

EPC - Proposals from the Mathematics Department

Based on recommendations from the Institutional Prioritization Committee, the Teacher Education Program, and our Dean, the faculty within the Department of Mathematics propose the following:

1. Proposal: Create a unified B.S. in Mathematics program to serve students in the existing B.S. in Mathematics and B.S. in Secondary Mathematics Education programs.
2. Proposal: Rename the department to the Department of Mathematics and Statistics
3. Request for EPC endorsement: Centralized coordination of statistics courses
4. Request for EPC endorsement: Develop curriculum for a B.S. in Statistics
5. Request for EPC endorsement: Move MATH 099 to the Student Success Center by Fall 2015
6. Informational: Change QUANT 131 back to MATH 131; reinstitute a MATH 099 prerequisite

1. Unified B.S. in Mathematics

Institutional Prioritization Committee recommendations:

1. (Page 8) Grow all STEAM (Science, Technology, Engineering, Art/Design, and Math) areas and support them by enriching the global lab, performance, and production space on campus.
2. (Page 12) Maintain the B.S. in Secondary Mathematics Education. Establish alignment between standard major/minor content requirement and teaching licensure course requirements.

Proposal:

Create a unified B.S. in Mathematics program that will serve students in the existing B.S. in Mathematics and B.S. in Secondary Mathematics Education programs. This, in effect, would eliminate our B.S. in Secondary Mathematics Education. Students would be able to supplement the unified B.S. in Mathematics with education courses to earn a secondary math teaching endorsement.

Details and Rationale:

Results from the Major Field Test in Mathematics and other departmental assessments indicate that many of our secondary math education majors, especially when compared to our Mathematics majors, do not graduate with adequate content knowledge. We attribute this, in part, to curricular differences between the programs. As the following table shows, the B.S. in Mathematics Education requires 10 fewer credits in mathematics (when compared to the B.S. in Mathematics). In place of these 10 credits, the B.S. in Mathematics Education requires education-focused courses (MATH 340: Secondary Math Methods, MATH 360: Modern Geometry, MATH 399: Postsecondary Clinical Teaching Experience):

| Current B.S. in Mathematics | | | Current B.S. in Mathematics Education | | |
|-----------------------------|------------------------|----|---------------------------------------|-----------------------------|----|
| MATH 191 | Calculus I | 4 | MATH 191 | Calculus I | 4 |
| MATH 192 | Calculus II | 4 | MATH 192 | Calculus II | 4 |
| MATH 220-WI | Intro to Logic & Proof | 3 | MATH 220-WI | Intro to Logic & Proof | 3 |
| MATH 290 | Linear Algebra | 3 | MATH 290 | Linear Algebra | 3 |
| MATH 291 | Calculus III | 4 | | (no Calculus III) | |
| MATH 300 | Probability & Stats | 3 | MATH 300 | Probability & Stats | 3 |
| MATH 301 or 305 | Stats elective | 3 | MATH 301 | Statistical Modeling | 3 |
| MATH 320 | Differential Equations | 3 | | (no Differential Equations) | |
| | | | MATH 340 | Math Methods | 3 |
| | | | MATH 360 | Modern Geometry | 3 |
| MATH 370 .WI | Real Analysis | 3 | MATH 370 .WI | Real Analysis | 3 |
| MATH 380 | Abstract Algebra | 3 | MATH 380 | Abstract Algebra | 3 |
| MATH 395 | Seminar | 1 | MATH 395 | Seminar | 1 |
| | | | MATH 399 | Postsecondary Clinic | 3 |
| MATH 400 | Topics | 3 | | (no Topics course) | |
| CSCI | Programming | 3 | CSCI | Programming | 3 |
| | Math Subtotal | 40 | | Math Subtotal | 39 |

We propose unifying these two programs into a single B.S. in Mathematics that can serve both students who wish to major in mathematics and those who wish to teach math at the secondary level. This unified program would be similar to our existing B.S. in Mathematics:

| Current B.S. in Mathematics | | | Proposed B.S. in Mathematics | | |
|-----------------------------|------------------------|----|------------------------------|------------------------|----|
| MATH 191 | Calculus I | 4 | MATH 191 | Calculus I | 4 |
| MATH 192 | Calculus II | 4 | MATH 192 | Calculus II | 4 |
| MATH 220-WI | Intro to Logic & Proof | 3 | MATH 220-WI | Intro to Logic & Proof | 3 |
| MATH 290 | Linear Algebra | 3 | MATH 290 | Linear Algebra | 3 |
| MATH 291 | Calculus III | 4 | MATH 291 | Calculus III | 4 |
| MATH 300 | Probability & Stats | 3 | MATH 300 | Probability & Stats | 3 |
| MATH 301 or 305 | Stats elective | 3 | MATH 301 | Statistical Modeling | 3 |
| MATH 320 | Differential Equations | 3 | MATH 320 | Differential Equations | 3 |
| MATH 370 | Real Analysis | 3 | MATH 370 | Real Analysis | 3 |
| MATH 380-WI | Abstract Algebra | 3 | MATH 380-WI | Abstract Algebra | 3 |
| MATH 395 | Seminar | 1 | MATH 390 | Math Programming | 3 |
| MATH 400 | Topics | 3 | MATH 400 | Topics | 3 |
| CSCI | Programming | 3 | | | |
| Total | | 40 | Total | | 39 |

