

External Program Evaluation for

MS in Analytics Program

Offered by the College of Business & Information Systems

Dakota State University

External Reviewer:

Dr. Rajeev Bukralia

**Associate Professor & Program Director for MS in Data Science
Minnesota State University, Mankato**

Date of Site Visit:

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Executive Summary

This report summarizes the evaluation of the Master of Science in Analytics (MSA) program offered by the College of Business and Information Systems (BIS) at Dakota State University (DSU). The report is based on the meetings the external evaluator conducted with various campus constituents during the site visit on April 1, 2022 and review of the self-study document provided by the program director. In addition, the external reviewer has utilized relevant information from the DSU website, South Dakota Board of Regents (SDBOR) website, and other resources related to analytics and data science. The report focuses on evaluating the alignment between the university's mission and vision with the MSA program, program curriculum, instructional resources, technology integration, student recruitment and retention, student support, and program assessment. It highlights areas of strengths and accomplishments of the MSA program, and it offers suggestions for improvement that can help enhance the program further to create a competitive advantage for the future.

The MSA program is a successful graduate program that aligns well with DSU's mission, vision, and values. It is a program that is critical to meeting the industry needs of analytics and data science related jobs that are growing at a rapid pace. The MSA program has shown a trajectory for growth and has enrollment comparable to data science and analytics programs offered at institutions of a similar size in the Midwest. The program is offered both on-campus and online, which helps expand the reach of the program and meet the needs of working professionals. The new university initiatives, including MadLabs and the proposed Applied Research Lab (ARL), can offer opportunities for symbiotic relationships that will strengthen the MSA program. The program has collaborations with faculty from other programs and colleges, and there is a potential for deepening strategic collaboration with the Beacom College of Computer and Cyber Sciences on key emerging technologies such as artificial intelligence, blockchain, and the application of analytics solutions in cybersecurity to meet the needs of the regional employers, especially the banking/finance industry in the state.

The students in the MSA program speak highly of the program faculty. The students appreciate that the faculty are responsive, approachable, and committed to student success. Student experiences reflect that faculty are engaged with students inside and outside of the classroom, for example many students are engaged in research projects with faculty. Students mention a need for greater industry collaborations for internships and job opportunities and funding for additional graduate assistantships. The faculty are continually looking to incorporate new trends to keep the curriculum up-to-date and meet evolving industry needs. The challenge will be to balance the need for new courses with existing faculty and fiscal resources.

The success of the MSA program is partly attributed to the support it receives from other departments, including the College of BIS, Graduate Studies, Research & Economic Development, the library, and career services. The program has sufficient resources, including classrooms, labs, research infrastructure, and student support services.

In sum, the MSA program has many strengths, including:

- Student-focused program faculty who have an expertise in analytics and related fields
- Flexible mode of delivery catering to both on-campus and distance students
- Curriculum with five elective tracks that allows students to pursue a track of their choice
- The program is available as a Fast-Track (4+1) option to undergraduate CIS students
- Availability of resources and technology infrastructure for instruction and research
- Initiatives such as MadLabs, Applied Research Lab, and CBAR add value to the program
- Collaborations with other colleges on campus, SDSU, and local industry

- 100% placement; graduates placed at leading companies in analytics related roles

The following are some suggestions to further strengthen the program:

Student Resources

- Develop new and strengthen existing industry partnerships for student internships.
- Strengthen partnerships with regional scholarly conferences and scholarly associations such as ACM, IEEE, and AIS to help students publish their research.
- Support the Analytics Student Club, so it can grow and provide a “value-add” to their degree. (Successful student clubs offer a variety of opportunities to their members, including industry talks, hackathons, collaboration for research projects, and industry mentorships.)
- Increase the number of graduate assistantships available to the MSA students.
- Develop opportunities so distance students can visit the campus to build connections with the faculty, on-campus students, and the physical campus.

Faculty Resources

- Strengthen partnerships between the BIS and Beacom College faculty in areas of mutual academic and research interest.
- Engage MSA faculty and students with the Applied Research Lab in Sioux Falls on projects that intersect cybersecurity and analytics.
- Develop a mechanism for faculty fellowships (stipend) in collaboration with industry partners. This will enable the faculty to work with an industry partner during the summer and bring that learning back to the classroom to enhance student learning.

