Department of Mathematics & Statistics

List of Programs in the Review

1. B.S. in Mathematics
2. Minor in Mathematics

Faculty Members, academic rank, and title

- Thomas Anderson, Ph.D., professor
- Ilwoo Cho, Ph.D., associate professor
- Timothy Gillespie, Ph.D., assistant professor
- Kevin Lillis, Ph.D., professor, interim chair
- Brad Thiessen, Ph.D., professor
- Lisa Thimm, visiting instructor

DEPARTMENTAL LEVEL REVIEW

I. Review of Previous Departmental Review (refresher of expectations)

A. Insert comments or documentation of suggestions given by EPC from last EPC review.

The EPC response form from our 2011 review stated:

- EPC commends you for the quality and thoroughness of your program review
- Please let us know how the changes in your program are going, especially the online component
- Please update us on how the transition from MATH 151 is going
- Math Department Program Review Approved until Fall 2016

B. Describe the department's progress that has been made towards the goals set in the previous review.

Goal #1: Improve the collection, analysis, and reporting of assessment results.

Progress: Our assessment methods have improved tremendously since our previous review. Over the past 5 years, we have administered the Major Field Test to our majors; developed and administered standardized prerequisite skills tests to students in MATH 131, 171, 191; piloted a complete standards-based assessment system in MATH 171; administered standardized surveys and tests in MATH 300 and 301; and tracked student progress in developmental mathematics programs via online assessment systems. More importantly, these improvements to our assessment systems yielded valuable information we have used to make significant changes to our department and its programs. Most importantly, our recent assessment results indicate these changes have actually improved student learning!

Goal #2: Evaluate and improve our developmental math program, including placement of incoming students.

Progress: Using 4 years of assessment results, we evaluated our developmental math program and made significant changes. First, we evaluated the existing semester-long online MATH 099 course. Then, we piloted a 6-week online summer bridge program. Based on a detailed analysis of data from MATH 099 and the summer bridge program, we ultimately decided to eliminate our developmental math program. So far, evidence suggests our students have not been harmed, but we will continue to evaluate the impact of the discontinuation of our developmental program.

Goal #3: Refine our course offerings for non-majors.

Progress: At our last program review, we received approval to eliminate MATH 151 (College Algebra). This, along with other changes made by other programs, led to several significant changes, such as the COB's development of STBE 137 for Business majors, the move of nursing majors from MATH 131 to MATH 171, and the choice to make MATH 171 a pre- or co-requisite for Biology and Chemistry courses. We view these changes as positive — allowing us to improve our service to students while reducing the number of General Education courses we offer. We will continue to communicate with departments we serve to ensure we offer courses appropriate for their majors.

Goal #4: Evaluate the courses we offer for elementary math endorsement to ensure they meet state standards and align with best practices.

Progress: Since our last review, we have met regularly with faculty from the Teacher Education Program. This led to the development of a new curriculum for the elementary math endorsement in 2013, including the creation of MATH 211: Mathematics for Teachers.

Goal #5: Work towards a "Department of Mathematics and Statistics" with a B.S. in Statistics and Actuarial Science and a statistics minor.

Progress: In 2014, EPC approved our proposal to rename our department and cross-list our MATH 300, 301, and 305 courses with the STAT prefix. While opportunities in actuarial science are limited (and competition is strong), we are still very much interested in developing statistics- and analytics-focused programs (such as a data science major or concentration)

C. Describe changes to the goals & rationale behind such changes, or reasons for not meeting set goals.

We met, or made significant progress towards meeting, all the goals we set during our 2011 review. Other improvements made since our last program review include:

1. We increased the accessibility of our programs and all quantitative courses at St. Ambrose.

- We eliminated our developmental math requirement. This came after replacing MATH 091/095/096/101 with a 3-credit MATH 099, a 1-credit MATH 099, and a 6-week summer bridge program. Eliminating the barrier of developmental math allows all first-year students to take credit-bearing General Education quantitative courses in the first semester.

- We replaced the university *mathematical reasoning requirement* with a *quantitative requirement*, thus opening the door for CSCI 140/281 and STBE 237 to receive General Education designation. This also allowed us to completely revamp our General Education offerings by changing QUANT 131 back to MATH 131 and eliminating MATH 151, 152, 161, and QUANT 113.

2. We improved the quality and efficiency of our programs and service we offer to other programs.

- Since our previous program review, our average scores on <u>every</u> subtest of the Major Field Test in Mathematics have improved significantly. Overall, our program increased from the 8^{th} percentile (in 2012) to the 79^{th} percentile (in 2016). Our students are also being admitted to more prestigious graduate programs in mathematics, statistics, and other programs (such as neuroscience, law, medicine).

- We changed requirements for the B.S. in Mathematics by eliminating all electives (MATH 230, 371, 375, 381, 396, 490), eliminating the CSCI requirement, and adding MATH 390 (Mathematical Programming). We also changed prerequisites for MATH 220/320 and added the WI-designation to MATH 380.

- We changed requirements for the B.S. in Secondary Mathematics Education by eliminating MATH 360 and adding MATH 399. We later merged the B.S. in Secondary Mathematics Education with our B.S. in Mathematics, allowing us to completely eliminate MATH 360, 396, 399. We also approved of the decision to merge MATH 340 (secondary math methods) into EDUC 347 STEM Methods.

