

External Review for the
Mathematics Program
College of Arts and Sciences
Dakota State University

Prepared by

Carla van de Sande

Associate Professor

School of Mathematical & Statistical Sciences

Arizona State University

Based in part upon a virtual visit on March 31, 2023

Part 1: Executive Summary of Findings

This report serves as an external review for the DSU Mathematics Program. The review was conducted virtually on March 31, 2023 by Associate Professor Carla van de Sande, Ph.D., School of Mathematical & Statistical Sciences, Arizona State University. In my opinion, the Mathematics Program is achieving excellence and exemplifies the mission, vision, and goals of DSU. The mathematics faculty are committed instructors and researchers, and the course offerings are consistent with the program's role as a service discipline and as a contributor to fields of study that prepare students to pursue technologically-centric careers. The faculty also exhibit a strong sense of community and shared commitments that fosters a friendly and pleasant work environment. Faculty morale, however, is a source of some concern. Although there are already plans in place to reduce workload following the successful search for two additional tenure track faculty members, there is a sense that faculty do not receive sufficient recognition for their dedication and efforts.

Part 2: Schedule of On-Site Visit

Prior to my visit, I received and read the Mathematics Program Review Self-Study. The self-study included a well-written and comprehensive description of the institutional history, mathematics discipline trends, academic program, curriculum, and instruction, program enrollment and student placement, faculty credentials, academic and financial support, facilities and equipment, assessment and use of results, and the Dakota University ADVANCE strategic plan for 2022-2027. Appendices included mathematics degree requirements and faculty vitae.

The original plan was for an on-site visit so that I could meet in person with various stakeholders, both within and outside the program. I arrived in Sioux Falls on March 30, 2023 with the intent of driving to Madison and conducting an on-site visit on March 31, 2023. However, while I was still at the airport, impending weather conditions caused DSU to be shut down on the day of the planned site visit. I therefore remained in Sioux Falls and conducted the visit via virtual meetings according to the schedule below. The expediency with which Pamela Lewis, Administrative Assistant in the College of Arts and Sciences, handled this last-minute change of venue was much appreciated and reflects the high-caliber of the support provided by DSU staff.

Time	Participants
8:15-8:45 AM	Provost Hoey and Dean Kenley
8:45-9:30 AM	Sarah Rasmussen-Director of Online Education
9:30-10:15 AM	Jeanette McGreevy-Director of Institutional Effectiveness, Assessment, and Policy
11:00-noon	Math Faculty (Group 1)
1:00-2:00 PM	Math Faculty (Group 2)
2:45-3:30 PM	Provost Hoey, Dean Kenley, and Dr. Jeff Palmer
3:30-4:15 PM	Tom Halverson-Associate Professor of Computer Science and Michael Ham-Associate Professor Cyber Sciences

Part 3: Program Evaluation

A. Program goals and strategic planning.

The goals of the Mathematics Program reflect its identity as both a service discipline and as a contributor to new and emerging fields, such as Artificial Intelligence and Machine Learning. One way in which the Mathematics Program at DSU has successfully responded to this call is by emphasizing the integration of computer technology and the information systems and computer science component of mathematics in their curricula and programs of study. These program goals are a direct manifestation of the institutional mission to provide learning that integrates technology and innovation. By forging close and supportive relationships with other programs (such as Cyber Operations, Computer Science, and Computer Network and Security), the Mathematics Program is also keeping abreast of current national interests and trends so that students are prepared to contribute to the workforce after they complete their studies.

B. Program resources.

The self-study indicated that the math program has sufficient resources in terms of the Karl E. Mundt library, wireless computer infrastructure, and technologically equipped classrooms. Although I was unable to personally visit the campus (classrooms and offices), the faculty indicated that the facilities are satisfactory and conducive to the work environment. For example, the design and layout of the faculty offices supports regular open exchanges with colleagues to discuss ideas and contributes to a sense of shared mission and commitment. In terms of staffing levels, the current faculty workload is considerable in terms of the number and sizes of classes per semester and the amount of effort expended. Some of the workload stems from the fact that the math faculty are committed to maintaining high academic standards and therefore prefer to assess students based on written work (rather than multiple-choice or computer-mediated assessments). This initiative takes considerable time and energy, especially without teaching assistants or graders. Even online courses can require substantial time investment, e.g. by responding to emails and assisting students. These issues should be decreased to some extent by the recent hire of two tenure track faculty members who will take on some of the class loads, especially support courses with increasing enrollments, while maintaining the math program's commitment to academic quality and standards. In terms of research, the provision of efficient and quality assistance with grant proposal and budget preparation is crucial for enabling faculty to secure external funding.

C. Program curriculum.

The courses offered by the math program emphasize computer technology and information system and are designed to support mathematics majors and also students in the Computer Science program. By designing a unique program curriculum that allows Computer Science students to double major (or obtain an Applied Mathematics minor), the math program at DSU provides interdisciplinary and enriching instructional opportunities that align well with students' career goals. The Computer Science and Cyber Sciences faculty members included in the visit expressed satisfaction with the preparation that the math courses provide for their students and had no concerns regarding the quality of the math instruction. They also discussed how shared appointments with the math program greatly benefit the ability to design and revise courses to meet the needs of students, improve the educational experience, and build even stronger connections between the various programs.