Curriculum

- Explore the possibility of developing courses or a specialization in Fintech to deepen the partnership with the banking and credit card industry in the state.
- Incorporate ethics, especially as it relates to emerging technologies such as artificial intelligence (AI) and DevOps (MLOps) in relevant courses.
- Consider replacing or supplementing the “short-answer” based comprehensive exam with a “project-based” exam to assess the students’ subject knowledge and readiness for industry work in analytics.
- Incorporate industry-sponsored mini-projects into appropriate courses.

Program Assessment

- Establish a process for internal and periodic assessment that is in congruence with the new policies established by the SDBOR for academic program evaluation in collaboration with the Department of Institutional Effectiveness.

Strategic Alignment

- Deepen collaboration with the BIS and Beacom College faculty on emerging technologies such as artificial intelligence, blockchain, and application of analytics solutions in cybersecurity.

Student Recruitment

- Consider hosting data analytics competitions and student-focused conferences for students that may create recruiting opportunities for the MSA program.

The report discusses the above strengths and suggestions for improvement in more detail, along with a SWOT analysis of the MSA program.

Program Goals and Strategic Alignment

The MSA program is a successful graduate program that aligns well with DSU's mission, vision, and values. It embodies DSU's mission of developing graduates who are "ready to contribute to local, national, and global prosperity."¹ The program enhances DSU's focus on technology and curricular innovation to meet the needs of industry, state, and society at large. Since its mission change in the 1980s, DSU has become the leader in offering successful undergraduate and graduate programs in technology related fields in South Dakota and the region. Launched in 2014, the MSA program continues DSU's tradition of offering high-quality programs in technology related fields. Currently, the program has 41 students.

The new strategic initiatives, including the DSU Rising Initiative, which resulted in the construction of Madison Cyber Labs (MadLabs) and the DSU Rising II—which brings a multimillion-dollar investment in the Applied Research Lab in Sioux Falls—provide an advantage to the program and have the potential to create a competitive advantage for the program in the future. DSU's technology infrastructure has played a key role in the success of the MSA program.

"The world's most valuable resource is no longer oil, but data."² Organizations are looking to harness data to foment innovation and improve decision-making; as a result, analytics jobs are rapidly growing. Essentially, every industry sector has needs for analytics professionals. Data science and analytics related jobs continue to be in very high demand and are one of the higher paying technology related jobs in the country. According to Glassdoor's annual job rankings, data science and analytics related jobs have been in the top 10 jobs every year since 2016.³ This trend is expected to continue as more organizations deploy analytics solutions to meet their business goals. The MSA program meets this critical need of the industry.

The new university initiatives, including MadLabs and the Applied Research Lab in Sioux Falls, can offer opportunities for symbiotic relationships that will strengthen the MSA program. The MSA program has collaborations with faculty from other programs and colleges, and there is a potential for deepening strategic collaboration with the Beacom College on key emerging technologies such as artificial intelligence, blockchain, and application of analytics solutions in cybersecurity to meet the needs of regional employers, especially the banking and credit card industry in the state.

Program Resources

Program resources are critical to the success of any academic program. The following are the highlights of the resources that play an important role in the success of the MSA program:

- **Program Faculty:** The MSA curriculum is taught by faculty with terminal degrees in analytics and information systems related fields. There are 16 faculty members associated with the program, and some of them regularly teach the core courses. Students mention that the faculty are approachable, responsive to student needs, and experts in the field. The faculty have access to instructional technology support through the Center for Teaching & Learning (CTL). The program is managed by a dedicated faculty director. The program faculty mentor students for industry projects through the Center for Business Analytics Research (CBAR). The program faculty keep abreast of trends in the field and look for opportunities to incorporate new tools and techniques into their courses to enhance student learning. The

¹ <https://dsu.edu/about-dsu/mission-vision-values.html>

² <https://www.forbes.com/sites/forbestechcouncil/2019/11/15/data-is-the-new-oil-and-thats-a-good-thing/?sh=1fd5b3097304>

³ https://www.glassdoor.com/List/Best-Jobs-in-America-LST_KQ0,20.htm

faculty can apply for institutional funding for their research projects and for projects that may result in grant proposals. They have a course load and course release opportunities consistent with similarly placed institutions and are eligible for travel support for their professional development.