- We worked to ensure graduates from St. Ambrose demonstrate achievement equivalent to a college-level quantitative course by increasing the ACT Math score needed to fulfill General Education quantitative requirements (from a score of 23 to 28). We also modified credits awarded for AP Calculus and IB equivalent courses. Finally, we reviewed all mathematics transfer courses with the Registrar's Office to ensure equivalence with our own courses.

- We received approval to cross-list CSCI 281 as MATH 281 and MATH 400 as HON 401.

- We worked with the Department of Engineering & Physical Sciences to require MATH 290, 291, 300, and 320 while eliminating MATH 280.

3. We worked to improve our capacity and infrastructure, while resources have declined.

- We replaced 2.00 FTE staffing (a full-tie instructional staff member and a full-time visiting assistant professor) with a 1.00 FTE tenure track line. As the table on the next page shows, our full-time staffing (at 4.00 FTE) is lower than it was in 1995 (5.25 FTE), when St. Ambrose had far fewer students.

- If we include part-time (adjunct) staffing, our department has gone from 9.07 FTE in 2009 to 5.00 FTE in 2016.

Year	Tenure-track FTE	Total FTE**	St. Ambrose UG FTE	Math, Engineering majors
1995	5.00	5.25		
2003	5.00	5.50	2265	61
2008	3.75	5.25	2720	84
2010	2.75	5.25	2649	96
2013	2.75	4.75	2596	92
2015	4.00	4.00		

** Does not include adjunct instructors

- Our prioritization report provides some evidence of the effect of this decreased level of staffing. Because we were able to restructure our curricular offerings, we were able to increase revenue while decreasing costs:

Year	Revenue	Direct Costs	Net Revenue
2009-10	$991,852	$457,981	$73,710
2010-11	$1,053,996	$472,957	$69,785
2011-12	$1,078,137	$441,008	$113,858

Source: Prioritization Report

- Our departmental budget also shows the reduction in resources we've faced over the past 7 years:

	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Annual change
Full-time salaries	319,300	296,800	314,543	276,100	296,500	306,900	258,800	270,300	-2.4%
Part-time salaries	40,000	30,000	15,000	15,000	15,000	15,000	12,810	21,900	-8.2%
Work-Study	4,788	3,600	5,550	4,216	3,712	5,550	5,550	4,500	-0.9%
Office Supplies	3,700	3,700	2,800	2,800	2,000	2,000	1,800	1,800	-9.8%
Equipment	1,000	700	500	500	500	500	0	0	(-100%)
Food	350	350	800	500	100	100	0	0	(-100%)
Postage	100	100	100	100	0	0	0	0	(-100%)
Pub's & Dues	400	200	500	500	700	700	300	300	-4.0%
Phone	1,080	1,080	1,080	1,080	1,080	1,080	780	780	-4.5%
Travel	1,000	900	1,000	750	1,250	1,250	400	400	-12.3%
Other	200	200	200	200	0	0	0	0	(-100%)
Staff Dev.	300	150	200	200	200	200	0	0	(-100%)
Total discretionary	$8,130	$7,380	$7,180	$6,630	$5,830	$5,830	$3,280	$3,280	-12.2%
Total budget	$466,211	$431,018	$437,250	$384,542	$397,157	$429,413	$359,156	$366,405	-3.4%

- This reduction in resources is the biggest threat we face in meeting our goals for the future. For the past 5 years, we've begun every academic year knowing we were already significantly over budget in our part-time salary line. Also, once mandatory expenses (copier contract and telephone charges) are factored in, our discretionary budget is effectively zero. Since our last program review, all our efforts have been focused on finding ways to serve more students with fewer resources. We've now hit a limit where any further reductions will reduce the amount or quality of services we offer students.

- The reduction in resources has also penalized our students. We have tried to eliminate an unnecessary $25 course fee being charged to students in MATH 191 and 192. This fee was originally established (20+ years ago) to cover software licenses for a program we haven't had for more than a decade. Students do not benefit from this fee and the revenue doesn't even go to our department, so we believe it's unethical to charge the fee. When we tried to eliminate the course fee, we were told we needed to cut our discretionary budget by an amount equivalent to the revenue the fee generates (for every year until St. Ambrose closes or changes budget models, we guess). Since the course fee brings in ~$2000 in revenue each year, we cannot find the money in our discretionary budget. We ask for EPC's support in eliminating this unnecessary course fee.

II. State of the Department (summary of data and trends since last review):

A. Insert the Department and Program(s) description in the current catalog.
If you are making changes to the descriptions, highlight those changes in green.

Mathematics & Statistics
The Department of Mathematics and Statistics offers a major and minor in mathematics, along with a concentration in secondary mathematics education. The BS in Mathematics is designed for students who intend to enter the job market immediately after graduation, as well as students who intend to enter graduate programs in mathematics, statistics, or related areas. Students wishing to earn a teaching endorsement in secondary mathematics education can complete the concentration in secondary mathematics education.

Requirements for a Bachelor of Science with a Major in Mathematics: 39 credits of math including MATH 191, 192, WI-220, 290, 291, 300, 301, 320, 370, 380, 390, 400.

~~Requirements for a Minor in Mathematics: 21 credits including MATH 191, 192, 290, 291, 300, 320.~~ (proposing to eliminate this minor as we investigate a minor in data science)

Requirements for a concentration in secondary mathematics education: Students will substitute MATH 340 for MATH 400. See the Iowa Endorsement Secondary Education section of the Catalog for information on Teacher Education courses.

