



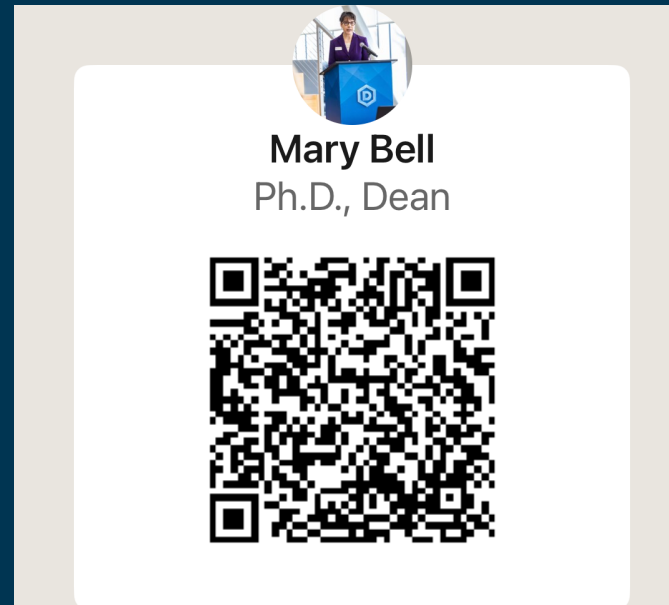
QUANTUM EDUCATION & WORKFORCE DEVELOPMENT

Quantum at Dakota State University

Curriculum as the Region's Quantum Workforce Pipeline — From High School to Graduate Program

Mary Bell

Dean, The Beacom College of Computer and Cyber Sciences





Quantum Computing: A National Priority

On June 22, 2026, President Trump signed two executive orders to accelerate U.S. quantum innovation and mandate post-quantum cryptography adoption by federal agencies.

EO 14413

Ushering in the Next Frontier of Quantum Innovation

- ◆ A quantum computer enabling scientific discovery, targeted by 2028
- ◆ Deployment of quantum sensors and networks; stronger domestic supply chains
- ◆ A skilled quantum workforce built through apprenticeships, credentials, and new National Quantum Workforce Development Institutes

EO 14412

Securing the Nation Against Advanced Cryptographic Attacks

- ◆ Mandates federal migration to post-quantum cryptography (PQC)
- ◆ High-value assets must transition by December 31, 2030
- ◆ Digital signatures must transition by December 31, 2031

Federal deadlines for post-quantum cryptography turn our MATH/QUAN 437 coursework from academic interest into workforce necessity — and reinforce why building this pipeline now matters for the Great Plains region.

South Dakota C-QIST

The Center for Quantum Information Science & Technology, formally established May 2024

\$3.6M

Combined state seed funding and cloud computing access secured for South Dakota's quantum initiative

2

Higher-ed institutions involved:
DSU (broad quantum applications)
and SD School of Mines &
Technology (2D quantum materials)

\$900K+

External federal grants won by DSU faculty since 2024, including NSF and DOE awards

DSU's tasks under C-QIST: research capacity building across quantum applications in physical sciences and post-quantum cybersecurity, quantum workforce development and skill training, and building collaborations and external funding partnerships.

Quantum Research at DSU

A growing research base gives students real problems to work on

PI: DR. PENG GUO

Quantum Simulations in Physical Sciences

- Extracting few-body dynamics in nuclear physics from quantum simulations
- Non-Hermitian physics phenomena, such as Bloch oscillation

PI: DR. VARGHESE VAIDYAN

Hybrid Quantum-Classical Environmental Monitoring

- Multi-drone gas leak detection using quantum-classical path optimization
- Quantum Voronoi spatial partitioning for methane detection

AUTHOR: MARIAM GADO

Quantum Networking & Communications

- “Multi-Year Power Upgrades to Support SQKD with Heterogeneous Quantum Servers in a Pre-Existing Cyber Layer Under Rising Key Rate Demands”*
- Accepted, QCE26 QNET Technical Papers Track — IEEE Quantum Week, Toronto, Sept. 2026

11+

Publications & accepted papers in the last 1.5 years

\$900K+

Federal grants since 2024 (NSF, DOE)

5+

Partner institutions, incl. Argonne & Savannah River National Labs

Growing Our Graduate Research Bench

Generously allocated funding for graduate assistantships on quantum-related work

6

Ph.D. students

Receiving AY 2026–27 graduate assistantship appointments on quantum-related research

2

M.S. assistantships

Funded for quantum-related work, one of which is designated for South Dakota or U.S. resident students

Curriculum Is the Workforce Pipeline

1

Start before college

Quantum concepts now reach students in high school, through dual-enrollment coursework — before they ever set foot on campus.

2

Anchor quantum in cybersecurity strength

DSU's applied cyber mission gives quantum education a ready home and a direct line to regional employer demand.

3

Design for regional impact

Every credential, from dual credit through degree, is built to produce quantum-ready graduates for Great Plains employers, agencies, and labs.

The Full Quantum Pathway at DSU

Four stages — from a high school elective to a dedicated degree



REACHING HIGH SCHOOLERS FIRST

Governors Cyber Academy

Statewide dual-enrollment program



Our Quantum Pathway Now Extends Into High School



Part of the Governors Cyber Academy

Our quantum curriculum is being built into DSU's statewide dual-enrollment program, not offered separately from it.



CSC/QUAN 275 available for dual credit

High school juniors and seniors can take Introduction to Quantum Computing while still enrolled in high school, earning transferable university credit.



A proven delivery model

The Academy already reaches students statewide — online or in their own high school — with faculty-taught, university-level coursework.



A head start toward a DSU cyber degree

Dual-credit coursework counts toward the first year of a DSU cyber degree, so quantum exposure in high school becomes credit earned toward the minor or major.