- The College of Business and Information Systems (BIS) office is the central point of support for students and program faculty. The BIS office has full-time personnel and several work-study positions that provide the necessary support for administrative tasks. The BIS office is led by a dean who is vested in the success of faculty and students and is engaged in conversations with faculty, students, and industry partners to explore ideas for enhancing the program.
- The office of Graduate Studies, led by the dean of Graduate Studies, facilitates the recruitment of prospective students, coordinates the graduate admission process, assists with program delivery for remote sites and course scheduling, allocates graduate assistant positions, monitors students' progress toward graduation, and oversees graduate education policies.
- The office of Research and Economic Development helps support research, grants, and economic development related initiatives throughout the campus. This office provides funding for research infrastructure, including the servers that are used by MSA faculty and students in their research projects. With the new \$90 million initiative to expand DSU's Applied Research Lab in Sioux Falls, the MSA program will potentially have new opportunities for expansion.
- The Karl E. Mundt Library provides excellent resources for the MSA program, including both hard-copy and electronic resources. Key electronic resources relevant to data science and analytics, such as IEEE, ACM Digital Library, ABI/Inform, are available in addition to dozens of other online databases. The library provides free interlibrary loan services and has relationships with other academic libraries in the state and beyond. A reference librarian leads the effort for bibliographic instruction and provides curricular and research support to students and faculty. Through an SDBOR funded system-wide initiative, it is impressive that the DSU library provides access to coveted Web of Science database and offers free download of EndNote (citation management software) to students and faculty.
- Career Services provides resources to students for jobs and internships. The job fairs, resumé building and interview tips workshops, and the Handshake system are helpful for connecting students with job and internship opportunities.
- The office of Online Education plays an important role in the online delivery of the MSA program and helps support the needs of distance students. As an early leader in distance education in the state, DSU has a good technology infrastructure for the delivery of distance and online courses.
- **Facilities & Equipment:** There are adequate facilities and equipment to support the instructional needs of the program, including the availability of both proprietary and open-source software commonly used in analytics and data science courses and industry work. The curriculum is further supported by servers with advanced GPUs and other research facilities available through MadLabs. Students receive 2-in-1 laptops configured with the necessary software to meet their academic needs.

The following are suggestions for improving the program resources:

- One of the key recent accomplishments for DSU is the success of the Beacom College of Computer & Cyber Sciences, which benefits from its industry partnerships and the NSA's designation as one of the centers for academic excellence in cyberoperations. There are many areas where cybersecurity and analytics intersect. The deployment of AI and analytics solutions in recognizing and mitigating cyber threats is one such area. Another possible area for collaboration is Fintech technologies such as blockchain. It will be valuable to strengthen partnerships between the BIS and Beacom College faculty on areas of mutual academic and research interests that can advance strategic goals for both the BIS and Beacom College.
- With its proposed \$90M investment in the Applied Research Lab in Sioux Falls, DSU will have a unique opportunity for innovation and economic development in the cybersecurity field.⁴ It would be prudent to investigate the possibilities for collaboration for the BIS faculty in the new lab, especially in areas intersecting Fintech, analytics, and cybersecurity to address the needs of the banking and credit card industry in the state and surrounding region.
- Analytics is an applied field that caters to the needs of the industry. These industry needs evolve regularly with the development of new technologies and processes. It is important for faculty to spend time in the industry periodically to learn about industry trends. It is recommended to develop a mechanism for faculty fellowships (stipend) in collaboration with industry partners. This will enable the faculty to work with an industry partner during the summer and bring that learning back to the classroom to enhance student learning. In addition, such an opportunity will allow faculty to explore and develop opportunities for student internships.
- There has been some attrition of program faculty over the years. It is challenging to recruit faculty in analytics and data science fields, since faculty with such expertise have more lucrative opportunities in the industry and at large, research universities. Thus, it is critical that the SDBOR and campus administrators develop appropriate faculty retention strategies addressing the shortage of faculty in high-demand areas.

