; campuses currently using M121 for nursing students are providing solid mathematical preparation, even if the specific healthcare applications are taught later in nursing coursework rather than in the gateway math course.

M115 (Probability and Linear Math) is not an appropriate pathway for nursing preparation. Only one institution currently accepts it as satisfying program prerequisites; its learning outcomes do not align with nursing priorities; and through the Math Pathways 2.0 work, M115 is being revised to serve the business pathway, making it even less suitable for healthcare students.

Allied Health

Programs surveyed: Paramedicine, Surgical Technology, Radiologic Technology, Respiratory Therapy, and related fields

Recommendation: M105 (Contemporary Math) or M140 (College Math for Healthcare) as appropriate mathematics pathways, with individual programs selecting the course that best fits their specific certification requirements and curricular structure.

M120 (Math with Healthcare Applications) might appear to be a natural fit for Allied Health programs given its healthcare focus. However, no MUS institution currently requires M120 for these programs and introducing it as a new pathway requirement would represent a systemwide change with limited practical benefit. The Taskforce therefore does not recommend M120 for Allied Health at this time.

Table 1. Top-priority outcomes identified by Allied Health faculty.

| Learning Outcome | Faculty Agreement | Covered By |
|------------------------------------------------------------------------|-------------------|------------------|
| Use units accurately | 100% | M105, M140 |
| Decimals, fractions, percents for healthcare calculations | 100% | M140 |
| Rational equations for ratios/proportions (volume, mass, weight, temp) | 100% | M140 |
| Metric, household, and apothecary measurement systems | 100% | M140 |
| Reason using ratio and proportions | 50% | M105, M140 |
| Use functions to model real-world phenomena | 50% | M121 |
| Statistics: measures of center/spread, normal distribution | 50% | M105, M115, M140 |
| Dimensional analysis and unit conversion | 50% | M140 |
| Mathematical/statistical reasoning for healthcare problems | 50% | M140 |

Table 2. Coverage of Table 1 outcomes by candidate courses.

| Course | Outcomes Covered | Coverage | Recommendation Status |
|-------------------------------------------|------------------|------------|---------------------------------------------------------------|
| M140 (College Math for Healthcare) | 8 of 9 | 89% | Recommended for calculation-intensive programs |
| M105 (Contemporary Math) | 3 of 9 | 33% | Recommended for general quantitative literacy programs |
| M115 (Probability and Linear Math) | 1 of 9 | 11% | Not appropriate |
| M121 (College Algebra) | 1 of 9 | 11% | Not appropriate |

Given the diversity of Allied Health programs, ranging from calculation-intensive fields like Radiologic Technology to programs with minimal math requirements like Surgical Technology, a flexible approach is warranted. M140 is ideal for more math-intensive programs requiring healthcare-specific calculations. M105 covers fewer of the priority outcomes shown above because the items it does not cover are healthcare-specific calculations not central to programs whose math needs are met by general quantitative literacy. M105 is therefore appropriate for less math-intensive programs needing general quantitative literacy while satisfying general education

requirements. Program faculty, in consultation with mathematics faculty and relevant accreditation or certification requirements, should determine whether M105 or M140 best fits each Allied Health program.

Business

Programs Surveyed: Accounting, Business Management, Finance, Management Information Services, Marketing

Recommendation: Revamp M115/M141/M143 into a unified course tentatively titled “Modeling with Functions and Data”, paired with the existing STAT 216 requirement.

Table 1. Top-priority outcomes identified by Business faculty (non-statistics; STAT 216 already required).

| Learning Outcome | Faculty Agreement | Covered By |
|----------------------------------------------------|-------------------|----------------------|
| Reason using ratio and proportions | 100% | M105 |
| Simple vs compound interest effects | 100% | M105 |
| Multiple representations of functions | 93% | M121 |
| Use functions to model real-world phenomena | 93% | M121 |
| Model financial problems using algebra | 93% | M105 |
| Solve linear equations in context | 86% | M121, M115/M141/M143 |
| Identify relations vs functions; function notation | 79% | M121 |
| Create graphs from formulas and vice versa | 79% | M121, M115/M141/M143 |
| Slope-intercept and point-slope forms | 79% | M121, M115/M141/M143 |

Table 2. Coverage of Table 1 outcomes by candidate courses.

| Course | Outcomes Covered | Coverage | Recommendation Status |
|----------------------------------------------------|------------------|----------|-----------------------------------------------------------------|
| New M1XX (Modeling with Functions and Data) | 9 of 9 | 100% | Recommended |
| M121 (College Algebra) | 6 of 9 | 67% | Insufficient: missing financial mathematics |
| M105 (Contemporary Math) | 3 of 9 | 33% | Insufficient: missing functions and modeling |
| M115/M141/M143 | 3 of 9 | 33% | Insufficient: missing financial math and most functions content |

The Taskforce considered modifying M105 to include the functions and modeling content Business faculty want but rejected this approach because it would compromise M105’s purpose as the quantitative literacy course for humanities students, making it significantly more algebraic than intended while potentially alienating students who currently benefit from its accessibility.