UNDERGRADUATE MINOR

Quantum Computing for Cybersecurity Minor

18 CR

Required Courses



CSC/QUAN 275

Introduction to Quantum Computing

DUAL CREDIT



CSC/QUAN 403

Quantum Computing Applications I



MATH/QUAN 437

Post-Quantum Cryptography

Plus 3 courses selected from approved quantum/cyber electives

- Dual credit available through the Governors Cyber Academy*

GRADUATE CERTIFICATE

Quantum Computing for Cybersecurity Graduate Certificate

12 CR

Required Courses



CSC/QUAN 275

Introduction to Quantum Computing



CSC/QUAN 403

Quantum Computing Applications I



MATH/QUAN 437

Post-Quantum Cryptography



Elective

Graduate Quantum Cybersecurity Elective

B.S. in Quantum Computing & Technology

Core Curriculum

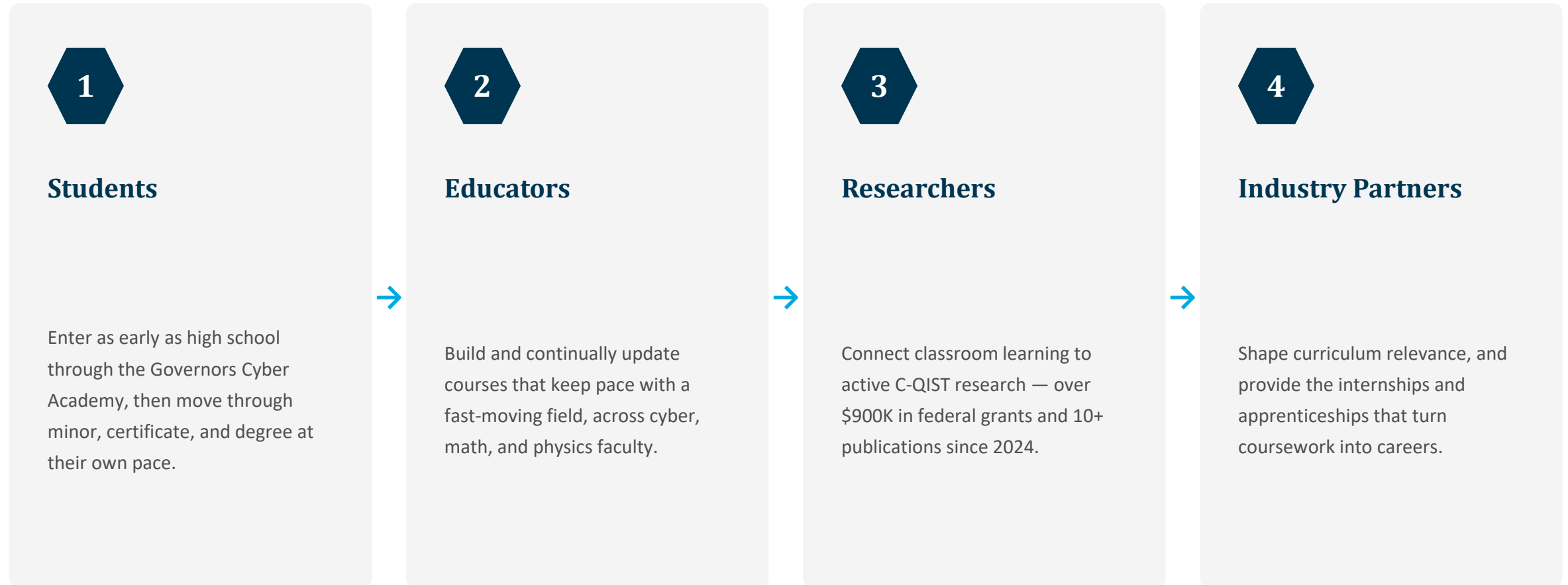
CSC 134	Introduction to Cyber
CSC 150	Computer Science I
CSC 234	Software Security
CSC 247	Introduction to Artificial Intelligence
CSC 250	Computer Science II
CSC 285	Networking I
CSC/QUAN 275	Introduction to Quantum Computing
CSC 300	Data Structures
QUAN 3XX	Introduction to Quantum Physics

CSC/QUAN 403	Quantum Computing Applications I
QUAN 404	Quantum Computing Applications II
QUAN 4XX	Quantum Networking
CSC 482	Algorithms and Optimization
MATH 201	Introduction to Discrete Mathematics
MATH 315	Linear Algebra
MATH 436	Number Theory and Cryptography
MATH/QUAN 437	Post-Quantum Cryptography



From Classroom to Career

A quantum-ready workforce takes all four groups working together



Opportunities, Challenges & Strategies

Advancing quantum education and workforce development across the Great Plains

OPPORTUNITIES

-  A statewide dual-enrollment pipeline already reaches high schoolers before college
-  C-QIST funding and federal grants (\$900K+) validate regional research strength
-  A cybersecurity-first foundation gives quantum education a credible, established home

CHALLENGES

-  Quantum-qualified faculty are scarce and highly competitive to recruit
-  The talent pipeline is thin relative to fast-growing employer demand
-  Emerging programs compete for scarce institutional funding and resources

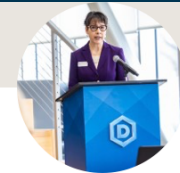
STRATEGIES

-  Extend dual credit access to CSC/QUAN 275 through the Governors Cyber Academy statewide
-  Deepen ties between coursework, C-QIST research, and employer partners
-  Build formal internship and apprenticeship infrastructure that converts students into hires

Questions?

Mary Bell

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Dakota State University



Mary Bell
Ph.D., Dean

