Mathematical Sciences Table of Contents

Mathematical Sciences Annual Report

Department Annual Report (outline)

I. Unit Goals/Progress/Accomplishments: focus on department/program accomplishments.
II. Program Viability and Enrollment Management: includes viability metrics, departmental enrollment management plan and departmental performance toward meeting enrollment management goals (supported by enrollment management report provided by Institutional Research).
III. Faculty, Student, and Staff Accomplishments: focus on individual accomplishments that provide evidence of advancing or enhancing program quality
IV. Alumni Accomplishments
V. Resource allocation recommendations

Department Annual Report (template)

Section 1: Unit Goals/Progress

In Table 1, list Unit Goals from the Five-Year Plan and additional goals established for the current year. Describe actions implemented to help achieve goals and provide evidence of how the actions contributed to goal achievement.

Table 1: Progress in Accomplishing 5 Year Goals

Goal Start Date	Unit Goal	Plan Action Items	Evidence of Progress to Goal (performance relative to action item)
January 2023	Advance successful entry level experiences for all students	1. Establish maintained systems for integrated analyses of enrollment projections, student success impacts, and general education assessment data 2. Review entry level course options, variety of pedagogical designs/modalities supported, and instructional staffing plans in comparison to	• Current practices for collecting and reviewing data each semester on student placements and success in first math courses. Continuing work to focus the analysis on success in first math/stat class taken and student experiences in cases of retakes. • Continuing development and analysis of entry level options, now including standard entry into MA

		projected capacity needs, support for campus programs, and impacts on student persistence and success 3. Further develop practices for early alerts (e.g., Navigate, advising/student support office consults) and determine ways of tracking impacts on student success	11100 with a required lab MA 11101, a co-requisite option (MA 12700), a pre-MA 11100 option intended to provide positive experiences and practices in mathematics (MA 12401), online options in MA 15300/15400 for students to enroll in a compressed class during second half of term as "drop down" or "fall back" in response to experiences with that class or next class in full term modality. • Review of curricula and course coordination roles structure in entry level courses, particularly significant in response to loss of full-time positions • Ongoing work with GTAs on student alert and academic dishonesty responses, towards connecting students and engaging them in successful practices throughout the term.

Goal Start Date	Unit Goal	Plan Action Items	Evidence of Progress to Goal (performance relative to action item)
January 2023	Advance distinctive opportunities within department programs	1. Review committee structures, inclusive participation envisioned, and leadership opportunities for focusing department energy and expertise on departmentally identified programs 2. Further empower new and existing distinctive opportunities, engaging students and faculty with regional communities 3. Complete the implementations of recently introduced courses, capstone/corporate projects experiences; incorporate with course offering/alternating year schedule planning 4. Incorporate elements of the department assessment plan that point to specific programmatic challenges and opportunities.	• Discussions in department meetings about purpose of our various committees and service roles contributed by faculty/staff; also intended to engage with information on membership and encourage participation on committees. • Continuing department support for third cohort of Reinvigorating Mathematics Classrooms, a professional development program for area school teachers. • Continuing department support for learning circle programming in area schools, with possibilities for expanding opportunities to all department instructors. • Development of sustainable external funding mechanisms and GRA assignments opportunities in Corporate Partners courses.

Goal Start Date	Unit Goal	Plan Action Items	Evidence of Progress to Goal (performance relative to action item)
January 2023	Expand the reach and impacts of departmental innovative contributions throughout the greater university community, region, and globally	1. Increase and sustain connections between department expertise and regional organizations (e.g., professional, corporate, public, nonprofit) 2. Foster increased communication of advances due to collaborative work, significant results, and funded projects involving students, faculty, staff, and external partners 3. Further establish a culture for identifying previously unexplored intersections across areas of expertise and advancing resulting innovative opportunities	• Previous completion and further departmental incorporation of joint faculty appointments with the School of Education. • Initiation of graduate seminar programming, with intent to welcome all department members in seminars showcasing ongoing work and follow up research opportunities; last year's program included speakers from Electrical & Computer Engineering and Communication Sciences & Disorders on ongoing departmental collaborations. • Extensive ongoing collaborations, programs, employment opportunities, and corresponding funding through the Center for Applied Mathematics & Statistics and the Laboratory of Data Science

			• Advancing community and corporate connections through Data Science and Actuarial student club opportunities, internships, professional actuarial exam preparations and completions, and additional program related projects. • Continuing professional development programming offered to area teaching through department expertise in classroom design and learning circle workshops. • Development of programming connections with extensive network of dual-credit teachers in high schools throughout the region.

Goal Start Date	Unit Goal	Plan Action Items	Evidence of Progress to Goal (performance relative to action item)
January 2023	Advance retention and graduation rates for all current and potential department majors	1. Identify opportunities in the curriculum, program options encouraging double majors, student clubs, departmental and tutoring employment, project-based experiences, seminars, and other special programs for supporting the success/persistence of current majors and attracting new majors. 2. Advance best practices, shared strategies, increased participation, and leadership opportunities among faculty advising; promote increased connection and collaboration with university advising expertise. 3. Review effectiveness of student support and improvement opportunities among current department student resources.	• Contest teams, problem solving seminars, corporate partner project courses, and Data Science funded student research positions. • Active events calendar maintained by Actuarial Science and Data Hub Clubs, including opportunities to network with corporate leadership and currently employed alumni. • Interdisciplinary collaborations and course substitution opportunities regarding common capstone objectives across programs. • Ongoing collaborations with university advisors on mathematics placements, new student orientations, and multiple major program advising.

		4. Identify opportunities for increasing high-impact experiences such as contained within our first-year seminar, collaborative and capstone projects, community-based learning, problem solving and contest teams, faculty-student research experiences, student mentorship, and cross disciplinary connections. 5. Discuss possible areas for particular focus among department programs, inclusive of undergraduate and graduate majors, minors, and certificates.	