The revamped course will be organized around four modules: Functions and Modeling (linear, exponential, and logarithmic functions in business contexts); Financial Mathematics (compound interest, loans, budgeting, index numbers); Linear Regression and Data Analysis (scatterplots, least-squares regression, correlation vs. causation); and Probability and Decision-Making (counting principles, expected value, Bayes' theorem, linear programming). It will be designed so that its functions content also serves as a prerequisite for M161 (Survey of Calculus) and M162 (Applied Calculus), enabling business students whose concentration requires calculus to proceed without additional preparatory coursework.

Students who have completed M121 or higher will satisfy the mathematics requirement for Business majors. This substitution recognition is particularly important for transfer and dual enrollment students, who often arrive with M121 credit. No campus shall require another mathematics course as a prerequisite (either at the 100 or 0-levels) for the new M1XX course; campuses are encouraged to offer a co-requisite support version alongside the standalone version. The Taskforce's goal is to develop and pilot this course during AY 2026–27, with system-wide implementation beginning in AY 2027–28.

The Taskforce will lead the development of this course at the system level so that individual campuses do not bear that burden alone. Shared course materials, a common textbook or OER resources, and cross-campus collaboration structures will be developed to support consistent delivery. Campuses currently offering M115, M141, or M143 can redirect the staffing for those sections to the new course.

Industrial Technology

Programs surveyed: Construction, Diesel, Machining, Heavy Equipment, Welding

Recommendation: Establish M111 (Technical Mathematics) as the MUS trades math pathway course. Align its learning outcomes in CCN, enhance it where appropriate so it carries general-education credit, and develop an asynchronous online version to increase access to the course through dual enrollment, particularly for high schools that have limited capacity to offer multiple DE math courses.

The industrial technology pathway was the most complex area addressed by the Taskforce, given the diversity of trades programs along with the large dual enrollment population. A separate meeting was held with two-year campus CAOs to ensure that the realities of these programs, including enrollment size, staffing capacity, and dual enrollment delivery, were fully integrated into the recommendation.

Table 1. Top-priority outcomes identified by Industrial Technology faculty.

| Learning Outcome | Faculty Agreement | Covered By |
|-------------------------------------------------|-------------------|------------|
| Decimals, fractions, percents applied to trades | 100% | M111/M114 |
| Ratios and proportions applied to trades | 100% | M111/M114 |
| Dimensional analysis (unit conversions) | 100% | M111/M114 |
| Metric/US Customary system conversions | 100% | M111/M114 |
| Pythagorean Theorem | 100% | M111/M114 |

| | | |
|---------------------------------------|------|-----------|
| Angles | 100% | M111/M114 |
| Trigonometry (trades applications) | 75% | M111/M114 |
| Area, perimeter, surface area, volume | 75% | M111/M114 |
| Solve right and oblique triangles | 75% | M111/M114 |

Table 2. Coverage of Table 1 outcomes by candidate courses.

| Course | Outcomes Covered | Coverage | Recommendation Status |
|-------------------------------------------|------------------|-------------|------------------------------------------------------|
| Revamped M111 (with gen-ed credit) | 9 of 9 | 100% | Recommended |
| Current M111/M114 (no gen-ed credit) | 9 of 9 | 100% | Content fits but gen-ed gap limits transfer mobility |
| M105 (Contemporary Math) | 0 of 9 | 0% | Not appropriate; 0% agreement on M105 core topics |

The Taskforce analyzed five pathway options before arriving at this recommendation. M105-only (gen-ed credit but content mismatch), M111/M114-only (content alignment but no gen-ed credit), M105 or M111/M114 (does not resolve the underlying tension), cohorted M105 with trades focus (relies on coordination that has already proven inconsistent), and M105 plus a 1-credit supplement (adds a credit and leaves M111 variability untouched). None resolved all three pressures simultaneously: content alignment, credential utility, and equitable dual enrollment access.