We propose reducing the overall credit requirement to 39 credit hours (from the existing 40 credit hour total) by eliminating MATH 395: Seminar in Mathematics and replacing a CSCI programming course with MATH 390: Mathematical Programming.

Based on our assessment of student projects in MATH 395, we have concluded that the 1-credit hour seminar wasn't adequate to meet the intended course outcomes. We attempted to use that course to get students to complete capstone projects, but found that students were unable to create high-quality projects due to a lack of experience with mathematical computing packages, such as Mathematica, and document markup languages, such as LaTeX. A 3-credit Mathematical Programming course will allow us to better prepare our majors with the skills expected by employers and graduate programs.

Students completing this proposed B.S. in Mathematics could complete additional courses to earn a secondary mathematics teaching endorsement. In total, earning this endorsement would require the same number of credit hours (approximately 116 credits, counting General Education requirements) as the current B.S. in Secondary Mathematics Education degree.

| Current B.S. in Mathematics Education | | | Proposed B.S. in Mathematics | | | Proposed path for teaching license | | |
|---------------------------------------|-------------------------|-----|------------------------------|------------------------|----|------------------------------------|-------------------------|-----|
| MATH 191 | Calculus I | 4 | MATH 191 | Calculus I | 4 | MATH 191 | Calculus I | 4 |
| MATH 192 | Calculus II | 4 | MATH 192 | Calculus II | 4 | MATH 192 | Calculus II | 4 |
| MATH 220-WI | Intro to Logic & Proof | 3 | MATH 220-WI | Intro to Logic & Proof | 3 | MATH 220-WI | Intro to Logic & Proof | 3 |
| MATH 290 | Linear Algebra | 3 | MATH 290 | Linear Algebra | 3 | MATH 290 | Linear Algebra | 3 |
| MATH 300 | Probability & Stats | 3 | MATH 291 | Calculus III | 4 | MATH 291 | Calculus III | 4 |
| MATH 301 | Statistical Modeling | 3 | MATH 300 | Probability & Stats | 3 | MATH 300 | Probability & Stats | 3 |
| MATH 340 | Math Methods | 3 | MATH 301 | Statistical Modeling | 3 | MATH 301 | Statistical Modeling | 3 |
| MATH 360 | Modern Geometry | 3 | MATH 320 | Differential Equations | 3 | MATH 320 | Differential Equations | 3 |
| MATH 370 | Real Analysis | 3 | MATH 370 | Real Analysis | 3 | MATH 370 | Real Analysis | 3 |
| MATH 380-WI | Abstract Algebra | 3 | MATH 380-WI | Abstract Algebra | 3 | MATH 380-WI | Abstract Algebra | 3 |
| MATH 395 | Seminar | 1 | MATH 390 | Math Programming | 3 | MATH 390 | Math Programming | 3 |
| MATH 399 | Postsecondary Clinic | 3 | MATH 400 | Topics | 3 | MATH 340 | Math Methods | 3 |
| CSCI | Programming | 3 | Total | | 39 | Math Subtotal | | 39 |
| Math Subtotal | | 39 | | | | U.S. History/Govt | | 3 |
| U.S. History/Govt | | 3 | | | | EDUC 205 | Field Experience | 2 |
| EDUC 205 | Field Experience | 2 | | | | EDUC 284 | | 3 |
| EDUC 284 | | 3 | | | | EDUC 300 | | 3 |
| EDUC 300 | | 3 | | | | EDUC 301-WI | | 3 |
| EDUC 301-WI | | 3 | | | | EDUC 305 | | 3 |
| EDUC 305 | | 3 | | | | EDUC 308 | | 2 |
| EDUC 308 | | 2 | | | | EDUC 309-WI | | 3 |
| EDUC 309-WI | | 3 | | | | EDUC 336 | | 3 |
| EDUC 336 | | 3 | | | | EDUC 419 | | 12 |
| EDUC 419 | | 12 | | | | SPED 310 | | 3 |
| SPED 310 | | 3 | | | | Education Subtotal | | 40 |
| Education Subtotal | | 40 | | | | Oral Comm | | 3 |
| Oral Comm | | 3 | | | | Written Comm | | 3 |
| Written Comm | | 3 | | | | Info Lit | | 1 |
| Info Lit | | 1 | | | | Quantitative | (fulfilled by major) | |
| Quantitative | (fulfilled by major) | | | | | Health/Fitness | | 2 |
| Health/Fitness | | 2 | | | | Second Language | | 6 |
| Second Language | | 6 | | | | Humanities | (U.S. hist/gov req) | 3 |
| Humanities | (U.S. hist/gov req) | 3 | | | | Social Science | (fulfilled by EDUC 284) | |
| Social Science | (fulfilled by EDUC 284) | | | | | Natural Science | | 4 |
| Natural Science | | 4 | | | | Creative Arts | | 3 |
| Creative Arts | | 3 | | | | Catholic IT | | 12 |
| Catholic IT | | 12 | | | | Integrated Learn. | (fulfilled by EDUC SIC) | |
| Integrated Learn. | (fulfilled by EDUC SIC) | | | | | General Education Subtotal | | 37 |
| General Education Subtotal | | 37 | | | | Overall Total | | 116 |
| Overall Total | | 116 | | | | | | |