B. Complete the below table using the most recent STAT PAK file

1. Enrollment Data – Identify enrollment in each program

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Totals
B.S. Math	3	4	4	7	16	16	50
B.S. Math Education	26	29	19	10	5	Program no longer exists	89
Minor	--	6	8	6	9	76	105
Total Enrollment	29 majors 0 minors	33 majors 6 minors	23 majors 8 minors	17 majors 6 minors	21 majors 9 minors	16 majors 76 minors	139 majors 105 minors

2. Graduates – Identify degrees and/or certificates conferred by the program

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Totals
B.S. Math	0	1	2	We	Will	Get	these
B.S. Math Education	3	5	8	Numbers	From	IR.	I
Total	3	6	10	Requested	Them	On	9/20.

Briefly discuss trends within tables

Since our previous program review, our overall number of majors has been steadily decreasing (from around 30 to less than 20). This may be due, in large part, to the elimination of our standalone B.S. in Secondary Mathematics Education. The number of minors increased dramatically once engineering majors began applying for the minor.

C. Insert the following tables from The National Study of Instructional Costs & Productivity (Delaware Study) results for your department or program.

Table 3A - Student credit hours (SCH), organized class sections (OCS), and FTE students taught per term per FTE instructional faculty - Faculty category: **Tenured & tenure-track faculty**

CIP	Year	Discipline	Degrees awarded	% UG degree	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
27.01	2007-2008	Mathematics	B	100	5.00	128	2.8	-	-	128	2.8	3.2	8.6
		National Norms				**218**	**3.0**			**222**	**3.2**	**3.2**	**15.0**
	2008-2009	Mathematics	B	100	4.00	126	4.3	-	-	126	4.3	4.8	8.4
		National Norms				**230**	**3.0**	**7**	**0.3**	**233**	**3.2**	**3.2**	**15.6**
	2009-2010	Mathematics	B	100	3.00	152	4.3	-	-	152	4.3	4.3	10.2
		National Norms				**248**	**3.3**	**7**	**0.3**	**249**	**3.3**	**3.4**	**16.7**
	2010-2011	Mathematics	B	100	3.00	113	3.0	-	-	113	3.0	3.7	7.5
		National Norms				**244**	**3.2**	**7**	**0.3**	**247**	**3.3**	**3.4**	**16.6**
	2011-2012	Mathematics	B	100	3.00	152	3.0	-	-	152	3.0	3.7	10.2
		National Norms				**245**	**3.2**	**8**	**0.3**	**247**	**3.3**	**3.3**	**16.7**
	2012-2013	Mathematics	B	100	3.00	161	3.3	-	-	161	3.3	3.3	10.8
		National Norms				**238**	**3.0**	**9**	**0.3**	**243**	**3.1**	**3.3**	**16.5**
	2013-2014	Mathematics	B	100	3.00	168	4.0	-	-	168	4.0	4.0	11.2
		National Norms				**233**	**3.0**	**9**	**0.3**	**238**	**3.2**	**3.3**	**16.1**

Table 3F - Student credit hours (SCH), organized class sections (OCS), and FTE students taught per term per FTE instructional faculty - Faculty category: **All faculty categories combined**

CIP	Year	Discipline	Degrees awarded	% UG degree	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
27.01	2007-2008	Mathematics	B	100	8.24	144	3.3	-	-	144	3.3	3.8	9.6
		National Norms				**263**	**3.4**			**267**	**3.5**	**3.5**	**17.9**
	2008-2009	Mathematics	B	100	9.07	146	4.0	-	-	146	4.0	4.5	9.7
		National Norms				**271**	**3.3**	**6**	**0.2**	**273**	**3.4**	**3.5**	**18.3**
	2009-2010	Mathematics	B	100	7.33	160	4.1	-	-	160	4.1	4.1	10.7
		National Norms				**284**	**3.4**	**5**	**0.2**	**285**	**3.4**	**3.5**	**19.1**
	2010-2011	Mathematics	B	100	7.42	150	3.6	-	-	150	3.6	4.0	10.0
		National Norms				**277**	**3.5**	**5**	**0.2**	**280**	**3.6**	**3.7**	**18.8**
	2011-2012	Mathematics	B	100	6.92	166	3.3	-	-	166	3.3	3.9	11.1
		National Norms				**285**	**3.4**	**5**	**0.2**	**287**	**3.5**	**3.7**	**19.2**
	2012-2013	Mathematics	B	100	7.83	189	3.4	-	-	189	3.4	4.0	12.6
		National Norms				**276**	**3.4**	**6**	**0.2**	**279**	**3.5**	**3.5**	**18.7**
	2013-2014	Mathematics	B	100	6.67	190	4.0	-	-	190	4.0	4.6	12.7
		National Norms				**274**	**3.3**	**5**	**0.2**	**279**	**3.4**	**3.6**	**18.7**

Table 4

Instructional unit costs, research and public service expenditures

1: Total FTE faculty
2: Tenured/tenure-track fac as % of total
3: Total FTE instructional faculty
4: Direct instructional exp/SCH ($)
5: Direct instructional cost/FTE student ($)

6: Personnel cost as % of direct instr'l exp
7: Research exp /FTE tenured & tenure-track faculty ($)
8: Public serv exp /FTE tenured & tenure-track faculty ($)
9: Research & public serv exp /FTE tenured & tenure-track faculty ($)

