

SOUTH DAKOTA BOARD OF REGENTS

Academic and Student Affairs
Consent

AGENDA ITEM: 5 – B (3)
DATE: March 29-30, 2023

SUBJECT

New Program Request – USD – PhD in Data Science and Engineering

CONTROLLING STATUTE, RULE, OR POLICY

[BOR Policy 2:23](#) – New Programs, Program Modifications, Curricular Requests, and Inactivation/Termination

BACKGROUND / DISCUSSION

The University of South Dakota (USD) requests authorization to offer a PhD in Data Science and Engineering. The PhD in Data Science and Engineering will be an interdisciplinary degree that would span across many existing and emergent technical fields, including Machine Learning and Artificial Intelligence, Data Mining and Big Data, Data Analytics and Applied Statics, Data Engineering, and Data Visualization. The proposed program would be a collaborative program with SD Mines, which was approved to offer the program in [May 2022](#). The collaborative program agreement is included on the February 2022 AAC agenda.

IMPACT AND RECOMMENDATION

A summary of the program proposal has been included as Attachment I. Additional information on this proposal is available from the Board office by request.

ATTACHMENTS

Attachment I – New Program Request Summary: USD – PhD in Data Science and Engineering

DRAFT MOTION 20230329_5-B(3):

I move to authorize USD to offer a PhD in Data Science and Engineering, as presented.

**Full Proposal Summary – Ph.D. Data Science and Engineering
University of South Dakota**

BOR Recommendation: The Board of Regents Academic Affairs and the Executive Director support the program request. This program will serve workforce demand for data scientists, analysts, and engineers while enhancing the strong collaborative relationship between the University of South Dakota and the South Dakota Mines and expanding opportunities for students pursuing graduate work in this field.

Program Description-

The purpose of the Collaborative Data Science and Engineering Ph.D. program is to provide for the common delivery of graduate data science programs (coursework, research, and mentorship) by the South Dakota School of Mines & Technology (Mines) and the University of South Dakota (USD). This collaborative program builds upon other existing collaborative programs and shared courses between the participating institutions. Through this collaboration, Mines will contribute content, research training, and faculty with expertise in computer science, math, and multiple fields of engineering. USD will contribute content, research training, and faculty with expertise in computer science, artificial intelligence, math and statistics, medicine and health science, business, and biomedical engineering.

The joint program agreement between USD and SDSMT is forthcoming.

Strategic Impact –

USD Strategic Impact: The proposed program will enable Mines and USD to form strong collaborations in academic, scholarly research, and economic growth activities across the state. The primary purposes of the proposed program are:

1. to enable USD and Mines to compete for more/larger federal research grants spanning the broad fields of machine learning/artificial intelligence, data science, data engineering, data visualization, and data analytics;
2. to enable an increase in research productivity from both junior and senior level faculty in our departments at the campuses;
3. to make career opportunities at Mines and USD more attractive to top-tier faculty within our departments, thus improving faculty recruitment and retention efforts;
4. to support research commercialization prospects, drive innovation, and increase entrepreneurial opportunities;
5. to attract industry partners to collaborate on cutting-edge research, leading to increased job opportunities for students, increased job growth within South Dakota, and improvements in economic development across the state; and
6. increase collaboration between the two institutions as well as provide a terminal degree option or a stackable credential for the many existing B.S./M.S. offerings at our universities in the general areas of computational statistics, biomedical sciences, business analytics, data science, computer science, electrical engineering, industrial engineering, biomedical engineering, and mathematics.

BOR Strategic Impact: The proposed program also aligns with the Board of Regents Strategic Plan 2022-2027, Goal 3: Academic Excellence, Student Outcomes, Educational Attainment, and Goal 4: Workforce and Economic Development. USD is committed to four key priority areas – student success, academic quality and performance, research and economic development, and affordability and accountability – and ties each to a firm set of outcomes. This program will connect to the BOR’s strategic plan and is aligned to the institutional mission of educating students who are

well-prepared for a global and complex world with classroom experiences that are robust, experiential, and practical.

