

## FORM D - IV A INSTRUCTION

The faculty member is encouraged to use a range of evidence demonstrating instructional accomplishment, which can be included in portfolios or compendia of relevant materials.

### 1. Undergraduate and Graduate Credit Instruction:

Record of instructional activities for at least the past six semesters. Include only actual participation in credit courses (on- or off-campus instruction) or virtual university on-line courses. In determining the “past six semesters,” the faculty member may elect to exclude any semesters during which s/he was on leave; additional semesters may be included on an additional page. Fill in or, as appropriate, attach relevant print screens from CLIFMS\*.

Semester and Year	Course Number	Credits (Number or Var)	Number of Sections Taught			Number of Students	Number of Assistants **	Notes
			Lec	Rec	Lab			
SP17	LB274	4	1	1	1 (integrated)	45	8 ULAs/ .25 GTA	This course is an integrated lab/lecture course. The GTA and ULAs are split across 3 sections of the course, though I acted as coordinator for all of these assistants.
FS16	LB273	4	2	2	2 (integrated)	80	8 ULAs/ .75 GTA	This course is an integrated lab/lecture course. The GTA and ULAs are split across 3 sections of the course, though I acted as coordinator for all of these assistants.
FS15	LB273	4	1			130	7 ULA/ 1 GTA	This was the large-lecture version of the course where the lecture was separated from the lab/recitation. I went on parental leave this semester and so co-taught with a post-doctoral scholar.
SP15	LB492	4	1			14	0	
	PHY905	3	1			5 (+4 auditing)	0	4 post-doctoral scholars in the physics and Astronomy dept audited this course.
FS14	LB273	4	1			135	7 ULA/1GTA	

\*Consult departmental staff who are authorized to enter data on the web-based CLIFMS (Course Load, Instruction, Funding and Modeling System) system and can search for course sections and enrollments by faculty name, per semester.

\*\*May include graduate and undergraduate assistants, graders, and other support personnel.

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**2. Non-Credit Instruction:**

List other instructional activities including non-credit courses/certificate programs, licensure programs, conferences, seminars, workshops, etc. Include non-credit instruction that involves international, comparative, or global content delivered either to domestic or international groups, either here or abroad.

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\*\*May include graduate and undergraduate assistants, graders, and other support personnel.

**FORM D – IV A INSTRUCTION, continued**

**3. Academic Advising:**

**a. Faculty member’s activity in the area of academic advising.** The statement may include commentary on supplementary materials such as recruitment activities, international student advising, evidence of peer recognition, and evidence of student recognition.

Undergraduate: During the period of review, I have supervised 8 undergraduate students who have worked as research assistants in my physics education research lab. My advising activities have included (i) program of study and career counseling, (ii) mentoring in the practice of science, and (iv) discipline-specific research training.

Graduate: I currently supervise two doctoral students in Physics and Astronomy who are investigating the design of learning environments to (i) make physics more relevant to life science majors, (ii) understand how laboratory practices contribute to developing a physics identity.

Graduate/Professional:

Other:

**b. Candidate’s undergraduate advisees (if applicable to individual under review):**

	Freshman	Sophomore	Junior	Senior
Number of current undergraduate advisees				

**c. Candidate’s graduate/graduate-professional advisees (limit to principal advisor or committee chairpersonship status):**

	Masters	Doctoral	Professional
Number of students currently enrolled or active		2	
Number of graduate committees during the reporting period		3	
Degrees awarded during the reporting period			
Degrees awarded during career			

**4. List of Instructional Works:**

List publications, presentations, papers, grants received (refer to Form D-IVE), and other works that are primarily in support of or emanating from instructional activity.

*Grants received:*

- **Science Studies at State Seed Grant**, co-PI, internal to Mich. State Univ., \$10k, 2016, Vital Signs: Bridging and Democratizing Physics.
- **Science Studies at State Seed Grant**, co-PI, internal to Mich. State Univ., \$10k, 2014, Facilitating the interdisciplinary education research in Lyman Briggs College.

*Peer-reviewed publications*

- [REDACTED] “Making Waves with Electricity: A Shockingly Robust Investigation of Equipotential Lines Using the IOLab,” submitted.
- [REDACTED] “Teaching About Racial Equity in Introductory Physics Courses,” *Phys. Teach.*, **55**, 328 (2017).
- [REDACTED] “Student Discourse about Equity in an Introductory College Physics Course,” Physics Education Research Conference, Sacramento, CA, Proceedings of the 2016 Physics Education Research Conference, American Association of Physics Teachers, 88-91 (2016).