CIP	Year	Discipline	Degrees awarded	% UG degree	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
27.01	2007-2008	Mathematics	B	100	8.24	61	8.24	193	5,785	98	0	0	0
		National Norms						**146**	**4,364**	**97**	**1,954**	**106**	**2,051**
	2008-2009	Mathematics	B	100	9.07	44	9.07	188	5,634	100	0	0	0
		National Norms						**141**	**4,157**	**97**	**1,132**	**120**	**1,252**
	2009-2010	Mathematics	B	100	7.33	41	7.33	198	5,930	98	0	0	0
		National Norms						**144**	**4,281**	**98**	**676**	**11**	**770**
	2010-2011	Mathematics	B	100	7.42	40	7.42	194	5,825	99	0	0	0
		National Norms						**147**	**4,371**	**98**	**1,774**	**32**	**1,923**
	2011-2012	Mathematics	B	100	6.92	43	6.92	193	5,776	99	0	0	0
		National Norms						**147**	**4,375**	**97**	**1,195**	**42**	**1,307**
	2012-2013	Mathematics	B	100	7.83	38	7.83	180	5,385	99	0	0	0
		National Norms						**152**	**4,515**	**98**	**1,020**	**13**	**1,102**
	2013-2014	Mathematics	B	100	6.67	45	6.67	198	5,933	99	0	0	0
		National Norms						**160**	**4,778**	**98**	**1,128**	**2**	**1,219**

Briefly discuss trends within tables

The tables reinforce what we already know: (a) our full-time staffing has generally declined over the past 8 years, (b) our overall staffing levels have also declined, and (c) our cost per student does not compare favorably to the national norms. This, we believe, is due to the fact that our class sizes are much smaller than those offered at larger institutions. We don't know, however, how overall costs compare once research and public service expenditures (both $0 for us) are factored in.

The following table shows the revenue/expense information we received during the 2015-16 academic year.

	Credit Hours	Net tuition revenue	Other direct revenues	Total direct revenues	Direct Expenses	Contrib. Margin 1	Contrib. Margin 1 %
2013	2,670	998,610	53,712	1,052,322	440,902	611,420	58.1%
2014	2,332	885,084	30,676	915,761	451,828	463,932	50.7%

	College Allocated	Contrib. Margin 2	Academic Support	Contrib. Margin 3	Other revenue	Overhead	Contrib. Margin 4
2013	16,499	594,921	78,091	516,830	8,695	454,084	71,440
2014	15,933	447,998	72,904	375,095	7,258	411,041	-28,689

D. If the degree program for a first major requires more than 42 credit hours in the discipline provide evidence and justification for exceeding 42 credit hours.

Not applicable.

E. If the degree program for a second major requires fewer than 30 different credit hours in the discipline justify and document the requirements.

Not applicable.

F. Evaluation of instructional resources: to include, but not be limited to facility resources and staffing resources

1. Complete table

Instructional Resource Category	**Status (sufficient or insufficient)**	**Need**	**Supporting Evidence**
Facilities	Sufficient		We are usually able to teach our courses in appropriate classrooms.
Faculty	Sufficient for current programs		We are able to staff our current courses (as long as adjunct faculty are available in the Fall)
Staff	Sufficient		We have very little need or use for staff.
Technology	Insufficient	Our needs are minimal — free, open source software to be installed in computer labs. We have found following institutional procedures (filling out *IT - Lab Software Request* form)	We requested the installation of R and RStudio for 6 consecutive semesters before it was actually installed. Our request to update the applications this semester was also

		has no impact on whether software actually gets installed.	apparently ignored. If we're asked to fill out the online form, we should have some assurance that someone will actually follow through.
Equipment	Sufficient		We have no need for specialized equipment.
Information Resources	Sufficient		We have very little need for information resources.
Ability to track student learning outcomes	Insufficient	We've been able to administer the Major Field Test by requesting free copies. This cannot be guaranteed in the future — and our budget can't afford to pay for any tests — so we're uncertain if we'll be able to keep using the MFT.	See our budget trends (page 4 of this program review). The Major Field Test costs $25 per student. We could charge a course fee for our capstone course, but we'd like to eliminate our MATH 191/192 course fees first.
Marketing & Communication	Sufficient for current programs		We, admittedly, have done little to recruit students.
Other:			

2. Explain the steps your department has taken (or will take) to secure resources for areas of need noted in the table above?

We'll continue to ask for free copies of the Major Field Test. We'll also continue to have our students bring laptops to class, when possible. Our requests for additional resources have rarely, if ever, been effective.

G. List other departments that provide resources to deliver the curriculum of your programs. Include an affirmation (email) that your department has consulted with and gained approval of other departments to continue providing resources to deliver curriculum required for the programs. (excludes changes proposed below in this review).

Only the Teacher Education Program provides resources for our majors who get a secondary teaching endorsement. This endorsement is an add-on to our program.

III. Departmental SWOT Analysis

Departments should complete a SWOT analysis and filling in the below table.

Strengths	Weaknesses
Nimbleness. We've demonstrated the ability to make changes anticipating (and in response to) the needs of the programs we serve. Frugality. In the face of declining a continuously declining budget, we still do our best to underspend. We also have minimized textbook expenses for our students.	Declining resources have limited research opportunities for our students. While we still bring in guest speakers and work with students on research projects, we're no longer able to fund any opportunities. Likewise, our travel budget no longer allows any of our faculty to travel to conferences.
Opportunities	**Threats**
Growing student and faculty interest in statistics and data science programming. We've managed to cobble together individualized interdisciplinary minors for students wanting to develop data science skills. We have the opportunity to develop programming in response to this student demand. A focus on data science would also open up opportunities to seek external funding. We can't compete with larger schools to get mathematics-focused funding; we can compete with much smaller data science programs. Over the past decade, we've eliminated a significant number of courses (including our developmental program and General Education courses). We also encouraged other departments to offer their own General Education quantitative courses (STBE 137, CSCI 140, CSCI 281). Now that we have a more limited number of programs to serve, we can work with these programs to ensure we're offering the most appropriate courses. We see opportunities to work with our colleagues in the health sciences to develop new courses (or modify existing courses) that focus on their student learning outcomes.	Because other departments offer their own General Education quantitative reasoning courses, our overall departmental enrollment has declined. This, in itself, is not a negative outcome. It does, however, threaten the viability of our department. Courses with a MATH prefix can be perceived as being more challenging than courses with other prefixes. Overall declining institutional enrollment threatens all academic programs.