Enrollment & Student Support

The following are the highlights of the MSA program related to enrollment and student support:

- **Program Enrollment:** The MSA program was launched with 6 students in the fall of 2014. The enrollment showed a consistent trajectory of growth, reaching 73 students in the fall of 2019. Since the COVID-19 pandemic, the program has dropped to 41 students (spring 2022). This decline in enrollment is understandable, as the pandemic drastically reduced the number of applications that many universities received, especially from international students who were severely affected by the travel restrictions. As the pandemic subsides and travel restrictions ease, one can hope enrollments in higher education will likely be back to their pre-pandemic levels soon. Still, it will be important to closely watch enrollment in the

⁴ <https://www.argusleader.com/story/news/education/2022/01/26/dsu-build-cyber-research-lab-sioux-falls-help-south-dakota-become-cyber-state-kristi-noem/9211164002/>

MSA program. The program's growth and enrollment numbers are reasonable considering closely related programs at similar-sized institutions.

- **Student Retention:** The MSA program is delivered in two modalities: on-campus and online/distance. Both delivery methods target different types of students. Most students (72% of the headcount in 2022) are pursuing the distance option, which primarily targets the working professionals and students who are unable to travel to Madison for classes. One potential area of concern is the low graduation rate—although 140 students have graduated from the program, the overall graduation rate is 53%. Studies have found that distance education programs tend to have low graduation rates.⁵ There are multiple factors that contribute to higher attrition and lower graduation rates in distance programs compared to traditional, on-campus programs. Since the MSA program has a greater number of distance students, the graduation rate of 53% is explainable. Yet, it would be essential to develop strategies to improve the graduation rate.
- **Academic Advising:** The MSA students are assigned a faculty advisor at the beginning of the program. Under the direction of their advisor, students complete a Plan of Study in their first semester, which helps establish a relationship between the student and their faculty advisor early in the program. The students work with their faculty advisor regularly regarding their coursework, program requirements, and expected milestones toward graduation. The number of advisees is capped at 50 per advisor, which is a reasonable number considering the advising load at similar institutions. There are mechanisms to address additional advisees.
- **Analytics Student Club:** Student clubs can provide greater engagement and resources to students for their learning needs, can act as a catalyst for collaboration for hackathons and research papers, and can help foster networking opportunities between students and industry professionals. The program has a small student club focused on analytics, though student participation in and activities offered by the club are limited. It would be beneficial for the analytics club to collaborate with other clubs on campus and similar clubs at other universities.

The following are some suggestions for improving enrollment and student support:

- One of the areas for improvement some MSA students identified is the lack of internships. Although it is beneficial that the Career Services office organizes career fairs and provides access to available jobs and internships through the Handshake system, many MSA students would like to have more internship opportunities. It would be helpful for the program faculty to partner with the alumni office, Career Services, and Research & Economic Development office to explore industry partnerships for internships for the MSA students.
- Though the MSA program doesn't require a capstone such as a thesis, one of the hallmarks of a stellar graduate program is student research. Many MSA students pursue research projects through their classwork or through CBAR under faculty guidance. It might be valuable to strengthen partnerships with regional scholarly conferences such as MWAIS and CADSCOM that often publish student work.

⁵ <https://www.tandfonline.com/doi/abs/10.1080/02680513.2013.847363>

- The program faculty and administrators should work with students to support the Analytics Student Club, so it can grow and provide a “value-add” to their degree. Successful student clubs offer a variety of opportunities to their members, including industry talks, hackathons, collaboration for research projects, and industry mentorships. A committed faculty advisor who has strong industry connections can provide the momentum and guidance student members need for club activities and events.
- The office of Graduate Studies supports graduate assistantships (GAs) throughout the campus. It is not clear if any specific number is allocated to the MSA program. The GA positions are a valuable tool for recruiting high-performing students into an academic program. The MSA students expressed a need for an increased number of graduate assistantships. Though limited financial resources are a barrier to expanding graduate assistantships, it would be necessary to explore ideas to obtain funding for additional GAs through industry support and indirect costs generated from relevant grants.
- To address the concerns of the graduation rate among distance students, it might be helpful to develop opportunities so distance students can visit the campus to build connections with faculty, on-campus students, and the physical campus. Such opportunities may include on-campus hackathons, athletic events, and student club events. Such events may include alumni and industry partners to expand networking opportunities for students. Industry partners and various campus departments (such as the alumni office/DSU Foundation, Graduate Studies, etc.) may want to financially support such opportunities of mutual benefit.