Section 2: Evaluation and Planning Program Viability

Summary Table of Fall Enrollments for Mathematical Sciences:

Program	2018	2019	2020	2021	2022	2023
Actuarial Science BSAS	35	35	29	28	20	16
Data Science & Applied Stats BSDSAS	3	13	18	18	24	31
Mathematics BS	42	58	57	57	57	54
Research Certificate Math Sci CERT				1		

Notes on this data:

It would be helpful to know whether these major counts include double/triple majors. The research certificate enrollment data appears to significantly differ from anecdotal accounts as well as requests received to add the certificate in 2022 and 2023.

Data for comparison shared at the COS Dean/Chairs meeting 08/29/24 (Numbers from Monday first day of classes)

	F24	F23	Chg	F24 cred hrs	F23 cred hrs	
MATH U	82	83	−1	7,633	7,603	TOT
MATH G	25	27	−2			

On the other hand, we refer to data provided in the 2022 COS annual report. The Fall 2021 and Fall 2022 major undergraduate enrollments there bear unclear connection with the Fall 2023 and Fall 2024 values above.

Program (Undergraduate)	Fall 2022	Fall 2021	Change
Math	101	105	−4
Program (Graduate)	Fall 2022	Fall 2021	Change
Math	27	33	−6

Actuarial Science BSAS

Using Tables 2a through 2d, and additional data provided by Institutional Research, describe efforts the department is taking to improve enrollment, retention, and graduation.

Table 2a – Fall Program Demand

Fall Semester	Demand (New to Major)	Majors (New plus Continuing)	Graduates
2023	9	16	
2022	5	20	6
2021	11	28	2
2020	17	29	2
2019	16	35	12
2018	18	35	3
Averages	**13**	**29**	**5**

Table 2b: Fall Viability Metric Ratios

Fall Semester	Graduation Efficiency	Student Attrition	Growth Trend
2022	25.00%	10.00%	0.417
2021	07.14%	25.00%	0.846
2020	06.90%	20.69%	1.417
2019	34.29%	17.14%	0.696
2018	08.57%	20.00%	1.125
Ratios	**16.33%**	**19.05%**	**0.882**

Actuarial Science BSAS (continued)

Table 2c: Fall Retention Totals

Fall Semester	New Majors	Total Majors	Retained in Major	Retained in Different Major	Graduated		Stopped Out
					In Major	*Out of Major*	
2023	9	16					
2022	5	20	7	5	5	1	2
2021	11	28	15	4	2	0	7
2020	17	29	17	4	2	0	6
2019	16	35	12	5	12	0	6
2018	18	35	19	6	3	0	7
Summary	**67**	**147**	**70**	**24**	**24**	**1**	**28**

Table 2d: Enrollment Management Plan Performance (Departmentally Set Goals and Action Items. Institutional Research will provide information for Enrollment Management Performance column)

	Enrollment Management Performance (Fall Semester)						Enrollment Management Goal	Action Items
	2018	2019	2020	2021	2022	2023		
New Majors	18	16	17	11	5	9	10	Nearly met last year's goal of 10. Continue successful student experiences with Meet the Firms events, Society of Actuaries exams, and professional opportunities.
Retained in Major	19	12	17	15	7		15	Continue quality advising and curricular development initiatives.
Retained at PFW	25	17	21	19	12		19	Promote Actuarial Minor campuswide.
Graduated in Major	3	12	2	2	5		5	Met last year's goal. Continued partnership with IDM initiatives, Corporate actuaries, Alumni success stories.

Actuarial Science BSAS (continued)

Table 2e: Discussion - Use the data from Tables 2a-2c to synthesize and analyze your program's enrollment and retention performance relative to the established goals. Discuss plans to improve program viability. Finally, describe any changes in your action plan to improve performance.

The Director of the Actuarial Program, Clinical Associate Professor Joe Francis, FSA, and Assistant Professor of Practice in Actuarial Science, Sarah Showalter, FSA, provide outstanding leadership, programming development, and student mentorship. The program has been recognized by Society of Actuaries as a 4-exam in Summer 2019. Starting with 2023, the ASA (Associate of Society of Actuaries) licensing curriculum was changed to eliminate the Investment and Financial Markets (IFM) exam and add Fundamentals of Actuarial Mathematics (FAM) Exam. Prof. Showalter developed the FAM (long term portion) exam coursework that launched in the 2023-24 academic year (undergrad/grad). Prof. Showalter developed an Introduction to Actuary Science course that has been offered for the first time in Fall 2024.

An important metric in continued use is High Impact Experiences (Passing actuarial exam, Internship/Co-op, Job placement). This has been expanded to include Data Science and Indiana Data Mine Corporate Partners experiences. The Indiana Data Mine is supported by the Lilly Endowment grant ($10 M - Purdue System, $1.4 M - PFW). Following the Fall 2022 recommendation of the Actuarial Board (LFG, Swiss Re, Med Pro, Buck, Central Insurance), the annual Actuarial Picnic became Actuarial and Data Science Picnic and invitations have since been extended to Data Science employers. Other actuarial employers such as Hylant, PHP, Brotherhood Mutual, Summit Re, have also joined our Board companies for the Actuarial and Data Science Picnic, Meet the Firms, Lunch with an Actuary, etc.

We continued to support students with field trips to area corporations (e.g., Central Insurance), support presentations by external partners (e.g., MedPro Group), and provide for trips to professional conferences (e.g., Midwest Actuarial Student Conference). In 2024 we continued with strong presence among interns in Buck (3), MedPro (1), Summit Re (1), and Franklin Electric (1). Our graduates have secured jobs at companies like MedPro and Buck. The Indiana Data Mine Corporate Partnership actuarial pricing project with Central Insurance was successfully completed. The team comprised of Kashyab Ambarani (CS, Math, Actuarial minor), Derek Brown (DSAS, Math, Actuarial minor), Tiffany McBride (DSAS), Kale Menchhofer (Math, Actuarial minor), Charissa Hoang (DSAS, Actuarial minor) made an impressive presentation and technical report of their findings. Such performance has led directly to additional IDM – Corporate partners projects, in the case of the above example this was Central Insurance in 2022-2023. Currently, Raytheon is also involved in a consecutive year of Corporate partners project work in our curriculum.

