

ACADEMIC SPECIALIST PROMOTION STATEMENT

The majority of my responsibilities in Nat Sci involve providing leadership and support for the implementation of the Biology Initiative. The overarching goal of the Biology Initiative is to improve the quality and efficacy of biology teaching and learning and to increase the retention and academic success of a diverse group of learners interested in the biological sciences. This effort has fundamentally changed the culture of undergraduate teaching and learning in the biological sciences. The adoption of a shared vision for biology education and the implementation of an organizational structure to support that vision will have a lasting impact on quality of education for our more than 3,500 life science majors and the many other students who complete courses in the biological sciences every year.

The new vision and structure that I have helped to develop provides a platform for continuous evaluation and improvement of biology undergraduate education that will endure well beyond the funding timeline for the Biology Initiative. This effort has engaged administrators, department chairs, program directors, tenure-stream and fixed term faculty, newly appointed course curriculum coordinators, and academic advisors in substantive discussions focused on teaching, learning, student outcomes, and student success. Following is a discussion of how I have played a role in this process and my plans to continue these efforts.

Teaching

Classroom Instruction

BS161: Cell and Molecular is the first biology course that most of our students take and has been a major target of the Biology Initiative efforts. One of my first roles in my academic specialist position was to lead the Biology Initiative BS161 Committee in the development of a shared vision for the course. Therefore, it was important for me to become part of the BS161 teaching team. Indeed, the large enrollment BS161 course that serves diverse majors from across the university provided new challenges for me compared to the similar, but low enrollment course I taught for several years in Lyman Briggs College. I am currently teaching BS161 for the third time and have personally witnessed the benefits of the Biology Initiative investments as I have been able to implement active learning strategies and written assessments that I commonly used in my Lyman Briggs courses.

My efforts to improve the course and utilize the Biology Initiative resources are grounded in the shared vision, which states the course should (1) develop students' conceptual understanding of Big Ideas in cell and molecular biology, (2) engage students in Science Practices, (3) engage students in activities and assignments that emphasize time-on-task and high expectations, and (4) create an inclusive learning environment that encourages faculty-student and student-student interaction. For example, a target learning outcome is for students to be able to develop and use models to explain concepts and phenomena in cell and molecular biology. Multiple lecture periods are dedicated to modeling exercises in which students work in groups to create a model focused on an important topic such as protein structure and function, cellular respiration, or gene expression. I have used modeling exercises originally developed by Dr. [REDACTED], Curriculum Coordinator for BS161, and created new exercises based on his model. GTAs and ULAs interact with the students during the modeling exercises to enhance learning. The student generated models are electronically submitted and graded to provide students with formative feedback. This example highlights important characteristics of my teaching including incorporation of active learning and cooperative learning pedagogical approaches and a focus on blending science practices and big ideas.

I am also working to improve assessment of student learning in the course by creating assessment items that blend science practices and big ideas. Up to 40% of the points on the unit and final exams come from written assessment items, something that only became possible recently in BS161 with the infusion of Biology Initiative resources. The written exam questions evaluate students' abilities to apply their knowledge of key concepts by constructing scientific explanations based on evidence and creating and using models to explain phenomena. These written assessment items both engage students in meaningful learning and allow me to better assess their learning, particularly of learning objectives that blend big ideas with science practices.

Faculty Development and Organizational Reform

In addition to my own teaching responsibilities, my other MSU instructional activities have centered on engaging faculty and academic staff in programs focused on improving STEM Education and increasing STEM student retention and success. Successful and sustainable reform of STEM education is dependent on establishing an institutional culture in which teaching and learning are valued, recognized, and rewarded. My instructional activities have been in service to achieving this type of institutional change.

For example, I am part of the planning committee for the STEM Teaching Essentials program and regularly give workshops on topics such as backward design and inclusive teaching. I am co-director of the STEM Gateway Teaching Fellowship. The overarching goals of the Fellowship are to facilitate curricular reform and encourage cultural transformation. The program is part of the MSU's AAU-funded project, 'Creating a Coherent STEM Gateway' and is supported with funds from the Office of the Provost, the College of Natural Science, and Lyman Briggs College. In collaboration with _____, I develop and deliver monthly workshops for the 9 Fellows in the inaugural cohort. We are preparing to recruit a second cohort of fellows this spring. This program is cultivating an expanding and highly visible community of faculty and academic staff committed to improving the STEM gateway curriculum. Additionally, I have worked with Sekhar Chivukula and Renee Bayer to develop and deliver several STEM Education Alliance meetings and a 2-day retreat focused on improving the STEM gateway curriculum as part of MSU's HHMI LEVERS program. These overlapping efforts contribute to the overall goal to transform STEM Education at MSU.