Students who complete the teaching endorsement along with the proposed B.S. in Mathematics will take the same classes as students in the existing B.S. in Secondary Mathematics Education with the following exceptions:

- MATH 291 (Calculus III), MATH 320 (Differential Equations), and MATH 390 (Mathematical Programming) are now required
- MATH 360 (Modern Geometry) and MATH 399 (Postsecondary Clinical Teaching Experience) are no longer required

Results from student assessment in MATH 360 show the course was not effective in teaching students modern geometry content. Instead, the course devolved into a review of high school geometry for students intending to teach at a high school level. Eliminating this course will have virtually no impact on the preparation of prospective high school math teachers. Adding MATH 291 and 320 will more than compensate for any content lost in MATH 360.

MATH 399, while a worthwhile course, suffers from low enrollment. Eliminating this course and creating a unified B.S. in Mathematics program should create greater staffing efficiencies. By eliminating MATH 360 and 399, we anticipate saving 9 credits in adjunct pay each year.

Students will benefit from these proposed changes. Students wishing to teach secondary math will graduate with a B.S. in Mathematics and will find greater opportunities post-graduation. Likewise, students intending to complete a B.S. in Mathematics may decide to take the additional education courses and earn a teaching endorsement. Either way, we anticipate having better prepared graduates.

List of changes:

1. Eliminate the B.S. in Secondary Mathematics Education
2. Modify the B.S. in Mathematics
 - A. Eliminate MATH 395: Seminar in Mathematics
 - B. Eliminate MATH 399: Postsecondary Clinical Teaching Experience
 - C. Eliminate MATH 360: Modern Geometry
 - D. Eliminate the CSCI programming requirement
 - E. Add MATH 390: Mathematical Programming

Note: We're creating a single new course and eliminating 3 existing courses, for a net loss of 2 courses. If these proposals are approved, we will have reduced our course offerings from 33 to 19 since 2003-04. This consolidation has allowed us to serve an increasing number of majors and General Education students with declining resources.

3. Modify the Catalog program description for the B.S. in Mathematics

Current: 37 credits of math including MATH 191, 192, WI-220, 290, 291, 300, 320, 370, 380, WI-395; two courses from: MATH 301, 305, or 400; and 3 credits of computer programming.

Proposed: 39 credits including MATH 191, 192, WI-220, 290, 291, 300, 301, 320, 370, WI-380, 390, 400. Students wishing to earn a secondary mathematics teaching endorsement will substitute MATH 340 for MATH 400.

Statements of Support:

(insert here)

Aji, Aron

To: Thiessen Bradley <thiessenbradley@sau.edu>

Re: 099/171 student success and scheduling

December 6, 2013 10:27 AM

[Hide Details](#)

2

I am with you on these recommendations.

A

2. Department of Mathematics & Statistics

Institutional Prioritization Committee recommendations:

1. (Page 14) Reallocate/Restructure Decision Sciences, General Education Math, and the Mathematics Major. Quality of inputs and outcomes uncertain as redundancy of offerings and expertise exist. Consider restructuring the offering of statistics courses (including but not limited to STAT 213) to eliminate redundancy of offerings and staffing patterns. Consider restructuring of Math department, potentially with Decision Sciences into a Quantitative Reasoning Department for oversight of STAT coursework and staffing.

Proposal:

Change the name of our department to the *Department of Mathematics & Statistics*.