Program Summary:

The Classification of this Program will be 30.7001 (Data Science, General) with a degree of Ph.D. The intended start date will be Fall 2023. This program will be assigned to the College of Arts and Sciences and the Department of Computer Science. This program is proposed to be an on-campus program, not delivered through distance education.

South Dakota Mines conducted the external site visit for this program on April 8, 2022. Dr. Marchette, Naval Surface Warfare-Dahlgren Division, and Dr. Rudolph, Utah Valley University, conducted their review. South Dakota Mines updated the curriculum to address their program concerns. Because this is a joint academic program, the results of SDSMT’s external site visit will be used to validate the quality of the program proposed by USD. USD’s program mirrors that of SDSMT while adding expertise in medical and business analytics.

Duplication and Competition:

The proposed Ph.D. in Data Science and Engineering approaches data science from the artificial intelligence and machine learning lens, which is different from SDSU’s Data Science Specialization in their Computational Science and Statistics Ph.D. program which focuses on mathematical and statistical course work. The proposed Ph.D. in Data Science and Engineering is also a collaborative cross-disciplinary program and is, to the best of our knowledge, the first of its kind being offered in a truly collaborative cross-disciplinary fashion with collaborations spanning Computer Science, Mathematics/Statistics, and Industrial Engineering/Operations Research.

Regental Universities:

University	Conferred Graduate in Related Fields	Total Number of Graduate Conferrals (All University)
Dakota State University	Master’s: 0* (20) Doctoral: 0* (2)	Total: 137
South Dakota School of Mines and Technology	Master’s: 0* (0) Doctoral: 0* (0)	Total: 125
South Dakota State University	Master’s: 0* (25) Doctoral: 0* (1)	Total: 450
University of South Dakota	Master’s: 0* (5) Doctoral: 0* (0)	Total: 767

* For purposes of these counts, the “related fields” category includes the following CIP disciplines: 14.09 Computer Engineering, 30.70 Data Science, 30.71 Data Analytics.

() For purposes of these counts, the “related fields” category includes the following CIP disciplines: 11.04 Information Science/Studies, 14.09 Computer Engineering, 27 Mathematics and Statistics, 30.70 Data Science, 30.71 Data Analytics.

Private SD Universities:

University	Conferred Degrees in Related Fields	Total Number of Graduate Conferrals (All University)
None Identified		

Total SD Sum of Peer Findings:

University	Conferred Degrees In Related Fields	Total Number of Graduate Conferrals (All University)
Total	Master's: 0* (50) Doctoral: 0* (3)	Total: 1,479

Outside of South Dakota Competitor University Peers to Institution:

University	Conferred Degrees in Related Fields	Total Number of Graduate Conferrals (All University)
Montana State University	Master's: 0* (26) Doctoral: 0* (6)	Total: 498
New York University: Ph.D. in Data Science	Master's: 329* (816) Doctoral: 0* (22)	Total: 10,553
University of Tennessee-Knoxville	Master's: 8* (49) Doctoral: 3* (12)	Total: 2,179

* For purposes of these counts, the "related fields" category includes the following CIP disciplines: 14.09 Computer Engineering, 30.70 Data Science, 30.71 Data Analytics.

() For purposes of these counts, the "related fields" category includes the following CIP disciplines: **11.04 Information Science/Studies**, 14.09 Computer Engineering, **27 Mathematics and Statistics**, 30.70 Data Science, 30.71 Data Analytics.

Workforce Outlook/State Need:

There is a critical need across disciplines and industries for trained data engineers and data analysts to analyze and process this tsunami of information effectively. A January 17, 2022, search of Indeed.com lists some 6500 job positions for data scientist or data analyst, with employers including Amazon, Apple, Assurant, Booz Allen Hamilton, Capital One, IBM, Intel, General Motors, Hewlett Packard, Lawrence Livermore National Lab, Lockheed Martin, Mayo Clinic, Microsoft, New York Life, Netflix, and USAA.

The demand for data science jobs continues to grow. Forbes reports that data science jobs have increased over 650% since 2013, while the U.S. Bureau of Labor Statistics expects demand for data scientists to increase by another nearly 28% by 2026. That equates to roughly 11 million new data science jobs by 2026.