Transfer and credential-stacking data informed the recommendation. Of 4,860 CAS degree earners since 2015, 416 (8.6%) later earned an AS or AA. Of 7,651 AAS degree earners, 334 (4.4%) did the same. The practical implication: the overwhelming majority of trades students do not transfer into academic degree programs, but for those who do, the pathway must remain open and carry transferable credit.

A revamped M111, aligned in CCN, enhanced for gen-ed credit, and made available asynchronously online for dual enrollment, addresses all three pressures. It honors the survey data, respects the operational realities raised by two-year college leadership, keeps transfer pathways open, and ensures that as dual enrollment expands under the STARS Act, Montana high school students bound for trades careers are not funneled into a gen-ed math course that does not serve them.

Because general education designation is determined through established campus and system processes, the Taskforce recommends that revised M111 outcomes be developed specifically to support general education review while preserving the applied technical content identified by trades faculty.

STAT 216 Prerequisite Standardization

Recommendation: M105 (Contemporary Mathematics) as the maximum allowable prerequisite for STAT 216 across all MUS institutions. Students who have completed M105 or any mathematics course above M105 may satisfy the STAT 216 prerequisite. Institutions may accept lower prerequisites or allow direct placement through appropriate placement processes. “Maximum allowable prerequisite” means that campuses may not require a prerequisite higher than M105,

but may allow direct placement or lower prerequisite structures when supported by local placement policy.

Currently, three institutions require M115 as the prerequisite for STAT 216, while all other MUS institutions accept M105 or allow direct placement. This inconsistency creates a barrier: a dual enrollment student who completes M105 in high school finds that their preparation is accepted at every MUS institution except these three, potentially requiring an additional course at additional cost.

The case for standardization rests on three pillars. First, M105's CCN learning outcomes explicitly include probability, statistics, normal distributions, measures of center and spread, and a qualitative understanding of the Central Limit Theorem, the foundational content STAT 216 builds upon. Second, nearly all MUS institutions already accept M105 as sufficient, and student success data from those institutions is consistent. Third, the content currently associated with M115/M141/M143 is being reorganized into a new business pathway course focused on functions, modeling, financial mathematics, and data applications. As a result, M115 should no longer serve as the prerequisite structure for STAT 216.

For this prerequisite standardization to succeed, institutions must ensure that their M105 courses cover the probability and statistics content specified in the CCN learning outcomes with appropriate rigor. The Taskforce recommends that the upcoming Math Faculty Learning Outcome Committee (FLOC) meeting revisit the CCN learning outcomes for M105 to confirm they explicitly reflect this content.

What Is Not Changing

These recommendations are targeted adjustments, not system-wide overhauls. The following remain unchanged:

Campus autonomy over course delivery, pedagogy, and local implementation is preserved.

No faculty member is being asked to surrender expertise or autonomy. Institutions retain the ability to include program or institution-specific content within the 20% of learning outcomes that are not required to align through CCN.

M105 retains its identity as the quantitative literacy course for humanities and liberal arts students. Modifying M105 to serve business students was explicitly considered and rejected to protect this purpose.

STAT 216 remains the gateway statistics course across the system. No changes to its content or standing are proposed.

M140 (College Math for Healthcare) continues in its existing role; the recommendation expands and clarifies where it fits within degree maps.

The STEM pathway, M121 (College Algebra), remains the same. No changes to the STEM pathway are required at any institution.

System Alignment and Institutional Autonomy

Throughout this process, the Taskforce held two commitments simultaneously, commitments that can appear to be in tension, but which are, in practice, complementary.

The first is to pursue system-level alignment. The Montana University System exists, in part, to serve students who move between institutions through transfer, dual enrollment, and shared course offerings. When mathematics requirements for the same program differ from one campus to the next for reasons that are historical rather than pedagogical, students pay the price in time, money, and lost momentum. Alignment is how the system fulfills its obligation to those students.

The second is a commitment to institutional autonomy. Each MUS campus has its own mission, student population, faculty culture, and instructional capacity. Faculty must teach these courses with genuine expertise and investment, and they cannot do that if recommendations are imposed in ways that disregard local context.

This is why the Taskforce's work was structured as it was. Recommendations were developed by math faculty drawn from those campuses, in active collaboration with discipline faculty also drawn from those campuses, and with advisors and CAOs informed and engaged at every stage. The Taskforce asked for input before drafting recommendations and then returned to discipline faculty with those drafts before finalizing them. The process was iterative by design, built to earn buy-in rather than assume it.