Details and Rationale:

In November of 2012, we brought several proposals to EPC, including a proposal to change the name of our department to the Department of Mathematics & Statistics. Below, I've pasted an excerpt from that proposal [with some additional comments](#):

In our program review approved by EPC in December 2011 (which some may say is the "best program review" they've ever seen), we set the following goal:

- Work towards a "Department of Mathematics and Statistics" with a B.S. in Statistics and Actuarial Science and a statistics minor.
- We are noticing a growing number of students interested in statistics and actuarial science. With our existing faculty and courses, it would not take too much more to offer such a program.
- We will keep this potential program in mind as we fill our staffing needs. We will begin the process of proposing a new program, identifying community need, student demand, and program costs. We may propose this new program at our next program review.

Our first step towards this goal was to clearly identify three of our courses as statistics courses:

STAT 300: Modern Introduction to Probability & Statistics

STAT 301: Statistical Modeling

STAT 305: Modern Data Analysis

} These were MATH courses that were approved to be cross-listed as STAT courses.

This proposal to rename our department to the Department of Mathematics and Statistics is the next step towards our goal. The new name better reflects our curricular offerings and our staffing expertise (with one Professionally Accredited Statistician and another visiting assistant professor with significant training in statistics). It also better positions us for increasing interest, enrollment, and employment opportunities in applied mathematics and statistics.

The authors of a 1998 review of undergraduate statistics courses lamented the fact that "... mathematics departments teach about four times as many students in introductory statistics as do statistics departments" (Loftsgaarden & Watkins, 1998). The dearth of statistics departments and programs was echoed in 2010 in *The American Statistician*:

Many colleges still do not offer an undergraduate degree in statistics and most likely do not have the financial resources to begin doing so in the near future. Also, many students (and the general public) still see statistics as a specialized extension of mathematics - a fact that is only reinforced when many introductory (and advanced) statistics courses are only offered through a school's math department (and designated as such in the course catalog...) (Kotz, 2010).

Naming our department the Department of Mathematics and Statistics acknowledges the importance of statistics at SAU and gives a home to the coordination of statistics courses and programs.

The new name also reflects current practice at other institutions. A quick review of 20 postsecondary institutions in Iowa finds that 19 house their introductory and advanced statistics courses within Mathematics Departments, while 2 of our aspirational peers have "Departments of Mathematics & Statistics."

EPC declined to vote on the proposal for reasons including: (a) other departments also teach statistics courses at SAU, and (b) we do not yet offer a major in statistics. During that meeting, it was acknowledged that changing the department's name and offering a major in statistics may be a chicken-and-egg problem.

Since that November 2012 meeting, EPC has approved name change requests from two departments:

Spring 2013: Engineering & Physics → Engineering and Physical Sciences (Note: no physical science degree is offered)

Fall 2013: Women's Studies → Women and Gender Studies (Note: Gender studies courses are taught in other departments)

We also have two other departments with names that do not align perfectly with the degrees they offer:

History, Art History & Geography (Note: no geography degree is offered)

Finance, Economic and Decision Sciences (Note: no decision sciences degree is offered)

This precedent, along with the fact that we currently house 3 of the 4 statistics courses listed in the Catalog (page 118), moves us to once again propose a name change. The new name better reflects our course offerings, expertise, and recommendations made by the Institutional Prioritization Committee.

3. Centralized Coordination of Statistics

Institutional Prioritization Committee recommendations:

1. (Page 14) Consider restructuring the offering of statistics courses (including but not limited to STAT 213) to eliminate redundancy of offerings and staffing patterns. Consider restructuring of Math department, potentially with Decision Sciences into a Quantitative Reasoning Department for oversight of STAT coursework and staffing.

Our response to the Institutional Prioritization Committee:

NCES reports show an increasing demand in undergraduate statistics programs (up 78% from 2003-12) and courses (up 266% from 2005-12). We are also seeing this increased demand at St. Ambrose:

- Enrollment in undergraduate statistics courses (STAT 213, 300, and 301) continues to increase
- Since 2008, all but one of our graduates from the Mathematics Department have gone on to teaching positions, actuarial science positions, or graduate programs in statistics (with 4 graduates enrolled in Ph.D. statistics programs and another in a neuroscience program). Another two of our recent graduates are currently preparing for the first actuarial science exam.

In our report to the Institutional Prioritization Committee, we recommended that our department, renamed as the *Department of Mathematics and Statistics*, should become stewards of the math and statistics courses that address our General Education quantitative skills requirement. We recommended our department coordinate STAT 213, updating the course to align with best practices, modern methods in statistics, and recommendations made by the American Statistical Association. Our rationale was that a reinvigorated STAT 213 could become a foundational course for a new B.S. degree in Statistics or in Data Science. We have discussed these proposals with our Dean and have ready-to-implement curricula that take advantage of existing courses. Since these new programs would take advantage of existing courses (inside and outside of the Math Department), they could be established with very little additional courses or resources.