In South Dakota alone, data scientists and engineers are sought by employers such as Pearson, Lexmark, Change Healthcare, Sanford Health, Ryder Systems, Raven Industries, and Citi. (Data came from the [SDSMT program proposal approved by the BOR in May 2022](#). A search of [Indeed.com](#) for [data engineers](#) or [data scientists](#) brings back most of these employers.)

While this Ph.D. program will include training in cleaning/organizing data, which is typically considered data science, this program will have a focus on data engineering (developing, constructing, testing, and maintaining architectures for data, databases, and large-scale processing systems) through computer programming and mathematical processing.

USD and Mines each contribute different attributes to training for students in this program. USD, being the pioneer AI program in the state, will be able to provide training to students to build data processing systems. In addition, through the School of Medicine and the School of Health Science, USD will capitalize on faculty expertise to provide training to students regarding data engineering and data science in medicine and health care. For example, USD offers CSC 787: AI in medical imaging informatics. This course teaches approaches to leveraging AI tools for medical imaging informatics and machine learning.

The [workforce demand](#) for data science and data engineering are both growing at a higher rate than the average career growth across all professions. Demand for data science positions saw a growth of 80% in 2019 and 10% in 2020. The growth of data engineering is more stable, with an average of 30% growth over the [past 5](#) years and 50% growth post-2020.

USD currently serves 159 students in our MS in Business Analytics and MS in Computer Science programs. Students in both programs are interested in continuing their graduate education to a Ph.D. in this area and are interested in pursuing research with the combined faculty at USD and Mines.

Student Learning Outcomes:

The proposed Ph.D. in Data Science and Engineering program objectives are to equip individuals to demonstrate the following knowledge and competencies before graduation:

1. Acquire and apply the knowledge and skills to make an original contribution to the field of Data Science and Engineering.
2. Conduct independent research within a supportive multidisciplinary framework.
3. Understand and critically evaluate the relevant literature in Data Science and Data Engineering.
4. Communicate relevant Data Science and Engineering principles and theories by written, oral, and visual means.
5. Apply Data Science and Engineering principles and procedures to the recognition, interpretation, and understanding of prior and current knowledge in the field.
6. Exhibit an appropriate awareness of and commitment to the ethical conduct of research.

Projected Enrollment:

ESTIMATES	FISCAL YEARS*					
	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
Students new to the university	2	1	2	2	2	3
Students from other university programs	2	2	2	2	2	3
Students off-campus or distance continuing students	--	--	--	--	--	--
	--	4	6	9	12	12
Total students in the program (fall)	4	7	10	13	16	18
Program credit hours (major Courses)**	72	126	180	234	288	324
Graduates	--	--	--	2	2	4
<i>*Do not include current fiscal year.</i>						
<i>**This is the total number of credit hours generated by students in the program in the required or elective program courses. Use the same numbers in Appendix B – Budget.</i>						

USD anticipates recruiting 2-3 students currently enrolled in either the MS in Business Analytics or MS in Computer Science into the proposed Ph.D. program in Data Science and Engineering. They believe they will be able to recruit about the same number of additional students (new to the institution) specifically for this program.

Projected Revenue/Expenses:

FINANCIAL HEALTH SUMMARY						
	1st FY24	2nd FY25	3rd FY26	4th FY27	5th FY28	6th FY29
TUITION & FEE REVENUES	26,754	46,819	66,885	86,950	107,016	120,393
PROGRAM EXPENSES	-	-	162,680	134,736	134,736	134,736
NET (T&F REVENUES LESS PROGRAM EXPENSES)	26,754	46,819	(95,795)	(47,786)	(27,720)	(14,343)
OTHER SUPPORTING REVENUES	-	-	-	68,000	68,000	68,000
NET AFTER OTHER SUPPORTING REVENUES	26,754	46,819	(95,795)	20,214	40,280	53,657

No additional expense is anticipated for this program until year 3. Because this is a collaborative and interdisciplinary program, students will take courses that are already being offered by other programs. Existing faculty will be engaged in dissertation and research mentorship. The existing STEP discipline fee will be applied to these courses.