IV. Goals for the next five years

Based on sections I-IV, provide department/program goals for next review cycle. Include an outline of department's/program's plans to meet these goals using the following format.

1. Goal: Develop major (or masters-level program) in Data Science.
Rationale: We've presented data regarding internal and external demands to EPC previously. We've also fully developed a curriculum for the major.
Plan:Continue following institutional procedures for proposing new programs. We have a meeting scheduled with Paul Koch on 10/19.

2. Goal: Convert MATH 171 to a competency-based, pass/fail course
Rationale: We have been gathering assessment evidence in support of this proposal for a few years now. We're confident a competency-based approach will improve student achievement.
Plan:We will work with programs that identify MATH 171 as a prerequisite to confirm we have appropriate core student learning outcomes for MATH 171

3. Goal: Work with health science programs to provide courses that better serve their students
Rationale: We have reason to believe our General Education courses are not aligned with the core skills desired by faculty in the health sciences.
Plan:Evaluate MATH 171 outcomes in comparison to the core skills desired by health science faculty. Continue working with faculty in Health Science disciplines to identify key student learning outcomes for potential courses.

PROGRAM REVIEW SECTION

Review of Major – B.S. in Mathematics

Program Evaluation & Assessment of Student Learning Outcomes

A. Program Evaluation

1. Provide the program description and how it fits within the department and the institution.

Excerpt from our admissions information sheet:

The mathematics program is designed for students who want to have many opportunities after graduation. Completing an undergraduate mathematics degree alone will give students options for immediate employment in areas such as actuarial science, business analytics, and data science. Students can combine their mathematics major with a secondary teaching endorsement to teach middle or high school math. Many of our graduates are immediately employed after graduation as secondary math teachers. Students can also combine the degree with a second major or minor in the sciences, computer science, psychology, or virtually any other field. Your mathematics degree can open doors to graduate programs in mathematics, mathematics education, statistics, and other quantitative disciplines.

In that same information sheet, we highlight the following strengths of our program (including some high impact practices):

- Individualized curriculum: *Our program does not have elective courses. Instead, we individualize our curriculum through special topics courses. This allows students to shape the program to meet their future goals and it also allows all students to graduate on time—even with a second major, minor, or concentration.*

- A focus on learning: *Our faculty focus primarily on student learning — not research or supervising graduate students. This focus on learning leads us to continuously improve our classes based on student feedback and performance.*

- Research and analysis projects: *In our topics and mathematical computing courses, students work one-on-one with faculty on research and analysis projects. This means students graduate ready for immediate employment or graduate school. Our department combines mathematics with statistics, which has helped some of our recent graduates obtain positions in the fields of data analysis, statistics, and actuarial science.*

- Graduate and professional school preparation: *The problem solving skills and perseverance gained through studying mathematics prepares students for graduate and professional schools. In fact, studies show students majoring in mathematics outperform other students on required graduate school standardized tests. Just recently, we've had students accepted into graduate programs in law, neuroscience, medicine, mathematics, statistics, and educational measurement. Some of our graduates have gone on to earn PhDs in mathematics and statistics.*

• Strong and lasting relationships: *Students can expect to get help outside of class directly from faculty. They can also expect recommendation letters to help them find employment or enroll in graduate school. Our students build strong working relationships with our entire faculty that last far beyond graduation.*