We are always exploring ways to enhance collaborations with the Doermer School of Business (Accounting and Corporate Finance VEE and Economics VEE and to advance the marketing of our Actuarial Major and the Actuarial Minor launched in Fall 2019. Our established tradition of having EVERY Freshman student meet the Director of the Actuarial Program and engage at the very start in the activities the Actuarial Club organizes are yielding excellent results on retention.

Actuarial Science BSAS (continued) High Impact Experiences 2013-2024

	Name	Start	End	Exams	Internships	Permanent Employment
1	Adekoya, Olamide	F'22	S'24		IDM - CP'22, Central	
2	Adio, Abdullaye	F'18	S'20		U of Mariland UBP - Su'19	PhD program, Bowling Green
3	Ambarani, Kashyab	F'18	S'22		Swiss Re, Su'21, F'21, S'22, IDM	Stryker
4	Atre, Atharva	F'22	S'24		IDM - CP'22, Central	Central
5	Avorgah, Saviour	F'21	S'23		Central - Su'22, F'22, S'23	
6	Barnes, Kenda	F '14	S '17	P, FM, 3, MAS-I, MAS-II, 5, 6, 7; Currently ACAS	Fall'15/S'17 Co-op, MedPro	Medical Protective (Top 50).
7	Bartz, Michael			P	Buck Su '22	Buck Sept 2022, MedPro August 2023
8	Bemus, Michael	F'21	F'23		IDM - CP'22, Central	
9	Bertsch, Luke	F '11	S '15	FM, P, ACAS 2021	LFG - Summer 2014	Medical Protective, AMTrust
10	Bezuhlyy, Diana	F '15	S '17	FM, P, ASA 2022	Summer 16 Internship at Buck	Buck
11	Birchfield, Neal	F'20	S'24		IDM - CP'22, Central	
12	Bolling, Sean	F '17	S '19			GTA - Math
13	Brown, Derek	F'18	F'22		IDM - CP'21, Central	GRA - Math
14	Carolan, Liam	F '17	F '20		Su'20 - Risk Strategies	Risk Strategies
15	Chan, Hang Fey	F '17	F'19	F,M,P,S,L, FSA 2024	Swiss Re, Su'19, SummitReF'19	Swiss Re
16	Cornet, Casey	F '16	S '20		Started Co-op 1/18, MedPro	
17	Demarest, Ava		S'26		Buck Consulting	
18	Dreihaus, Adam	F '14	S '18		Started Co-op 1/17, MedPro	Nyhart, Indianapolis, accepted 1/18
19	Egnor, Kolson	F'23	S'25	FM, P		
20	Everett, Karson				Buck Su '24	
21	Franklin, Karun	F'18	F'21		Sweetwater, Su/F 2021	Sweetwater
22	Foreman, Jonathan	F '16	S '18	P, FM, ASA 2023	Central Ins, Su'18	GTA - Math, LFG
23	Haas, Skyler	F '14	S '18		F'15/S'16 Co-op, MedPro	Central Insurance, Van Wert, OH
24	Hadrami, Abdelhak	F'19	S'21		Central - Su'20	Indianapolis High School Academy
25	Harmeyer, Ryan	Su'13	S '16	P, FM	Swiss Re in 2013?	Employed at Buck.

26	Hartberg, Anthony	F '13	S '17	P, FSA 2023	Fall 15/Spring 17 Intern, LFG.	LFG full time in May 2017.
27	Hinniger, Nils	F'18	S'22	FM, P	2019 FW Metals, Swiss Re S'21	Swiss Re
28	Hoang, Chraissa	F'19	S'22		IDM - CP'21, Central	MS, Purdue WL
29	Hope, Hannah	F '13	S '18	ASA 2023		LFG - Summer 2018, FT August 2018
30	Hukill, Marissa	Su'14	S '16	P, FM		Baldwin & Lyons, Indianapolis 2/2017.
31	Islam, Ishrat	F'19	S'23		Robotics Junior Engineer, S'23	
32	Kersey, Jayme		S'25	FM		
33	Komarabatini,S	F'19	S'23		Swiss Re, Sp'22	
34	Le, Ha	F '19	S '21	FM	Swiss Re, F'19, Sp'20	GTA - Math; Central Insurance 2021
35	Le, Linh	F '16	S '20	P, F, I, S	M Fin, OR'18; PacMutual,LA'19	GTA - Math, S'20;
36	Lei, Ningle	F '16	S '18	P,F,M	Steel Dynamics Inc. in Sp '18	Su '18 - Swiss Re, FW; Plymouth Rock - NJ; Munich Re 2023
37	Liang, Anna	F '18	F '19	F, P, I		Plymouth Rock Assurance, NJ
38	Li, Zongwei	F'20	F'21		Facebook Research - Su'21	Facebook
39	Lipinski, Zach		S' 24	FM		
40	Liu, Guchen (Alex)	S '16	F '17	P, FM		GTA - Math; Conduent (Buck)
41	Masters, Maxwell	F'19	S'21	P, FM	LFG Su '19, Central Su'20-Sp'21	GTA - Math;
42	Mamyrbek, Dariya	F '21	S'23		City of San Francisco, IDM CP'22	GTA - Math
43	McBride, Tiffany	F '22	S'24		City of Fort Wayne, IDM CP'21	GTA Math
44	Melchert, Bryan	F'18	F'19		Holland Trucking DS intern	Holland Trucking, MI
45	Menchhofer, Kale	S'22	F'22		IDM – CP'21	Ph. D. program
46	Mills, Jack				Summit Re Su '24	
47	Mills, Nathan	F'20	S'23		Central Su'21, Su'22, MedPro Su' 23	MedPro
48	Mollema, Lucas				Buck Su '24	
49	Nelson, Mike	F '15	S '19	P	***Returning adult***	
50	Nguyen, Linh	F '12	S '14	P, F, M	Interned at Swiss Re SU'13.	Cigna (Met Life, Brotherhood Mutual,CBIZ)
51	Nguyen, Nguyen	F'18	F'20	P, FM	Central Su'19, F'19, Sp'19	GRA - Math; Central Insurance 2020
52	Ott, Riley	F'19	S'22		Lincoln Su '21, Su '22	
53	Olagoke, Brian	F'21	Su'22			D3 Machine Learning Lab, Harvard University