D. Technology integration.

In keeping with the university's mission of integrating technology and innovation into learning and instruction, the math program routinely incorporates technology in the classroom and to support online instruction. As stated in the self-study, the math faculty are committed to using technology thoughtfully, appropriately, and effectively in their instruction:

DSU faculty use technology as a tool to solve and analyze problems throughout the curriculum but firmly believe that technology should not replace paper-and-pencil skills and conceptual understanding but rather should supplement and expand the realm of what is possible in the mathematics classroom.

In addition to recognizing the potential of technology to support mathematics instruction, they also expressed concerns about how technology can clash with academic integrity if used inappropriately. Dealing with this issue is a legitimate and major concern in higher education as technology continues to evolve and instruction has to follow suit.

E. Program assessment.

To monitor student progress in the Mathematics Program, the mathematics faculty constructed program learning outcomes in the Spring of 2021, mapped these to curricula, and designated an assessment process for each of the specific mathematics programs. The Program Learning Outcomes (PLO's), as documented in the self-study, for the Mathematics BS Program are as follows:

1. Students will demonstrate knowledge of fundamental skills and concepts of mathematics.
2. Students will apply mathematical skills to the analysis of real-world problems.
3. Students will use logical arguments to explore problems and prove conjectures.
4. Students will solve mathematical problems with technology tools.

These PLO's are aligned with the program's mission of providing students with a solid foundation in mathematics and also reflect DSU's mission statement and values. However, as discussed with Jeanette McGreevy-Director of Institutional Effectiveness, Assessment, and Policy, these PLO's would benefit from being refined and narrowed in scope for the purposes of assessment.

F. Student support / student enrollments.

The mathematics faculty offer the requisite core mathematics degree courses every year and offers elective courses on a rotating basis depending on demand. This schedule may not provide students with the courses they wish to take immediately, but does allow them to complete their degree requirements in a timely fashion. Enrollment in core courses appears to be solid, with some core courses experiencing larger growth due to other DSU programs such as Cyber Operations, Computer Science, and Computer Network and Security. Some, but not all, core courses have online versions, the addition of which may help alleviate the need for faculty to teach multiple sections of the same course in person because of classroom size constraints. Given the recent addition of Specialization in Cryptograph specialization for the Mathematics B. S. degree, it is promising that the upper level Cryptography & Codes course (MATH 436) appears to be one of the more popular upper level courses, both in person and online. As a testimony to the quality of

the mathematics instruction at DSU, undergraduates have the opportunity to collaborate with faculty on research projects, and nearly 100% of the Mathematics Program graduates find positions in the job market or continue their studies in graduate school.

G. Program strengths and areas for improvement.

The strengths of the Mathematics Program are consistent with those discussed in the previous review conducted in 2014. The mathematics faculty demonstrate a thoughtful integration of technology in their instruction, an excellent job placing graduates in careers or programs of study, embodiment of the university's mission, vision, and values, a low student to faculty ratio compared with other state universities, and cooperative support for other academic programs on campus. In addition, the faculty exhibit a strong sense of community and collegiality, and expressed respect for their leadership and many shared beliefs and standards for providing quality mathematics instruction. The skill and expertise of the department leadership is very much evident, in terms of mentoring early career faculty, hiring faculty who will "fit in" with the group dynamics, and especially in building up the Mathematics Program by fostering a symbiotic (as opposed to solely supportive) relationship with other programs at the university. Also, the recently added Specialization in Cryptography within the Mathematics B.S. degree speaks to how the Mathematics Program continues to evolve to meet the needs of students at a university that has made a name for itself in the fields of cyber security and operations.

Since the last review, the Mathematics Program has made considerable progress on shoring up vulnerabilities, specifically low enrollment and the associated issue of offering upper-level courses on a more frequent basis. Increased enrollment, however, also comes with its own challenges. Some of the faculty expressed concern regarding the amount of time and work that they spend supporting and providing feedback to students in both in person and online classes. It may seem that online instruction would be more efficient and less taxing for faculty, but, without the support of qualified teaching assistants, it requires substantive amounts of time and energy. There was also a sense from the faculty that they spent considerable time and effort constructing and mapping learning outcomes to the curricula, but that changes made as a result of data collected from this activity were not apparent to them. Perhaps the most troubling concern was a general sense that the mathematics faculty are not recognized and appreciated for the critical role that they play in the success of DSU. Teaching core courses for other programs is not glamorous, but it is a vital service that the mathematics faculty diligently and assiduously perform, and this should be rewarded and not overlooked.

Part 4: Recommendations for Change

In terms of reducing workload for faculty while continuing to offer quality feedback, I suggest that the program investigate the use of AI-assisted grading tools (such as Gradescope). The use of such modern technology is not only consistent with DSU's focus on integrating technology in every aspect of instruction, but could also mitigate the grading process, especially as enrollment numbers increase. I also appreciate the faculty's concern for maintaining standards and preserving academic integrity which becomes even more of an issue with an increase in online instructional environments. Toward this end, I would suggest that, in addition to focusing on preventative and detection measures, the faculty also develop resources (such as exam simulations) to proactively

disincentive cheating. Finally, the Mathematics Program faculty would benefit from receiving more recognition for their dedication and service to the university. Part of this includes consulting them (or asking for recommendations) when hiring mathematics tutors in the tutoring center, and encouraging Beacom Faculty to suggest to students that mathematics faculty be invited to participate on their committees. Also, hiring additional faculty as needed will help distribute the workload and will allow the Mathematics Program faculty to continue to provide quality instruction and conduct impactful research.