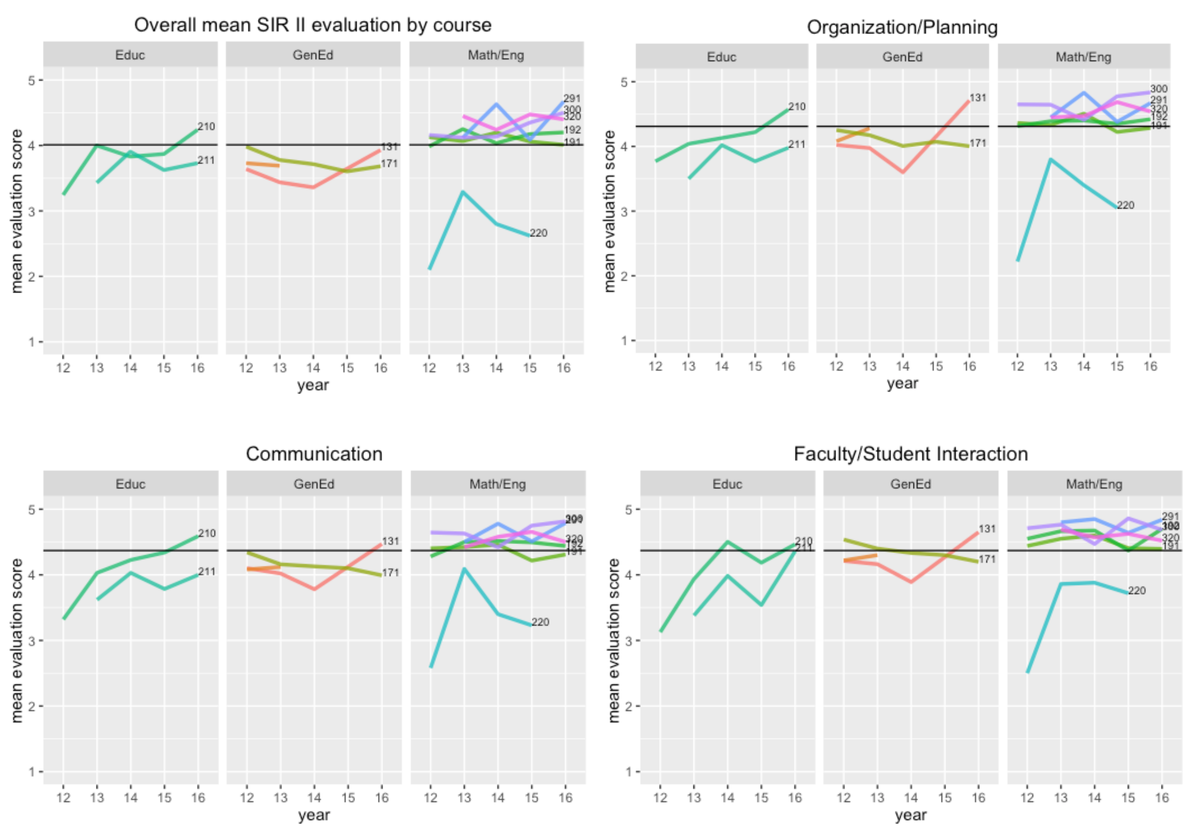
The fit of the program within our department is self-evident.

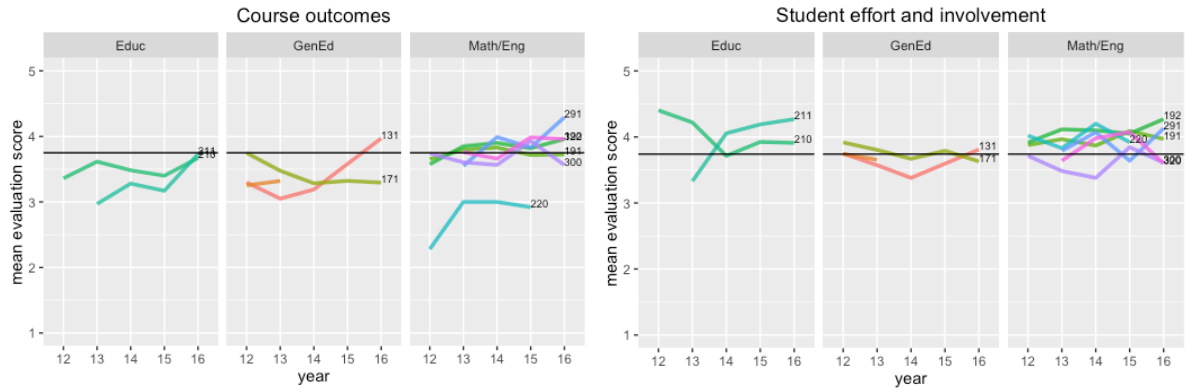
The program aligns with the university mission, enabling students to develop intellectually to enrich their own lives and the lives of others, and our institution's grounding in the liberal arts.

One could question the fit of our program — mainly designed as a pure mathematics program — with the students we attract and serve at St. Ambrose. Likewise, the fit within the institution could be questioned based on the relatively small number of majors we produce.

2.Present findings associated with program evaluation as appropriate. This may include surveys (students, graduates, stakeholders, employers, etc.), course evaluations, departmental achievements/awards, focus groups, advisory boards, etc.

Here are summaries of the SIR II (mean) scores for each of our courses over the past 5 years:





Observations:

• With the exception of MATH 220, math and engineering majors rate our courses higher than the St. Ambrose mean (the black, horizontal lines on each plot).
• Evaluations for our math education courses (MATH 210/211) have improved over time.
• Recent changes to MATH 131 have improved evaluation scores
• MATH 171 evaluation scores have dropped as more students have been required to take the course.
• MATH 220 is an incredibly difficult course to teach. It's the first introduction students have to proof writing, so many students dislike the course initially.

B. Student Learning Outcomes

<u>Non-Accredited Programs</u>

1. Insert the following documents in the appendices
    a. Annual Assessment Form
       Link: https://drive.google.com/open?id=1qgpXOO7cPsg486WhGtyzk045dw5ekVnoxmukwVlq0xw
       That link provides access to dozens of assessment plans, reports, and analyses we've conducted since 2012.
    b. Feedback from the Assessment Committee
       Link: https://drive.google.com/open?id=1qgpXOO7cPsg486WhGtyzk045dw5ekVnoxmukwVlq0xw
    c. Assessment Results of Student Learning Outcomes.
       Link: https://drive.google.com/open?id=1qgpXOO7cPsg486WhGtyzk045dw5ekVnoxmukwVlq0xw

2. Explain how your stated student learning outcomes are appropriate to your mission, programs, and students.

The mission of our department is: *to provide all students opportunities to develop mathematical and quantitative skills to model systems and solve problems. The Department provides its majors with a deep understanding of mathematical concepts and mastery of problem-solving skills to prepare them for immediate employment or enrollment in graduate/professional programs.*

Our student learning outcomes were developed in alignment with recommendations from the MAA and ASA for undergraduate programs in mathematics and statistics. Our outcomes were also aligned with bachelors-level-degree-outcomes from the Degree Qualifications Profile.