54	Rex, Ian	F'22	S'26	FM		
55	Rife, Jacob	F'17	S'21		Data Sci-Republic Airways S'21	Republic Airways
56	Rigdon, Brandon	F'17	Su'21	P, FM, ACAS 2024	Med Pro Su'21	Medical Protective
57	Ruble, Rachel	F'18	S '20	FM, FCAS 2024	Central Su'19	Central, start May 2020
58	Sarazine, Melissa	F '14	S '18	P, FM	Swiss Re Su'16, LFG Su'17.	LFG
59	Sarrazine, Zach	F '13	S '17	FM, P		AIG Nashville; AON 2019
60	Schlichtenmyer, K	F '13	S '17	P		LFG
61	Soronnadi, James	F '23	S '25	FM	Franklin Electric Su '24	
62	Smethers, Justin					Data Science at Sweetwater
63	Sproat, Jessica	F '11	S '14	FM, ASA 2021		LFG, May 2014.
64	Steele, Emma			FM, P	Central Su '23	Central Insurance, Van Wert, OH
65	Stager, Dawn	F '18	S '18		Indiana Board of Accounts	Graduate program, LTL
66	Stuckey, Justin	F '17	F '18	P, F, IFM	FSA 2023	PHP
67	Thatcher, Tessa	F'19	S'23		IDM – CP'21	
68	Weimer, Erin		S' 24		Med Pro Su '23	Med Pro
69	Wilbanks, Hunter	S '11	F '14		Summer 2013 at Buck	Buck, J'14, managerial track.
70	Williams, Brittany				Buck Su '23	Buck
71	Yuan, Xiao	F '18	S '20	F, M, P,S, FSA 2024	Centene,'19, Swiss ReF/Sp'20	LFG - full-time June 2020
		Grad	Curr			Received employment before graduation

Data Science & Applied Stats BSDSAS

Using Tables 2a through 2d, and additional data provided by Institutional Research, describe efforts the department is taking to improve enrollment, retention, and graduation.

Table 2a – Fall Program Demand

Fall Semester	Demand (New to Major)	Majors (New plus Continuing)	Graduates
2023	15	31	
2022	16	24	2
2021	14	18	3
2020	12	18	3
2019	12	13	4
2018	2	3	1
Averages	**11**	**15**	**3**

Table 2b: Fall Viability Metric Ratios

Fall Semester	Graduation Efficiency	Student Attrition	Growth Trend
2022	08.33%	16.67%	2.000
2021	11.11%	27.78%	1.556
2020	16.67%	38.89%	0.857
2019	23.08%	00.00%	2.000
2018	33.33%	33.33%	1.000
Ratios	**14.47%**	**22.37%**	**1.436**

Data Science & Applied Stats BSDSAS (continued)

Table 2c: Fall Retention Totals

Fall Semester	New Majors	Total Majors	Retained in Major	Retained in Different Major	Graduated		Stopped Out
					In Major	*Out of Major*	
2023	15	31					
2022	16	24	16	2	2	0	4
2021	14	18	8	2	2	1	5
2020	12	18	4	4	3	0	7
2019	12	13	6	3	3	1	0
2018	2	3	1	0	1	0	1
Summary	**56**	**76**	**35**	**11**	**11**	**2**	**17**

Table 2d: Enrollment Management Plan Performance (Departmentally Set Goals and Action Items. Institutional Research will provide information for Enrollment Management Performance column)

	Enrollment Management Performance (Fall Semester)						Enrollment Management Goal	Action Items
	2018	2019	2020	2021	2022	2023		
New Majors	2	12	12	14	16	15	15	Again exceeded last year's goal of 14. Marketing in dept new major seminar and Data Hub Club events; engagements in Laboratory of Data Science.
Retained in Major	1	6	4	8	16		15	Doubled retention over last year. Strong projects based curricular and student-faculty research engagements.
Retained at PFW	1	9	8	10	18		15	Exceeded last year's goal of 10. Continue high quality advising support, student club events, and engaging course designs advanced by faculty.
Graduated in Major	1	3	3	2	2		3	Nearly met last year's goal of 3. Focused planning of completions.

Data Science & Applied Stats BSDSAS (continued)

Table 2e: Discussion - Use the data from Tables 2a-2c to synthesize and analyze your program's enrollment and retention performance relative to the established goals. Discuss plans to improve program viability. Finally, describe any changes in your action plan to improve performance.

The BSDSAS program continues to exhibit solid growth and all indications are that it will continue to do so. Given the breadth and depth of machine learning and AI impacts throughout society, the program draws upon numerous opportunities throughout the curriculum for engaging students directly with problems and projects having immediate relevance to their lives and future career directions. These naturally extend into outside of class events, networking, and research opportunities such as supported through the Data Hub Club, collaborative Actuarial and Data Science events, Laboratory of Data Science programs, Corporate partners projects course work, and Lilly Endowment funded Indiana Data Mine initiatives.

Drawing upon such extensive connections across DSAS programming, IDM initiatives, and Centers of Excellence focus areas, the last two years of Corporate partners projects courses have incorporated partnerships with 3Rivers Federal Credit Union, BAE, Raytheon, and Metal Technologies. On the other hand, given this type of course structure is still fairly new to the department, efforts to further establish and sustain enrollments in all sections initiated by corporate projects will continue. A large part of the work will be meeting observed need for information among students about potential impacts the course can have on their academic and professional development. Alongside reasonably serving as a capstone course for program requirement purposes, it has recently been seen as a fast track to internships, as witnessed in recent student experiences.

Among work towards department goals listed above, further consideration of available opportunities, collaborations, and student connections will be conducted. Promising areas for empowering department faculty and partnering expertise will be identified for advancing BSDSAS to its next levels of growth potential and impacts throughout the greater community.

Mathematics BS

Using Tables 2a through 2d, and additional data provided by Institutional Research, describe efforts the department is taking to improve enrollment, retention, and graduation.