The balance these recommendations strike is system-level alignment defines the what: which courses serve each program, which prerequisites are appropriate, and which course numbers mean the same thing everywhere. Campus autonomy governs the how: how courses are taught, what materials are used, how sections are organized, and how changes are communicated to students and advisors. The Taskforce has been careful not to encroach on the second while doing the necessary work in the first.

Implementation

Professional Development and Advising

Pathway changes only help students if advisors, at both the high school and college level, understand and can communicate them. Successful implementation requires intentional professional development across several audiences:

MUS academic advisors will need updated pathway guidance, training on new degree map configurations, and clear materials for communicating changes to current students.

Mathematics faculty teaching the new business course will need support developing and delivering the content. The Taskforce's course development work will include shared materials and cross-campus collaboration.

Partner discipline faculty, particularly in Business and Nursing programs, will benefit from understanding the content of the recommended pathways so they can advise students and integrate expectations into their own courses.

K–12 dual enrollment coordinators and high school counselors will need clear, accessible pathway guidance; the companion K–12 one-pager is being developed alongside this report.

Co-Requisite Course Development

The Taskforce strongly encourages campus development of co-requisite support sections for M140, M111, and the new business course, recognizing that many students arrive without full readiness. Co-requisite models, which provide concurrent, embedded support rather than a prerequisite developmental course, are nationally proven to improve completion rates while shortening pathways. This directly supports the equity dimension of this work.

Transition Planning

Campuses should develop teach-out and catalog-transition plans so that students already enrolled under existing degree requirements are not delayed or disadvantaged by pathway changes.

Placement Alignment

The Taskforce will provide a system-wide placement framework for the new business course that fits naturally into each campus's existing placement structures, including multiple measures. For campuses currently offering M115, M141, or M143, placement equivalent to current standards for those courses is appropriate. For campuses not currently offering these courses, placement between M105 and M121 is appropriate. Final placement decisions remain with each campus's existing structure for establishing placement.

Common Course Numbering

Several recommendations have direct CCN implications. M111 learning outcomes will need to be standardized across institutions. The new business course will need a permanent CCN designation. M105 CCN learning outcomes should be reviewed at the upcoming Math FLOC meeting to confirm adequate probability and statistics coverage. These changes will be advanced through the existing FLOC process.

Ongoing Assessment

Math pathways are not a one-time policy fix; they require ongoing stewardship. The Taskforce recommends that MUS establish a recurring review cycle including annual review of transfer credit applicability data, periodic re-engagement of partner disciplines, formal assessment of co-requisite course outcomes, and ongoing monitoring of dual enrollment participation and pathway completion rates.

M111 Revision and General Education Designation

The Taskforce's goal in revamping M111 is to create a consistent, streamlined trades mathematics course across the MUS while also meeting the requirements for general education designation. Accessibility is central to this goal: students who have completed the minimum mathematics requirements for Montana high school graduation should arrive prepared for the course without needing an additional college-level mathematics prerequisite first. The course is intended to serve trades students directly out of high school, including those entering the course through dual enrollment.

Revised M111 outcomes will reflect the overarching goal of gen-ed mathematics: building transferable quantitative reasoning skills that serve students across academic, professional, and real-world contexts. Applied trades content engages all of these skills when framed as authentic quantitative reasoning rather than procedural calculation. The Taskforce recommends that revised outcomes be developed jointly by trades and mathematics faculty, reviewed through the Math FLOC for CCN alignment, and submitted through each campus's gen-ed review process.

The Taskforce recognizes a legitimate concern that elevating M111 to gen-ed status could inadvertently introduce a new barrier if the revised course includes content that is too advanced for the preparation level of students it is meant to serve. To monitor this, the new M111 course will be piloted and data on pass rates, placement, and other relevant metrics will be assessed and inform full-scale implementation of this math pathway.

Conclusion

The recommendations in this report are the product of a faculty-driven process that catalogued every degree program in the system, surveyed the discipline experts who teach in those programs, developed draft recommendations grounded in these findings, and refined those recommendations through direct engagement with discipline faculty, advisors, and campus leadership.

The Taskforce does not claim these recommendations will eliminate every challenge in mathematics education. They will, however, better connect MUS students to the relevant mathematics course for their chosen discipline and will better support credit mobility as students increasingly earn credits at multiple points in time and at multiple institutions across the secondary and postsecondary landscape. The courses they take will be designed with rigor, aligned with purpose, and accessible across every institution in the system.

The Taskforce is grateful to the many faculty, advisors, CAOs, and discipline experts who contributed their time and expertise to this process. The quality of this work is a direct reflection of their engagement. The Montana University System is stronger for it.