The outcomes for our B.S. in Mathematics (since our last review) have been:

1. Demonstrate a breadth and depth of knowledge appropriate for a bachelor's degree in mathematics. According to the assessments we use, this knowledge includes routine and non-routine problems in:
   - Calculus – single and multi-variable
   - Linear Algebra – Matrices, Linear transformations, Eigenvalues and eigenvectors, Vector spaces, Systems of linear equations
   - Abstract Algebra – Elementary theory of groups, rings and fields; Elementary topics from number theory
   - Other Topics – Complex analysis, Differential equations, Discrete mathematics (including graph theory and combinatorics), Foundations (including logic, proofs, sets, functions and relations), Geometry, Point-set topology, Probability and statistics, Real analysis

2. Communicate mathematical ideas using proper terms and symbols

3. Construct concise and rigorous mathematical proofs.

4. Learn mathematics independently by locating and assimilating technical material

5. Persevere in solving routine and non-routine problems using appropriate technology strategically.

6a. Critically consume and apply research and local/state/national standards in mathematics education to plan, deliver, and evaluate effective instruction

6b. Appreciate the career and educational opportunities for mathematics majors.

3. Explain how student learning outcomes are aligned across delivery formats (if applicable).

While assessing our courses in 2012, we found that the outcomes were not aligned across modes of delivery. Courses offered at the ACCEL program did not cover the breadth or depth of topics covered in our non-accelerated main campus courses.

Since that time, we have worked to ensure all our courses teach towards and assess the same student learning outcomes. We ensure this by reviewing syllabi and student assessments across multiple sections of the same course each semester.

4. Document how your department analyzes and uses evidence of student learning.

Our online assessment form documents how our department analyzes assessment data. The numerous changes we've made over the past decade (section I.c. of this program review) demonstrate our use of assessment evidence.

5. Describe how your faculty members share responsibility for student learning and its assessment.

In addition to the fact that every faculty member is responsible for the assessment of student learning within a course, we have demonstrated a shared responsibility by:
• Developing, administering, and analyzing basic skills pre-tests in MATH 171/191
• Developing common exams in MATH 171
• Completing institutional General Education assessment rubrics

6. Reflect on evidence and describe your findings. Propose any needed changes to curriculum or student learning outcomes. (Must at least address any areas of low performance or concern.) Include how you evaluate and improve your efforts to assess and improve student learning.

Based on changes we've made to our curriculum, changing recommendations from professional organizations, and changes we've noticed with our majors, we would like to update our student learning outcomes:

B.S. in Mathematics:
In completing the B.S. in Mathematics, students will demonstrate a breadth and depth of knowledge sufficient for immediate employment or admission to quantitative-focused graduate programs.

Students will:
1. Construct clear, concise, and rigorous mathematical arguments
2. Independently locate, access, & assimilate technical material to facilitate further mathematical learning
3. Use proper terms, symbols, and visualizations to communicate mathematical ideas to peers and faculty
4. Competently use high-level programming languages (Matlab, R, Wolfram Alpha) and other appropriate technology to teach, learn, and/or practice mathematics
5. Persevere in solving routine and non-routine problems in:
    - Calculus: single- and multi-variable
    - Foundations: logic, proof, sets, functions, and relations
    - Linear algebra: matrices, linear transformations, eigenvalues, eigenvectors, vector spaces, linear systems
    - Abstract algebra: elementary theory of groups, rings and fields; elementary topics from number theory
    - Probability & statistics: distributions, statistical inference, statistical modeling, statistical computing
    - Differential equations: first, second, higher order; linear systems; Laplace transform
    - Real analysis: theory and proofs of limits, sequences, derivatives
    - Other: complex analysis, discrete mathematics, geometry, point-set topology

We would also like to further investigate the student learning outcome(s) for the General Education quantitative reasoning requirement. Below, I've pasted definitions of "quantitative literacy" and student learning outcomes articulated by AAC&U and the Degree Qualifications Profile. It is questionable whether MATH 171 aligns with any of these externally-developed recommendations for quantitative literacy/reasoning student learning outcomes.

Notes: Our main General Education courses are MATH 131/171, but all math courses meet GenEd requirements. Other courses that fulfill this requirement include CSCI 140, 281, STAT 213, and STBE 137.

General Education outcome: Students will develop fundamental skills and knowledge necessary to flourish in a rapidly changing world.

VALUE rubrics: Quantitative Literacy (also known as Numeracy or Quantitative Reasoning)

Definition: a "habit of mind," competency; comfort in working with numerical data. Individuals with strong QL skills possess the ability to reason and solve quantitative problems from a wide array of authentic contexts and everyday life situations. They understand and can create sophisticated arguments supported by quantitative evidence and they can clearly communicate those arguments in a variety of formats (using words, tables, graphs, mathematical equations, etc., as appropriate).

Assessment: Given widespread agreement about the importance of QL, it becomes incumbent on faculty to develop new kinds of assignments which give students substantive, contextualized experience in using such skills as analyzing quantitative information, representing quantitative information in appropriate forms, completing calculations to answer meaningful questions, making judgments based on quantitative data and communicating the results of that work for various purposes and audiences. As students gain experience with those skills, faculty must develop assignments that require students to create work products which reveal their thought processes and demonstrate the range of their QL skills.