Table 2a – Fall Program Demand

Fall Semester	Demand (New to Major)	Majors (New plus Continuing)	Graduates
2023	26	54	
2022	30	57	16
2021	26	57	18
2020	33	57	10
2019	34	58	13
2018	25	42	7
Averages	**30**	**54**	**13**

Table 2b: Fall Viability Metric Ratios

Fall Semester	Graduation Efficiency	Student Attrition	Growth Trend
2022	28.07%	15.79%	1.034
2021	31.58%	10.53%	0.867
2020	17.54%	19.30%	1.269
2019	22.41%	17.24%	1.000
2018	16.67%	11.90%	1.389
Ratios	**23.62%**	**15.13%**	**1.080**

Mathematics BS (continued)

Table 2c: Fall Retention Totals

Fall Semester	New Majors	Total Majors	Retained in Major	Retained in Different Major	Graduated		Stopped Out
					In Major	*Out of Major*	
2023	26	54					
2022	30	57	28	4	16	0	9
2021	26	57	27	6	18	0	6
2020	33	57	31	5	10	0	11
2019	34	58	24	11	13	0	10
2018	25	42	24	6	7	0	5
Summary	**148**	**271**	**134**	**32**	**64**	**0**	**41**

Table 2d: Enrollment Management Plan Performance (Departmentally Set Goals and Action Items. Institutional Research will provide information for Enrollment Management Performance column)

	Enrollment Management Performance (Fall Semester)						Enrollment Management Goal	Action Items
	2018	2019	2020	2021	2022	2023		
New Majors	25	34	33	26	30	26	30	Nearly met last year's goal of 30. Significant marketing efforts through recruiting future teachers and double major students.
Retained in Major	24	24	31	27	28		30	Met last year's goal of 28. Continue on advising successes and impacts of new majors seminar.
Retained at PFW	30	35	36	33	32		30	Exceeded last year's goal of 30. Math and Actuarial minors continue to indicate significant impacts.
Graduated in Major	7	13	10	18	16		15	Again exceeded last year's goal of 12. Continue quality advising efforts and identifying pathways in the major to completion.

Mathematics BS (continued)

Table 2e: Discussion - Use the data from Tables 2a-2c to synthesize and analyze your program's enrollment and retention performance relative to the established goals. Discuss plans to improve program viability. Finally, describe any changes in your action plan to improve performance.

The Mathematics BS program has maintained solid enrollment since 2019. To further illuminate the intersection of such sustained commitment by students for mathematics programming and our efforts to advance Math/Secondary Teaching students, it would be helpful to systematically incorporate data on these double majors in the university provided tables above.

There is now compelling evidence that opportunity for adding a second major in Mathematics among ETCS and COS students is bringing about growth of a distinctive type of student audience at PFW. These students are drawn to us by programs having strong natural connections with mathematics, and they actively seek out these connections further among what appears to be an emerging active peer network. Alongside success in their first major, these students exhibit considerable ability and growth in areas of theoretical mathematics/statistics as well. They have formed a nucleus of strong recent Putnam Competition teams.

Several of our Mathematics BS (as well as BSAS and BSDSAS) students continue in the department graduate Mathematics MS program. It is possible for strong students to complete the masters program in one additional year, through a recently introduced streamlined process. Also contributing to our sustained graduate enrollments are area mathematics teachers who enroll in the MS program for advancing their professional qualifications. They include a very high percentage who are teaching dual credit mathematics courses for us, thus representing another important department support for secondary and university level students and their teachers.

In still further connections developed around the Mathematics BS/MS programs and support for area mathematics teachers, two particularly significant initiatives have emerged through our PFW Mathematics Education faculty research expertise. One is a professional development program “Reinvigorating Mathematics Classrooms”, now beginning a third cohort with joint funding by the department, COS, and the School of Education. Another is a growing cohort focused on professional development for teachers in the form of Learning Circles. These include a number of our dual-credit mathematics teachers as well as an emerging cohort of department faculty.

Yet another significant set of contributions by our Mathematics Education faculty among these same audiences and beyond are continuing podcasts on a range of topics directly related to promoting successful classroom experiences for all students. One of the most recent examples contains discussion of a corresponding published research article, "Textbook representations of radian angle measure: The need to build on the quantitative view of angle," that previously appeared in the journal *School Science and Mathematics*.

Such initiatives, opportunities, and impacts to students through growth of Mathematics BS (including Secondary Teaching) programs are particularly of interest for ongoing consideration among listed departmental goals. These further draw upon synergies, expertise, and common interests among department faculty, including new joint mathematics/education appointments and anticipated new mathematicians joining as a result of current/future position requests.

Research Certificate Math Sci CERT

Using Tables 2a through 2d, and additional data provided by Institutional Research, describe efforts the department is taking to improve enrollment, retention, and graduation.

Table 2a – Fall Program Demand

Fall Semester	Demand (New to Major)	Majors (New plus Continuing)	Graduates
2023			
2022			
2021	1	1	1
2020			
2019			
2018			
Averages	**1**	**1**	**1**

Table 2b: Fall Viability Metric Ratios

Fall Semester	Graduation Efficiency	Student Attrition	Growth Trend
2022			
2021	100.00%	00.00%	1.000
2020			
2019			
2018			
Ratios	**100.00%**	**00.00%**	**1.000**

Research Certificate Math Sci CERT (continued)

Table 2c: Fall Retention Totals

Fall Semester	New Majors	Total Majors	Retained in Major	Retained in Different Major	Graduated		Stopped Out
					In Major	*Out of Major*	
2023							
2022							
2021	1	1	0	0	1	0	0
2020							
2019							
2018							
Summary	**1**	**1**	**0**	**0**	**1**	**0**	**0**

Table 2d: Enrollment Management Plan Performance (Departmentally Set Goals and Action Items. Institutional Research will provide information for Enrollment Management Performance column)

	Enrollment Management Performance (Fall Semester)						**Enrollment Management Goal**	**Action Items**
	2018	**2019**	**2020**	**2021**	**2022**	**2023**		
New Majors				1				
Retained in Major				0				
Retained at PFW				0				
Graduated in Major				1				

Research Certificate Math Sci CERT (continued)

Table 2e: Discussion - Use the data from Tables 2a-2c to synthesize and analyze your program's enrollment and retention performance relative to the established goals. Discuss plans to improve program viability. Finally, describe any changes in your action plan to improve performance.