Ultimately, we envision our department housing a B.S. in Mathematics and a B.S. in Statistics (both of which could lead to a secondary teaching license); a Minor in Mathematics (which could lead to an elementary endorsement in teaching); and General Education courses in math and statistics. This would position our department for the future, increase student enrollment, and improve student learning in our institutional quantitative reasoning student learning outcome.

Proposal:

We request that EPC endorse the concept that General Education statistics courses should be centrally coordinated.

Rationale - Coordinating STAT 213:

Undergraduate statistics courses at St. Ambrose suffer from a lack of coordination. The course that best exemplifies this has to be STAT 213: Applied Statistical Reasoning for the Sciences. This course, which serves students in the health and social sciences, used to be clearly housed within the Psychology Department. Over the past decade, however, the course has been taught by faculty, administrators, and adjuncts from Psychology, Political Science, Mathematics, Sociology, and the Health Sciences.

To help coordinate the course, a "STAT 213 Group" was established several years ago by Aron Aji and Katie Trujillo. While participation in that group has waned over the years, the group did manage to agree to a common set of student learning outcomes for all sections of STAT 213. The group, in response to curricular changes in the Mathematics Department, also agreed to list MATH 171 as a prerequisite for STAT 213.

The last meeting of the STAT 213 group took place in Spring of 2013. At that meeting, it was made clear that:

- Very few instructors of the course are aware of the existence of the agreed-upon common student learning outcomes.
- These outcomes do not appear on course syllabi or in any course summary sheet submitted to EPC.
- While a common textbook is used across sections, different instructors teach different content (e.g., some instructors teach probability, while others don't; some teach regression, while others don't).
- Assessment data from the course are not shared across instructors or course sections.
- Staffing and scheduling STAT 213 are challenging.

The meeting concluded with calls for:

- the Chair of the Mathematics Department to disseminate student learning outcomes to STAT 213 instructors
- continued assessment of student learning of STAT 213.

It is clear that without increased coordination of STAT 213, no meaningful assessment is possible. It isn't possible to get useful assessment data from a course with sections taught by faculty from multiple departments and Colleges covering different content aimed towards different outcomes. While the Psychology and Sociology Departments used to provide the necessary coordination (back when the course was clearly aimed only at students in the social sciences), expansion to include the health sciences has led to a course that does not fit clearly within a single social or natural science department.

To provide coordination of content, pedagogy, assessment, and staffing, we propose the logical place to house STAT 213 is within the Department of Mathematics and Statistics. We have discussed this idea with Aron Aji for several years and believe this move will produce immediate benefits:

1. Assessment of student learning

A General Education statistics (or statistical reasoning) course should be aimed at a common set of student learning outcomes based on current recommendations from the American Statistical Association, GAISE (Guidelines for Assessment and Instruction in Statistics Education), and AIMS (Adapting and Implementing Innovative Material in Statistics). Our Department has expertise in this area. We currently are collaborating with other introductory statistics educators through eCOTS (Electronic Conference On Teaching Statistics) and CATALST (Change Agents for Teaching and Learning Statistics), and also have a faculty member that serves as an advisor for an NSF-TUES grant on "Developing an Innovative Randomization-Based Introductory Statistics Curriculum."

A central coordinator could also coordinate assessment for course improvement, General Education, and program review purposes. Our Department has experience with several externally-benchmarked assessments of introductory statistics courses developed by CAUSE (the Consortium for the Advancement of Undergraduate Statistics Education), such as:

- ARTIST test databank (Assessment Resource Tools for Improving Statistical Thinking)
- CAOS test (Comprehensive Assessment of Outcomes in a Statistics Course)
- SATS (Student Attitudes Towards Statistics) or STACS (Student Attitudes and Conceptions in Statistics)
- e-ATLAS (Evaluation and Assessment of Teaching and Learning About Statistics)
- SRA (Statistical Reasoning Assessment)

Results from these assessments could be made to modernize and strengthen the course through external benchmarking. These results would also be shared with EPC and the General Education Committee to strengthen the assessment of our institutional focus on quantitative problem solving (a fundamental skill in General Education). These results, along with other forms of assessment, could also help determine if we offer too many or too few statistics courses on campus.

2. Professional development opportunities in modern statistical methods, tools, and pedagogy

The faculty, administrators, and adjuncts from multiple departments and Colleges could benefit from a central coordinating body that could request and provide professional development resources and opportunities. Our department could plan and provide opportunities for STAT 213 instructors to help modernize course content (e.g., Bayesian and simulation methods; effect sizes) and pedagogy (teaching inference through randomization-based methods). Our department could also provide instructor and student training in the use of statistical applications (such as R, JAGS, Stata, and/or SPSS).