Skills (benchmark scores of *milestone 3* seem most appropriate for completion of GenEd req's)

Interpretation: Provides accurate explanations of information presented in mathematical forms. (e.g., equations, graphs, diagrams, tables, words)

Representation: Competently converts relevant information into an appropriate and desired mathematical portrayal. (e.g., equations, graphs, diagrams, tables, words)

Calculation: Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.

Application / Analysis: Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions.

Assumptions: Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate.

Communication: Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.

Degree Qualifications Profile: Skills appropriate for associate level (which transfers in to fulfill General Education requirements):

1. Presents accurate interpretations of quantitative information on political, economic, health-related or technological topics & explains how calculations and symbolic operations are used
2. Creates/explains graphs or other visual depictions of trends, relationships or changes in status

7. Describe how you inform your various stakeholders (students, employers, accreditation agencies, etc.), both on and off campus, about what and how well your students are learning.

We share program-level assessment results within our department and discuss them regularly. We do not share our assessment results with external stakeholders.

Review of Minor – Minor in Mathematics

A. Provide a description, purpose and the requirements of the minor:

> The minor in mathematics really didn't have a purpose. The description could have been "foundational courses in mathematics."

B. What are the goals of the minor:

> We have never identified goals for the minor in mathematics.

C. How do you determine if the goals of the minor are met?

> We have never identified goals for the minor in mathematics. We look forward to offering a focused minor in Data Science that will allow for assessment (including a capstone course with project).

D. If a major is offered in a similar area, how are the goals of the minor different:

> N/A

I. Requests for approval of proposed changes

A. Complete the following table.

Course name and number	Action proposed (add, delete, or change)	Rationale/evidence for proposal
+MATH/STAT 123: Introduction to Data Science	Add	With an increasing number of students participating in undergraduate research projects, it's become clear that many (if not all) of our students do not know how to import, wrangle, visualize, model, and communicate data. This General Education course could be an attractive option for any student who anticipates needing to convert data into insight. This course will also serve the demand we're seeing from students who want minors in data science and statistics. We've only been able to serve these students in our 400-level topics courses (which is not an appropriate course number for introductory content).
+MATH 131: Thinking Mathematically	Change name to "Fundamentals in Math"	This title more accurately reflects course content and purpose.
MATH/STAT 305: Data Analysis	Change name to "Advanced Data Science"	This name more accurately reflects the content and outcomes of the course (with its focus on statistical/machine learning and statistical computing)
MATH 340: Secondary Math Methods	Un-delete	On April 26, 2016, EPC approved the merging of this course into EDUC 347. The state rejected this proposal, so we need to bring this course back.

B. Acknowledge and examine the impact of these changes on other programs. Affirm (email) the department/program has consulted with members of other departments/programs that may be affected by changes in your program. Course additions or deletions, WI-status changes, and changes in course pre-requisites all may have an impact on other departments' needs.
These proposals have no impact on other academic programs.

II. Review of syllabi and course summary sheets

Department chair/director has ensured the following (check box to acknowledge statement)

☐ All existing courses offered within the program have an up to date syllabus that meet the EPC syllabi guidelines.

☒ All existing courses have a completed course summary sheet.

☒ The syllabi and course summary sheets of courses that support this program, but are delivered outside of the program have been reviewed to ensure they are contributing to the program student learning outcome.
☒ All online courses have received proper approval as described in the Distance Education Manual.
☒ Expectations and student learning outcomes courses that are delivered in multiple delivery methods are similar.
☐ The program maintains an archive of syllabi of courses taught with the program.

Course Summaries and Syllabi:

Department chairs need to upload course summary sheets and syllabi to their location on the Blackboard EPC site. Please contact the chair of EPC for assistance. All courses must utilize the 13-14 version of the course summary unless given permission by the chair of EPC to use an older form. See syllabi requirements in Blackboard: Policies.

III. Letter of support from the following committees as appropriate:

Letters of support from the following committees are required as part of the program review process. Below each committee is a list of feedback EPC is seeking.

1. Assessment Committee
    a. Statement about whether programs are performing appropriate assessment.
    b. Statement about if program appears to be meeting student learning outcomes.
    c. Identification of areas of weakness or areas in which programs should work towards strengthening before the next review.
    d. Identification of areas of strengths.
2. General Education
    a. Approval that courses identified as meeting general education outcomes are correctly aligned
    b. Identification of areas of weakness or areas in which programs should work towards strengthening before the next review.
    c. Identification of areas of strengths.
3. Writing Intensive
    a. Approval that courses identified as writing intensive meet the established criteria
    b. Identification of areas of weakness or areas in which programs should work towards strengthening before the next review.
    c. Identification of areas of strengths.

IV. Letter of support from the Dean of the College

This can be a inserted as an appendix or submitted as a separate letter. The members of EPC would like the dean to address at a minimum the following

a. An assessment of the Department's submitted documents.
b. Strengths, challenges and opportunities for the Department
c. Ensure that the Department has consulted with other Departments that provide resources to deliver the programs
d. If changes are being made to the curriculum or course offerings, ensure that the Department has consulted with other Departments that rely on those courses.

Deadlines for Program Reviews:

All Programs/Departments appearing before EPC must submit Program Reviews by September 15 for fall appearances or December 7 for spring appearances.

The Chairperson of the EPC will announce scheduled meeting times for a given semester and will share program reviews schedule for review. Members of the programs are encouraged to attend the EPC meeting, which is open to faculty, staff, administrators and students.