Given at least four students pursuing the Research Certificate were known at the time of last year's report, the enrollment data seems puzzling and potentially incorrect. We continue to expect the number of students applying for this certificate will increase significantly in the near future. Utilizing *no additional* resources and enhancing the research experience for undergraduate students, the certificate program is well coordinated with ongoing Indiana Data Mine program initiatives at PFW, to cite just one key current example.

Section 3: Department Undergraduate Non-Dual Credit Hour Production

Discussion: Describe changes in total non-dual credit hour production for your program and its relationship to overall program viability. You may include a discussion of the contribution of service hours to program viability.

Fall	In-Major	Service	Total Credit Hours
Fall 2023	685	6178	6863
Fall 2022	583	6186	6769
Fall 2021	598	6964	7562
Fall 2020	607	8043	8650
Fall 2019	571	8547	9118
Fall 2018	429	8622	9051

Since taking a dramatic drop immediately following the pandemic, department service enrollments continued declining sharply through Fall 2022. There is now some indication in Fall 2022 to Fall 2023 this may have begun to restabilize. Considering the large dual-credit footprint in the department, it seems unclear regarding the magnitude of such decline that is attributable to dual-credit courses.

Major factors impacting PFW based courses through this period of change have been observed to be unclear university direction regarding online courses, possible changes in university advising practices for incoming student registrations in math/stat courses (e.g., using MA 11100/11101 as a type of placeholder in the student's schedule), IUFW major program enrollment patterns/changes (e.g., impacting MA 213, STAT 125, STAT 301), and niche PFW program requirements (e.g. DSB programs switching MA 229 from a required to an optional course). Impacts of the recently approved changes to general education at PFW are yet to be fully understood.

There appears to be increasing administrative attention devoted to "underenrolled" courses, requiring continually provided rationale or cancellation of courses enrolled below 10. It is difficult to determine whether corresponding early decisions made have been warranted by eventual enrollments or have in fact negatively influenced subsequent enrollments, retention, course capacities in remaining sections, etc. In cases where increased capacity seems needed, this also presents a challenge to decisions on going forward with new sections so as to not create underenrolled issues among existing sections. There are further indications of related issues generated concerning the department's enrollment imbalance across fall and spring terms, creating uneven staffing issues and comparatively higher needs for part-time instructors in fall.

Significant impacts of all these impacts are currently seen in (1) difficult to project enrollments that don't appear to follow previous trends alongside widely varying impact among different courses, and (2) online class choices by students that appear to be increasingly for convenience and not evenly supported by data as promoting student success (despite a variety of design initiatives).

Service courses may reasonably provide an entry point for department majors, depending upon strength of background in mathematics/statistics, as well as significantly impact deployment of available instructional FTE between major and service courses. Thus, development of better, just-in-time enrollment projection models, along with readily available time series and disaggregated data for developing these, is needed for course planning.

While the In-major credits for Fall 2023 show recent growth, it is potentially due to dramatic recent increases in CS majors. Since our department major courses are often the same as those required by ETCS and COS programs, resulting over demand for courses like MA 175 and MA 351 have come upon us without advantage of prior projection, with limited response options until instructional assignments (including considerable LTL personnel in fall terms as mentioned above) can be readjusted. It is here where the issues connect in a need to deploy LTL and GTA instructional staff effectively to meet service course demands. Again, better and just-in-time enrollment projects are needed for determining a path forward.

Student success data maintained by the university through the period suggests overall little to no impact on passing rates throughout the time span. On the other hand, department data strongly indicates marked increases in student success depending upon a variety of student engagement metrics. University early alert resources, incoming student mathematics placements, first-year advising, and data driven analyses of various course/program design features appear to be worthwhile next steps for department efforts.

Section 4: Faculty/Staff/Student Accomplishments

1. Scholarship and Creative Endeavor

Publications

- Coffman - book

"The Indiana College Mathematics Competition (2001–2023) and the Peter Edson Trophy". Co-Editors: Adam Coffman, Justin Gash, Rick Gillman, John Rickert. Published 2024 Springer Nature, "Problem Books in Mathematics" series.

- Articles - 14 appeared, 8 accepted, 35 presentations

Research Awards

- Alessandro Selvitella - Faculty Enhanced Research Appointment. Office of Research, Purdue University – 2023
- Alessandro Selvitella - Seed for Success Acorn Award. Office of the Executive Vice President for Research. Purdue University – 2023
- Yuan Zhang - Pippert Science Research Scholar award - 2023

Grants – submitted

- Assylbekov - "Benign Overfitting with Gaussian Mixture Models," Summer Research Grant Proposal, Purdue University Fort Wayne, $8,000.00
- Buldt - Travel grant application submitted to the College of Science to support my travel to the *17th Congress for Logic, Philosophy and Methodology of Science and Technology* (CLMPST) in Buenos Aires, Argentina, July 24–29. ($3,300 received from CoS)
- Selvitella - "Harvard Radcliffe Institute Fellowship," Sponsored by Harvard Radcliffe Institute, $75,000.00.
- Selvitella - "Sloan Research Fellowship," Sponsored by Sloan Foundation, $75,000.00.
- Zhang - National Science Foundation proposal 'Partial Differential Equations in Several Complex Variables.' Submitted in Sept 2023.
- Zhang - Association for Women in Mathematics (AWM) travel grant ($2,300). Submitted in Oct 2023.

Grants – received during reporting period

- Z. Assylbekov - Takhanov, R. (Principal), Assylbekov, Z. (Supporting), "Analysis of Benign Overfitting in Retrieval Augmented Models," Sponsored by Nazarbayev University, $124,421.00. (January 2023 - December 2025)
- A. Coffman - one of the organizers of the 2023 Midwestern Workshop on Asymptotic Analysis at IUPUI, October 13-15, funded in part by NSF grant DMS 2331073 (PI: Max Yattselev); 2024 MWAA funding received NSF grant DMS 2427685
- A. Selvitella (Supporting), Lix, L. (Principal), M. Azimaee, Y. Chiu, L, Ejskov, A. Hamad, M. Jafari Jozani, O. Plana-Ripoll, and H. Sorensen., "Comparing Methods to

Construct Chronic Disease Histories from Administrative Data: Application to Family Disease Studies," Sponsored by CIHR Project Grant, Other, $508,725.