Eventually, this coordination of professional development opportunities could lead to the development of a statistical consulting center that could serve faculty, students, and the local community.

3. Coordinated staffing and scheduling

With such high enrollment from growing programs in the social and natural sciences, STAT 213 is a challenge to schedule and staff. If we were to coordinate the course, we would have neither the desire nor the capacity to staff it with faculty from our department. Centralized coordination, however, could simplify scheduling and staffing, especially if the course is housed in the same department as its MATH 171 prerequisite.

Our department, with its involvement with the local and national statistical community, could also locate and train highly qualified adjunct instructors.

4. Foster future statistics opportunities at St. Ambrose

Centralized coordination of STAT 213 would simplify the identification of, and application for, statistics-related education grants offered by the ASA and NSF. Coordination of this course could also allow STAT 213 to become a solid foundation for further statistics programming, such as a major or minor in statistics.

Plan to Coordinate STAT 213:

The first step would be to establish common student learning outcomes for the course. The outcomes submitted to EPC on the most recent STAT 213 course summary sheet are:

- describe data using the appropriate statistics
- determine which descriptive and/or inferential statistics should be applied to data
- calculate all statistics
- interpret the answers that you get

Based on recommendations from professional organizations, the course would have five core outcomes: Students will develop statistical literacy, computation, reasoning, thinking, and dispositions. These outcomes, which are identical to the outcomes in STAT 300, 301, and 305, could be expanded to show the following course-specific learning objectives:

1. Statistical literacy

The ability to interpret, critically evaluate, and communicate statistical analyses and claims

Interpret various representations of data

Interpret statistical analyses and probabilities

Interpret output from statistical applications

Evaluate the appropriateness of analysis methods

Evaluate conclusions from data analyses

Define statistical terms

Communicate statistical analyses using effective visual displays, appropriate terminology, and correct notation

Understand and use the language and tools of statistics

2. Statistical computation

The ability to assemble computational tools to solve data analysis problems by reading, writing, and modifying code

Derive statistical formulas and use them to carry-out analyses

Calculate probabilities

Create effective displays and meaningful summaries of data

Produce statistical analyses using statistical applications

Plan, create, and automate a replicable analysis (clean data, run the analysis, present results, protect files)

Produce code and documentation to run a statistical analysis

Effectively manage large data sets

3. Statistical reasoning

The ability to reason with statistical ideas, make connections across concepts, and make sense of statistical information

Explain statistical processes

Fully interpret and make appropriate conclusions from statistical analyses

Choose appropriate analysis methods for a given problem

Identify and explain sources of variation

Explain and evaluate assumptions underlying analysis methods

Apply knowledge in novel situations

4. Statistical thinking

The ability to design, conduct, and evaluate statistical investigations

Develop, apply, and evaluate statistical models

Demonstrate a deep understanding of the theories underlying statistical processes and methods

Explain the constraints and limitations of statistics and statistical inference

Use statistical models to simulate random phenomena

Explain how data are produced to estimate probabilities

Recognize how, when, and why inferential tools can be used

Utilize the context of a problem to plan and evaluate investigations and draw conclusions

Explain the need for data and analysis

Quantify, measure, and model variability

Describe common pitfalls & sources of error in statistical analyses

Evaluate the effectiveness of visual displays and the appropriateness of statistical analyses

5. Dispositions of a statistician

Attitudes, beliefs, and values that will lead to the appropriate use of statistics after graduation

Persistence in using statistical skills and understanding after the course
Positive attitudes towards the importance, usefulness, and value of statistics
Confidence in their statistical competency

The next step would be to reestablish and reinvigorate the STAT 213 group. The immediate focus of this group would be to decide upon common content and topics for the course. While instructors will have some freedom to choose additional topics, the course needs a common set of topics that will best lead students towards the outcomes. On the course syllabus, these topics could be listed under the outcomes:

These five skills will be developed through the study of the following topics:

1. Chosen by stakeholders
2. ...

The STAT 213 group would then decide upon which externally benchmarked assessments would be administered in the course. Information from these assessments would then be analyzed prior to the department's next program review. At that program review, we'd be able to make informed decisions regarding the most appropriate prerequisite(s) for STAT 213, and any changes in outcomes, content, or pedagogy that could improve student learning.

4. Develop a B.S. in Statistics

Proposal to Develop a B.S. in Statistics or Data Science:

A coordinated and modernized STAT 213 could serve as the foundation for a new B.S. in Statistics or a B.S. in Data Science. We seek an endorsement from EPC to continue development of a B.S. in Statistics (or Data Science, or Actuarial Science). This development would include curriculum development, an analysis of student demand, etc.