Program Curriculum

The MSA program is a 30-credit hour graduate program designed to be delivered on-campus and online. It caters to the needs of both traditional and non-traditional/distance students. The program can be completed on a full-time or part-time basis. A student can complete the program in as little as one calendar year. The program curriculum has six core courses (18 credits), two required courses (6 credits), and two elective courses (6 credits). The electives are divided into five tracks: AI, Business, Healthcare Analytics, Information Systems, and General. The students who do not meet the academic requirements for direct admission are required to pursue up to nine credits of additional knowledge courses.

The program curriculum incorporates important elements of analytics competencies, including programming, databases, big data analytics, data warehousing, predictive analytics, and data mining. The tracks provide an opportunity for students to pursue an area of interest.

The program curriculum has the following key strengths:

- It has a flexible mode of delivery catering to both on-campus and distance students.
- In addition to the core and required courses that build common competencies, the curriculum has five different tracks for elective courses, which allow students the opportunity to pursue a track of their interest.

- The program is available as a Fast-Track (4+1) option that can save money and time for undergraduate students interested in pursuing a master’s degree. The BS in CIS students can take 9 graduate credits in their senior year, which expedites their graduation with a master’s degree.
- The program-level learning objectives and courses are relevant for industry needs for analytics professionals.
- The program-level learning objectives (PLOs) are mapped to course-level objectives.
- The program covers leading technologies (such as AI) and the courses build competencies in leading tools (TensorFlow, Hadoop, Tableau, etc.), languages (SAS, Python, SQL, and R), and techniques (such as visualizations, predictive analytics, and text mining).
- The program recognizes the importance of cloud-scale analytics.

The following are some suggestions for enhancing the curriculum:

- The faculty should consider exploring the possibility for developing courses or a track in Fintech to deepen the partnership with the banking and credit card industry in the state.
- Though the curriculum includes courses in data mining and deep learning, there are two additional valuable skills that industry desires in data science and analytics professionals: AI ethics (Responsible AI) and DevOps (MLOps). AI ethics is an emerging area of AI that can play a critical role in the success of AI solutions and has implications for organizations, their customers, and society at-large.⁶ Thus, it would be important to incorporate the ethics of emerging technologies, especially AI, into the curriculum. The continuous deployment and evaluation of machine learning models is a concern for industry. Thus, it would be helpful to introduce students to DevOps (MLOps) in relevant, existing courses.
- The program requires a comprehensive exam to assess cumulative student learning; however, the exam appears to be primarily focused on recalling facts and assessing students’ subject knowledge. Consider replacing/supplementing the “short-answer” based comprehensive exam with a “project-based” exam to assess the students’ subject knowledge and readiness for industry work in analytics.
- One of the ways to enhance industry relationships and prepare students for industry work is industry-sponsored and industry-mentored mini-projects. Consider including such mini-projects into courses as appropriate.

Technology Integration

DSU has been a leader in integrating technology in its curricula and teaching. The University provides each student a laptop/tablet configured with the necessary software and tech support. The campus is connected to a 100-gigabit network backbone to provide seamless and speedy access to the internet. The classrooms are equipped with audio-visual technologies. The coursework is readily delivered through a learning management system (D2L Brightspace), and lectures are video recorded and made available to students as appropriate. The faculty and students have access to computer

⁶ <https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/>

servers equipped with advanced GPUs for coursework and research projects. The proposed ARL will establish a cyber/IT park, which will add to the technology infrastructure. In essence, DSU has an advantage in integrating technology in curricula and research.

Program Assessment

There has been no internal program assessment or external program evaluation conducted for the MSA program up to this point. Though the program-level objectives (PLOs) of the MSA program are mapped with the course-level objectives (CLOs), there is a need to establish a process for internal and periodic assessment of the program. For this assessment, it will be helpful to focus on specific PLOs each year and assess student learning in specific courses related to those PLOs. Though time-consuming, a well thought-out process will help achieve DSU's goal of continuous improvement. The SDBOR has established a new program evaluation and review process, which will hopefully streamline the reporting process.⁷

Additional Items

The MSA program is not accredited and there is no accreditation specific to analytics or data science programs. The program is offered by the College of Business & Information Systems (BIS), which is accredited by the ACBSP. Though not essential for the MSA program, it would be helpful to investigate the possibility for the College of BIS to pursue the AACSB accreditation, especially since it now offers a PhD program in information systems. The AACSB accreditation will likely enhance the reputation of the MSA program.