- Y. Zhang - Association for Women in Mathematics (AWM) travel grant, funded ($2,300).

2. Teaching and Learning

Instructional Grants

- D. Alexander - $5000 GRANT FROM DCS/CELT FOR THE DEVELOPMENT OF THE 8-WEEK ONLINE VERSION OF MA14000
- J. LaMaster - Summer Instructional Development Grant to design 8 Week Online MA 154000 ($4000).

Awards or Honors for Teaching

- J. LaMaster - 2023 Recipient of the Featured Faculty Award for Teaching Excellence
- H. Alyami - 2024 Leepoxy Plastics, Inc., Award for Excellence in Undergraduate Teaching

3. Service

Offices in Professional Organizations

- B. Berry - Member Advocacy Committee 2023-2025: Association of Mathematics Teacher Educators.
- B. Buldt - Indiana Philosophical Association: *listserv* owner.
- A. Coffman - Indiana Section of the MAA: Abstracts Editor; ICMC Problem Book Committee; PFW Sigma Xi: web author

Journal Editing

- Z. Assylbekov - Editorial Review Board Member, Intelligent Data Analysis. (February 2023 – June 2023), Associate Editor
- D. Coroian **-** Associate Editor of the *Carpathian Journal of Mathematics*: 2004 – present

Student Accomplishments

- A paper by Elliot Nesler (BS, MS, PFW), *Novel Parallels: On the Intersections of Geometry and Prose*, for the MA 560 Geometry class in 2020 is featured in a "Media Highlight" in The College Mathematics Journal (1) **55** (Jan. 2024), p. 66
- Paul Gongwer, PFW data science & applied statistics major, a 2023 recipient of the American Mathematical Society's Trjitzinsky award, a scholarship for undergraduate math students

- Spring 2023 Honors Showcase featured work by mathematical sciences students NIkolas Albertson, Austin Brandenberger, and Nathan Mills
- 8 PFW students presented posters at Data Science Week 2023, most were department BS or MS majors
- Yash Bhandare, Winne Har, Mark Trovinger, and Atharva Atre, PFW, *Over the air voice translation*, 3rd, Poster and Short Talk Awards, Data Science Week 2022
- Nathan Mills, Lizze Haub, Riley Ott, Neal Birchfield, PFW, *Shape changes in schizophrenic brains*, 3rd, Poster and Short Talk Awards, Data Science Week 2022
- 21 PFW students presented posters at Data Science Week 2022, most were department BS or MS majors

Section 5: Alumni Most Recent Accomplishments

In this section, discuss how your program is contributing to the ongoing success of its graduates. Include information such as survey results (e.g., the First Destinations Survey), alumni career accomplishments, employment information, and professional and graduate school enrollment.

Aiham Hassan (MS) and **Enoch Fedah** (MS) complete Ph. D. program at Bowling Green State University;

Derek Brown (BS) started a Statistics Ph.D. program at IU-Bloomington;

Olamide Adekoya (MS) started a Ph.D. program at University of Kentucky;

Kale Menchhofer (MS) started a Ph.D. program at Georgetown University;

Kashyab Ambarani (BS) was hired at Tik Tok;

Dariya Mamyrbek (MS) started at Hunt Cancer Center at University of Utah;

Princess Sarpong (MS) had an article "Characteristics of the Distribution of Minerals Among the Space Groups" accepted (with Carl Drummond) in American Mineralogist: International Journal of Earth and Planetary Materials Research, a top-tier journal in Geology.

Section 6: Resource Allocation Request

Please use the section below to discuss resources needed to help meet departmental and enrollment management goals. Describe the specific projected uses of those funds and your plan for evaluating the effectiveness of the requested resources in helping reach those goals.

Two main areas of focus here are (1) faculty replacement in cases of retirements, resignations, or other separations, and (2) classroom infrastructure maintenance in support of effective teaching and learning environments (here, focused on university support for whitewall replacements and general repairs necessary due to extensive water damage, e.g., of chairs and ceiling tiles)

(1) The department Professional Affairs Committee, which is one of two departmentally elected committees, maintains a department hiring plan. The most recent version of this is as follows.

Faculty Hiring Plan 2023

The Professional Affairs Committee has prepared the following report on the status of the staffing levels of the Department of Mathematical Sciences, as of Fall 2023, with a recommendation on future hires. This 2023 plan is an update to the 2022 Hiring Plan.

Recommendations:

- Replacement Hiring:
  o Replace retiring (or resigned) tenured/tenure-track faculty with new tenure-track faculty
  o Replace vacancies in full-time Lecturer positions
  o The 2017-18 Program Review supports hiring in research groups rather than in isolated areas of expertise
- Strategic Hiring:
  o Request an additional new tenure-track line in the area of statistics

and data science

Rationale:

- As expected, a disproportionate number of retirements is occurring. There were also resignations of an Assistant Professor and a Lecturer in Spring 2023. Retirements have most significantly impacted the discrete math research group, and also the mathematics education group.
- Tenure-track level expertise is needed to deal with growth and other changes in statistics-related courses at all levels: 100-level, major programs, and graduate programs.
- Tenure-track level expertise is needed to support new grant-funded interdisciplinary activity in data science.
- The 2017-18 Department Program Review set a strategic goal of **three new** T-T lines in three years to support new programs. There have since been two successful searches. The “third” remains a priority.

Rationale: (continued)

- Hiring in applied statistics/data science remains an unfulfilled goal of a recent state legislative priority funding initiative, supported by the Purdue system (see the 2022 Hiring Plan).
- The strategic goals and the department needs described in the 2022 Hiring Plan are separate from the need to replace retiring faculty.
- The decreasing trend in the percentage of tenure-track faculty is slow, but still a problem that can only be addressed by hiring.
- Tenure-track and Lecturer faculty on campus are supported by the department's Faculty Review Committees, including peer review of teaching, and various on- campus resources supporting teaching. The lack of this structure for online-only teachers is another cause for concern.