Details for a B.S. in Statistics or Data Science:

Because we will need to fully develop an analysis of student demand, we won't provide a full rationale for this program proposal here. In short, student demand for undergraduate programs in statistics is growing and we believe we can offer a program that is both low-cost and high-quality. The program would take full advantage of existing courses taken by students majoring in Mathematics and Engineering and could also possibly lead to a secondary teaching endorsement in mathematics.

Student learning outcomes for a B.S. in Statistics could align perfectly with the outcomes from STAT 213. In fact, every statistics course offered as part of the B.S. in Statistics could have the same five student learning outcomes: statistical literacy, computation, reasoning, thinking, and dispositions. These outcomes would be taught in greater-depth in higher-level courses and in different contexts through different topics. A program like this, in which the majority of courses attempt to address the same outcomes, could eventually be run as a competency-based program.

The curriculum for a B.S. in Statistics would be based on the updated "Curriculum Guidelines for Undergraduate Programs in Statistical Science" to be published by the American Statistical Association in early 2014. The current ASA guidelines recommend coursework in each of the following areas: Mathematical Foundation, Statistical Foundation, Computation, and an External Substantive Area. The table below shows an example of a program of study that would satisfy these recommendations:

| Proposed B.S. in Statistics | | | Courses required by | | | New Course |
|-----------------------------|-------------------------|----|---------------------|-------------|-----------------------|------------|
| | | | B.S. in Math | Engineering | Social/Health Science | |
| MATH 191 | Calculus I | 4 | √ | √ | | |
| MATH 192 | Calculus II | 4 | √ | √ | | |
| MATH 290 | Linear Algebra | 3 | √ | √ | | |
| MATH 291 | Calculus III | 4 | √ | √ | | |
| STAT 213 | Applied Statistics | 3 | | | √ | |
| STAT 300 | Modern Prob/Stats | 3 | √ | √ | | |
| STAT 301 | Statistical Modeling | 3 | √ | | | |
| STAT 305 | Statistical Computing | 3 | | | | |
| STAT 306 | Bayesian Statistics | 3 | | | | √ |
| STAT 307-WI | Multivariate Statistics | 3 | | | | √ |
| MATH 400 | Topics or Internship | 3 | √ | | | |
| CSCI | Programming/Data | 3 | | | | |
| Total | | 39 | | | | |

A program like this would require the development of only two new courses (STAT 306 and STAT 307). Another advantage of a program like this is that it fulfills state requirements for a teaching endorsement in secondary mathematics. Our current General Education integrated learning requirement (in which students complete a second major, an interdisciplinary minor, or a signature integration concentration) would address the ASA's recommendation that students complete coursework in an External Substantive Area.

At this time, we're not asking EPC to approve a curriculum for a B.S. in Statistics. We're looking for an endorsement from EPC to continue developing the curriculum and to begin a study of student demand. We have reason to believe demand is strong (based on local and national demand for employees skilled in "big data" management and analysis) and we will continue working to develop a curriculum that matches ASA recommendations and reflects the inherently interdisciplinary nature of the field of statistics. We may also decide to pursue a second major option or interdisciplinary minor in statistics or a related field.

5. Move MATH 099 to SSC

Institutional Prioritization Committee recommendations:

1. (Page 14) Reallocate/Restructure Developmental Math. Eliminate MATH 099 and replace with student requirement to complete existing ALEKS program. Minimizes cost to students and institution without compromise to quality or student outcomes.

Our response to the Institutional Prioritization Committee:

In 2011-12, 90 students enrolled in our new online MATH 099 course. Of these 90 students, 54 (60%) managed to master at least 90% of the course content. In Fall of 2013, 90 (76%) of 119 students in MATH 099 mastered at least 90% of the course content. This represents a significant improvement over the traditional MATH 095 we had offered over the past decade, where fewer than half of all students managed to pass the course (which, at the time, required mastery of around 70% of the course content).

The only disappointment was our relatively low enrollment in 2011-12 – only 90 (40%) of the 227 incoming students who placed into developmental math enrolled in MATH 099 at St. Ambrose. We attribute this low enrollment to a few factors: (a) some students majoring in the humanities or nursing were allowed to take QUANT 131 instead of MATH 099, (b) we did not adequately inform advisors about MATH 099, and (c) students found cheaper developmental courses offered elsewhere.

To encourage our students to enroll in MATH 099 – and to better align with our institutional definition of a credit hour – MATH 099 was changed from 3-credit hours to 1-2 credit hours. This change seems to have worked, with nearly 130 students enrolled in MATH 099 this Fall semester (and 73 more enrolled this Spring).