The MSA program is classified as a STEM program, which is helpful in attracting international students.

Beyond the suggestions noted, this report did not find any concerns related to the program curriculum, resources, assessment, and enrollment.

⁷ https://www.sdbor.edu/the-board/agendaitems/2014AgendaItems/2022%20Agenda%20Items/March2022/6_D2_BOR0322.pdf

SWOT Analysis

Strengths (internal)	Weaknesses (internal)
<ul style="list-style-type: none"> • Program faculty • 4+1 option • On-campus & distance delivery • Flexible coursework and many tracks • Technology infrastructure • MadLabs and CBAR • Instructional resources • 100% placement for graduates • Program covers leading technologies 	<ul style="list-style-type: none"> • Internships (more internship opportunities for MSA students) • Student club activities • Coursework lacking AI ethics and MLOps • Graduate assistantships (more GA opportunities for MSA students) • Periodic program assessment • Faculty attrition • Lower graduation rate
Opportunities	Threats
<ul style="list-style-type: none"> • Proposed Applied Research Lab and associated funding • Collaborations with Beacom faculty • Fintech track • AACSB accreditation • Project-based learning (PBL) • Enrollment potential • Faculty fellowships for industry experience 	<ul style="list-style-type: none"> • Covid disruptions impacting enrollment, retention, and student learning • Competing programs in the area • Distance from large metro area and industry hubs • Sparsely populated state with relatively small economy

Appendix II

Schedule for site visit

9:00 - 9:40 AM	Campus Tour Cameron, Student Ambassador
9:45 - 10:10 AM	Dr. Dorine Bennett, Dean College of BIS Dr. Mark Hawkes, Dean Graduate Studies East Hall 115B
10:15 - 10:40 AM	Conversation with Information Systems students East Hall 109
10:45 - 11:10 AM	Dr. Jeanette McGreevy, Director of Assessment East Hall 109
11:15 - 11:45 PM	Academic Resources (Library, Career Services) East Hall 109
11:45 - 12:30 PM	Lunch
12:45 - 1:15 PM	Conversation with Coordinator (Dr. Jun Liu) East Hall 109
1:20 - 2:00 PM	Research (Dr. Ashley Podhradsky, Dr. Pete Hoelsing, Dr. David Zeng, Dr. Patti Brooks) East Hall 109
2:00 - 2:45 PM	Conversation with Program Faculty (Dr. Jun Liu, Dr. David Zeng, Dr. Jack Walters, Dr. Renae Spohn) East Hall 109
2:45 – 3:30 PM	Open East Hall 109
3:30 - 4:00 PM	Coordinator wrap up (Dr. Jun Liu) East Hall 109
4:00 - 4:30 PM	Exit Interview (Dr. Dorine Bennett, Dr. Jun Liu, Dr. Richard Hanson) East Hall 109

Appendix III

Biographical Sketch of the External Evaluator

Dr. Rajeev Bukralia is a tenured associate professor and graduate research faculty in the Computer Information Science (CIS) Department at Minnesota State University, Mankato. Dr. Bukralia serves as the program director for the MS in data science program. He is the faculty founder of and advisor to DREAM (Data Resources for Eager & Analytical Minds), an award-winning student organization dedicated to data science and artificial intelligence (AI). DREAM has over 300 student members.

Dr. Bukralia is a recipient of the Minnesota State Colleges & Universities Board of Trustees Outstanding Educator award and the South Dakota Board of Regents faculty award. Dr. Bukralia is co-founder and chair of the Twin Cities Professional Chapter of the ACM (Association for Computing Machinery). He serves as chair of the Midwest Undergraduate Data Analytics Competition (MUDAC).

He earned doctoral and master's degrees in information systems from Dakota State University. His research interests include data science, artificial intelligence, ethics of AI, and IT strategy. Dr. Bukralia is active in industry; he has participated in data science trainings at Google, Microsoft, and UC-Berkeley and has served as a research fellow at United Health Group. He is a thought leader in data science education and serves as a distinguished volunteer for MinneAnalytics, a non-profit, industry-focused organization dedicated to data science.

Previously, Dr. Bukralia served as the director of data science outreach and associate provost for Information Services/CIO at UW-Green Bay. At Black Hills State University, he was dean of Educational Outreach and Libraries.