*Invited Talks:*

- [REDACTED] “Rethinking Physics for Biologists: Reconciling Interdisciplinary Perspectives,” Invited colloquium, Texas State – Commerce, April 2015.
- [REDACTED] [REDACTED] “Rethinking physics for biologists: A design-based research approach”, Invited talk, American Physical Society, San Antonio, TX, March 2015.

*Contributed presentations at national conferences*

- [REDACTED] “BLISS Physics: A Studio Physics Course for Life Science Students,” Contributed Poster, AAPT National Meeting, Cincinnati, OH, July 2017.
- [REDACTED] “Incorporating Computation into a Physics Course for Life Science Students,” Contributed Talk, AAPT National Meeting, Cincinnati, OH, July 2017.
- [REDACTED] “Student discourse about equity in an introductory college physics course”, Contributed poster, AAPT National Meeting, Sacramento, CA, July 2016.
- [REDACTED] “Purpose of Representation Use in Modeling Instruction Physics,” Contributed presentation, AAPT National Meeting, Sacramento, CA, July 2016.
- [REDACTED], “Troubleshooting Formative Feedback in P<sup>3</sup> (A Group Based Learning Environment),” Contributed poster, Physics Education Research Conference, College Park, MD, July 2015.

**5. Other Evidence of Instructional Activity:**

Cite other evidence of instructional productivity such as works/grants in progress or under review (refer to Form D-IVE). Address instructional goals and approaches; innovative methods or curricular development; significant effects of instruction; and curatorial and patient care activities, etc. Include evidence of instructional awards and peer recognition (within and outside the university).

In my time at Michigan State I have worked to develop research-based teaching materials and environments that (i) emphasize connections across the disciplines of science, (ii) build students’ sense of competence and belief in themselves as science students, and (iii) can see the relevance of physics to their lives.

My introductory physics class is dominated by life science majors who typically find physics to be a hurdle they have to cross that they have little interest in. One of my primary goals in redesigning the LB273 – Introductory Physics with Calculus was to tackle this perspective by building connection to biology and chemistry. I served as co-PI on an S3

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grant (and also two submitted NSF grants that were not funded) to build interdisciplinary modules for science classes. I also was accepted as a STEM Gateway Fellow, where I am working with colleagues from across the science disciplines on campus to build curricular materials that have an authentic basis in biology or chemistry. My peers across the country have recognized my expertise in this area, as evidenced by invitations to speak at both the national meeting of the American Physical Society (the leading organization of physicists in the United States) as well as the American Association of Physics Teachers, and universities that are considering adapting an introductory physics course to build connections. I evaluate the effectiveness of my teaching by utilizing the interdisciplinary assessment that was supported by my LPF-CMP 2 research grant LPF-CMP 2 (see Research).

In addition to building connections across the science disciplines, I have also focused on building classrooms where students can see their competence in physics growing, and see themselves as scientists. The integration of the laboratory with the lecture in the redesign of the LB273 course was a key aspect to this goal. Incorporating the lab into the class supports students in developing skills around designing and conducting experiments, analyzing results from data, and building model simulations. The computational problems I have co-designed for this class emphasize the connection between experimental data and simplified models.

Finally, one of my primary goals in teaching is to help students see the relevance of physics (and science) to their lives. One way this plays out is in the cross-disciplinary connections I described above. However, I also believe that teaching extends beyond the classroom. To this end, I have mentored 8 undergraduate students in research, 2 PhD students, and 3 post-doctoral researchers. I believe that the process of designing experiments, writing about them, and carrying them out are all a central part of doing science, but that are often left out of research experiences. I involve all of my students in these different parts of the process, and it is my goal that at least one of these resonates with a student in a way that they can begin to see themselves as part of doing science. For example, I supported one of my PhD students (██████) in applying for and winning an S3 award (on which I serve as co-PI) this past year. The mentoring of writing a designing a project, putting together a team of relevant people, and writing a grant proposal is part of what I see as a goal of making students see physics as more personal, and thereby more relevant to themselves.

**FORM D - IV B RESEARCH AND CREATIVE ACTIVITIES**

**1. List of Research/Creative Works:**

Attach a separate list of publications, presentations, papers, and other works that are primarily in support of or emanating from Research and Creative Activities. Indicate how the primary or lead author of a multi-authored work can be identified. The list should provide dates and, in particular, accurately indicate activity from the reporting period. Items to be identified:

- 1) Books
- 2) Book chapters
- 3) Bulletins or monographs
- 4) Articles
- 5) Reviews
- 6) Papers and presentations for learned professional organizations and societies
- 7) Artistic and creative endeavors (exhibits, showings, scores, performances, recordings, etc.)
- 8) Reports or studies

Indicate peer-reviewed or refereed items with a “\*”.