As we suggested in our prioritization report, we are working with Maureen Baldwin and representatives from ALEKS (the online system we use in MATH 099) to implement an online placement test for incoming freshmen beginning this summer. We are also investigating how we can transition MATH 099 from the Math Department to the Student Success Center (SSC). This transition would allow incoming freshmen to complete their developmental math requirements at a very low cost prior to taking any courses at St. Ambrose. Housing both peer tutoring and MATH 099 under the SSC should have a positive impact on student retention, graduation, and achievement.

Proposal:

We propose housing all of developmental mathematics (placement testing and an online developmental program) within the Student Success Center.

Rationale - Housing MATH 099 within the Student Success Center (SSC):

Moving our developmental mathematics program to the Student Success Center will improve student achievement, save money, and (potentially) provide a new source of revenue for St. Ambrose.

Student Success

While we do have faculty trained in secondary math education, our department is not well-positioned to handle developmental mathematics. For the past two years, Kathy Potter has served as the both the administrator and instructor for MATH 099. As she would attest to, the online MATH 099 system requires management skills and frequent communication with students, but it does not require any particular expertise in mathematics. We believe the Student Success Center has resources that should lead to continued student success in MATH 099 and, ultimately, improved retention and graduation rates.

As it was originally envisioned, each section of MATH 099 was to be staffed with an instructor and a student helper (a mathematics education major who earned credit as part of our MATH 399 course). The instructor was expected to develop the course syllabus, meet with students to get them started on the online system, contact students throughout the course, and schedule, administer, and proctor progress assessments and final exams. The instructor also worked with student helpers in a MATH 399 class, preparing them to assist with the course. With this staffing model, a student in MATH 099 would be able to reach out to a student helper or the course instructor for assistance.

Because of higher-than-expected enrollment in MATH 099 and lower-than-expected numbers of math education majors, we haven't been able to employ this staffing model. Instead, we've had to rely on work study students and support from peer tutors in the SSC. This may have been detrimental to student success in the course.

The Student Success Center, with its wealth of peer tutors, is an ideal location to house developmental mathematics. In fact, we've already begun this transition, as the SSC is scheduled to implement our new placement test system this summer (using the same online system we use for MATH 099). Once this system is up-and-running, it simply makes sense to house the entire developmental math program within the SSC.

Although MATH 099 is a 1-2 credit hour course, the credits do not count towards the 120 credit hour graduation requirement. In a sense, MATH 099 isn't really a postsecondary course. By housing MATH 099, or something similar, within the SSC, it opens up opportunities to offer a developmental mathematics program outside the boundaries of a traditional St. Ambrose class. We could ultimately decide, as an example, to offer MATH 099 year-round and allow students to complete their developmental mathematics requirement in the time and location that is most convenient and conducive to learning for them. If a developmental mathematics program were offered outside of a typical class format, we could also decide to offer it at a greatly reduced cost to students.

Cost Savings

We currently devote 0.75 FTE (and some work study student time) to managing MATH 099 and the related MATH 399 course. If we did not staff MATH 099, our department could save up to \$16,200 in adjunct/overload pay each year and we'd be able to reassign our work study students.

Current annual budget related to MATH 099

| | | | |
|---------|--|------------|------------------------------------|
| Fall: | 4 sections of MATH 099, 1 section of MATH 399 | = 0.75 FTE | = \$ 8,100 in adjunct/overload pay |
| Spring: | 3 sections of MATH 099, 1 section of MATH 399 | = 0.75 FTE | = \$ 8,100 in adjunct/overload pay |
| Total: | 7 sections of MATH 099; 2 sections of MATH 399 | = 0.75 FTE | = \$16,200 in adjunct/overload pay |

This summer, our department has already planned to provide \$2700 to the Student Success Center to help pay for administration of an online placement system (from March until August). This proposal is just taking the next logical step to transition the year-round developmental math program to the SSC.

Potential Revenue Stream

Regardless of where the developmental math program is housed, MATH 099 offers St. Ambrose a chance to develop a new revenue stream. Right now, the online ALEKS program we use in MATH 099 is available in a 6-week format for \$34 per student (and longer formats at slightly higher costs).

6. QUANT 131 -> MATH 131

Change:

Change QUANT 131: Thinking Mathematically back to a MATH 131 course number. Reinstigate a MATH 099 prerequisite for the course.

Rationale:

The QUANT prefix has made it more difficult for students and advisors to locate the course in Beeline. Bringing back the MATH 099 prerequisite will position this course at a level equivalent to MATH 171, so it deserves a MATH prefix.

The MATH 099 prerequisite will ensure students have the mathematical skills necessary to succeed in the course.