Curriculum Development

My first curriculum development responsibilities were as chair of the BS161 Committee and I led the effort to identify a shared vision for the course that was based on sound teaching practices. This was a challenging but rewarding effort. Faculty exhibited skepticism and resistance to change. Many had witnessed previous pushes for biology education reform that resulted in little change. Others were unconvinced that we needed to change the course at all. Over time the group developed a sense of community and came to a shared understanding of how the course could be improved using Biology Initiative resources. We identified the big ideas and science practices that should comprise the course and then began to develop learning objectives and assessments based on those big ideas and practices. This work provided a foundation upon which _____, the new BS161 curriculum coordinator, has continued to build. Moreover, the model I used for curriculum review and transformation has been adopted by other course committees such as the BS162 committee and the ZOL355 committee.

After being appointed Assistant Dean and following the appointment of _____ as the BS161 course coordinator, my curriculum development work shifted away from course-based development to broader efforts to coordinate curricula across the multiple Nat Sci academic programs in the biological sciences. My experiences and lessons learned as the chair of the BS161 committee have guided my approach to engaging faculty, academic staff, and chairs in the

evaluation and improvement of our biology programs. In this role, I have worked with the Biology Initiative Executive and Oversight Committees to develop a shared vision for undergraduate biology education in Nat Sci. We have also identified and described a foundational curriculum that be the basis for continued evaluation and improvement of undergraduate biology education. Moving forward, this vision and set of foundational courses will be the focus of continued curriculum coordination efforts.

Research

My research overlaps with my teaching, curriculum development, and administrative efforts. I am part of MSU's interdisciplinary research group focused on improving STEM education across the gateway curriculum. Led by _____, MSU's AAU STEM Education Initiative research team has been at work developing a pair of instruments designed to assess changes over time in the content, instructional practices, and assessments used in gateway courses across disciplines. The Three-dimensional Learning Assessment Protocol (3D-LAP) characterizes the extent to which assessment items evaluate three-dimensional learning, that is, learning that blends disciplinary core ideas, science practices, and crosscutting concepts. Similarly, the Three-dimensional Learning Observation Protocol (3D-LOP) is designed to evaluate teaching practice by measuring to what extent a typical class meeting incorporates disciplinary core ideas, science practices, and crosscutting concepts. The instruments are not discipline-specific and can therefore provide a more systematic and integrated understanding of course reform efforts. Moreover, this research aligns well with my other roles and responsibilities. We will eventually use these instruments to evaluate and improve teaching across the gateway curriculum.

All members of the group are co-authors of multiple posters and conference presentations that have been presented at disciplinary conferences in biology, chemistry, and physics, as well as at conferences focused on STEM education more broadly. The group recently published an Education Forum in *Science* titled "Challenge Faculty to Reform STEM Learning" and we will shortly submit a research article to *PLOS ONE* that describes the development and validation of the 3D-LAP instrument. It is expected that this work will lead to several additional publications and will be the basis for NSF grant proposals.

Administration

My administrative duties involve ensuring that proposed policy and curricular changes come to fruition. I work to ensure that the decisions made by the Biology Initiative Executive Committee and the Biology Initiative Oversight Committee are enacted. For example, the Executive Committee shares responsibility for and make collective decisions about the Biological Sciences Program. I work with the committee to identify the faculty who teach in the BioSci program. I organize and collect data for the new teaching evaluation process implemented for these instructors. This administrative work has increased transparency and improved communication across the units, outcomes that are necessary to achieve the broader goal to improve biology education across the college.

Vision for the Future

As Assistant Dean for Curriculum Coordination, my highest priority is to ensure that our biological science programs in the College of Natural Science provide learning experiences that blend disciplinary core ideas, science practices, and scientific communication. I will continue to pursue this goal by facilitating groups of faculty and academic staff to develop, implement, and continually evaluate course and program curricula that ensure that students are achieving learning outcomes that will prepare them for continued educational experiences and future careers.