Since preparation of these hiring plans, the following updates are notable.

- We have restarted a search for a Discrete Mathematics faculty (to start Spring 2025), following unexpected decision change by a candidate who had accepted an offer to join us.
- We had a retirement of one Lecturer prior to Fall 2024, with another retirement upcoming at the end of Spring 2025.
- Our current position requests submitted to COS, beyond the current search mentioned above, are presented below. Decisions on these by administration are anticipated in the near future.
    - One TT line in Discrete Math or Analysis (replacing retired faculty member) to start in Fall 2025
    - One conversion of a current Visiting Position in Math Ed to TT starting Fall 2025
    - One Lecturer to replace recent retirement, with possible start in Spring 2025

(2) Classroom infrastructure maintenance

As celebrated in a recent edition of Inside PFW (see photo and article introduction below), the department draws heavily upon classroom infrastructure for supporting effective teaching and learning environments. Ultimately these lead to retention and student success, albeit in ways not yet fully understood or quantified. These include classroom technologies, and IT classroom support has been across the board amazing in providing quick response and contributing very well thought out solutions. We continue to appreciate their work and partnership in advancing our common academic mission.

On the other hand, whitewall installations (such as featured in the Inside PFW photo) have been heavily used across department classes, are showing signs of significant wear, and starting to be in need of replacement (e.g., in KT 218). Exploring costs associated with replacing one wall of these revealed the price tag to be around $7,600. Going into the new fiscal year (FY25), a corresponding budget request for costs was denied. At present, we are left with a front of room white wall that has a prominent location right in the middle which is essentially unusable.

As the university went forward some years back with widespread installations of whitewalls, it appears there was no plan in parallel regarding replacements in cases of failure such as we've experienced. Given the department is likely the heaviest user of these in classrooms for encouraging student engagement, e.g., through individuals/groups working on sections of boards during class and related extensive class session presentations, we suspect KT 218 is the first of what will soon surface in additional near future replacement needs. This is an area of particular resource concern to us, and we include the topic here towards requesting solution options.

Water damage in classrooms and labs across campus has been considerable, with immediate solutions for repairs understandably difficult to fit within stretched university maintenance and repair budgets. Currently, however, one of our classrooms in particular (KT 216) is in a nearly unusable state, with severely damaged (i.e., brown stained) ceiling tiles across the room and chairs of struggling condition brought on by repeatedly being soaked and dried. This also runs counter to supporting our mission for creating effective classroom teaching and learning environments for all students. Unfortunately, our department budgets and other available resources will not cover needed replacement costs.

Retention Numbers Reach 10-Year High

Keeping students on track and on campus from the day they first arrive through commencement is a challenge for many in higher education. A major component in Purdue University Fort Wayne's 2020 strategic plan focused on increasing retention, particularly among first-year students.

Because of new programs, PFW has raised the overall return average among first-time, full-time students from approximately 58% to 66.5% over the last three years. That's based on census data released Tuesday by the Office of Institutional Research and Analysis. It's also 2.2% higher than last year's fall semester retention numbers, and a 10-year high for PFW, according to Irah Modry-Caron, the office's executive director.

At the start of the fall 2024 semester, over 88% of all students enrolled in the spring 2024 semester returned.

Picture and article from Inside PFW 09/05/24

Annual Program Review Data Definitions

The Annual Program Review document uses two data sources. The New Majors, Total Majors, Retained In and Out of Major, Stop-out, and Student Attrition measures are derived from the Office of Institutional Research Census data files. The Graduated measure is derived from Banner's degree awarded tables. The viability metric ratios, Graduation Efficiency and Growth Trend, use a combination of the two data sources.

Table 2a – Fall Program Demand

Program demand data is defined by the number of new students to a major or concentration, the total number of majors or concentrations, and number of graduates per academic year.

1. Demand
    a. The number of students who are new to the major in a given fall semester either as first year students or as returning students who have changed their major. The number of students where identified by their first or second declared major.
2. Majors
    a. The total number of students who declared a major in a given fall semester. This is the sum of new and continuing students. The number of students where identified by their first or second declared major.
3. Graduates
    a. The number of students who graduate in a given major or concentration in a given academic year. The number of students where identified by the first or second major on their degree.

Table 2b: Fall Viability Metric Ratios

1. Graduation Efficiency
    a. The number of students who graduated in major divided by the number of majors. Since graduation efficiency measure is calculated using values in Table 2a and Table 2c, the graduation efficiency measure accounts for students first and/or second major.
2. Student Attrition
    a. The number of students who stop out (are not retained at PFW) divided by the number of majors or concentration.
3. Growth Trend
    a. The sum of the number of students entering major or concentration divided by the number of students graduating, changing a new major, or stopping-out. In the situation where the denominator is zero, the simply the number of majors is reported.

Table 2c: Fall Retention Totals

1. New Majors
    a. The number of students who are new to the major in a given fall semester either as first year students or as returning students who changed their major.
2. Total Majors
    a. The total number of students who declared a major in a given fall semester. This is the sum of new and continuing students.
3. Retained in Major
    a. The number of students who were retained at the University in a given fall semester to the next academic year's Fall semester. For example, the Fall 2015 retained in major number shows the number of majors who returned in Fall 2016 in the same major.
4. Retained in Different Major
    a. The number of students who were retained at the University in a given fall semester to the next academic year's Fall semester. For example, Fall 2015 retained in different major number shows the number of majors who returned in Fall 2016 in a different major.
5. Graduated
    a. In Major
        i. The number of students who earned a degree in an academic year. Determining whether someone graduated in major is based on the comparison of a student's fall major against major(s) on their degree awarded.
    b. Out of Major
        i. The number of students who earned a degree in an academic year. Determining whether someone graduated out of major is based on the comparison of a student's fall major against major(s) on their degree awarded.
6. Stop Out
    a. The number of students who did not return to the University in the next academic year's Fall semester. For example, the Fall 2015 stop-out number shows the number of majors who did not return to the University in Fall 2016.