Indicate items with a significant outreach component with a “\*\*” (determined by the faculty member)

**2. Quantity of Research/Creative Works Produced:**

For each of the categories listed in question one above, list the number of research and creative works produced.

	1	2	3	4	5	6	7	8
During the reporting period	0	1	0	18	0	28	0	0
During career	0	1	0	40	0	65	0	0

**3. Number of Grants Received** (primarily in support of research and creative activities; refer to Form D-IVE):

During the reporting period: 4 During career: 4

**4. Other Evidence of Research/Creative Activity:**

Cite other evidence of research and creative productivity such as: seminars, colloquia, invited papers; works/grants in progress or under review (refer to Form D-IVE); patents; formation of research-related partnerships with organizations, industries, or communities; curatorial and patient care activities, etc. Include evidence of peer recognition (within and outside the university).

My research has two main thrusts: (i) understanding how to cultivate students’ sense of self-efficacy, identity, and mindset about physics, and (ii) deriving mechanisms for building interdisciplinary connections across physics and biology. Since arriving at MSU I been very active in pursuing research funding, applying for 12 NSF grants as PI or co-PI, including an NSF sole-investigator CAREER proposal.

At present I am co-PI of a external National Science Foundation research grant (\$4.9M; with a research component of \$780k). This award in particularly focuses on understanding how to support the development of self-efficacy, identity, and mindset for students transferring from Michigan community colleges to MSU. Toward the goal building interdisciplinary connections, I have also received three awards internal to MSU, two S3 grants (\$10k each)at the intersection of teaching and research, and a LPF-CMP 2 award (\$100k).

I have given 6 invited research presentations at conferences, university colloquia, and seminars on these topics. I have also given 3 contributed talks, and supported my mentees in giving an additional 35 talks and posters (including 7 from undergraduate researchers).

## FORM D - IV C SERVICE WITHIN THE ACADEMIC AND BROADER COMMUNITY

### 1. Service within the Academic Community

#### a. Service to Scholarly and Professional Organizations:

List significant committee/administrative responsibilities in support of scholarly and professional organizations (at the local, state, national, and international levels) including: elected and appointed offices held; committee memberships and memberships on review or accreditation teams; reports written and submitted; grants received in support of the organization (refer to Form D-IVE); editorial positions, review boards and ad hoc review requests; and programs and conferences planned and coordinated, coordinated or served on a panel or chaired a session. Include evidence of contributions (e.g., evaluations by affected groups or peers).

I have taken on a significant amount of national-level service to the physics education community that highlights the strong connection between my research and my teaching. Since starting at MSU I have taken on leadership roles in the primary professional organizations of physics education: serving as vice-chair and chair of the Committee on Research in Physics Education for the American Association of Physics Teachers (AAPT), the Committee on Education for the American Physical Society (APS). I have served on the advisory board for the Statistical Resource Center at the American Institute of Physics, and I have recently become an elected member of the Physics Education Research Leadership Organizing Council (PERLOC), the governing body of the field. In my time at MSU I have served as a guest editor of a Focused Collection on Gender in Physics for the journal *Physical Review – Physics Education Research*, which culminated in 2016. I have also served as a journal referee for *Physical Review – Physics Education Research*, the *American Journal of Physics*, and *Science Education*.

#### b. Service within the University:

List significant committee/administrative responsibilities and contributions within the University. Include service that advances the University's equal opportunity/affirmative action commitment. Committee service includes: appointed and elected university, college, and department ad hoc or standing committees, grievance panels, councils, task forces, boards, or graduate committees. Administrative responsibilities include: the direction/coordination of programs or offices; admissions; participation in special studies or projects; collection development, care and use; grants received in support of the institution (refer to Form D-IVE), etc. Describe roles in any major reports issued, policy changes recommended and implemented, and administrative units restructured. Include evidence of contributions (e.g., evaluations by peers and affected groups).

In the Lyman Briggs College I have served for several semesters (FS14, SP15, FS16) as the senior member of the physics group while [REDACTED] [REDACTED] was on leave. Within Lyman Briggs I also served on two search committees (for an Academic Specialist split between Physics/Math and a tenure-track joint position between Lyman Briggs and Physics and Astronomy). In the Physics and Astronomy department, I have co-directed the Physics Education Research Lab (PERL), organized the departmental Physics Education Research Seminar, and served on the Undergraduate Program Committee. In Physics and Astronomy I have served as a consultant and provided expertise to many of my faculty colleagues on teaching practices. More recently I have served as a physics represented to the STEM Teaching Building Committee.

## FORM D - IV C SERVICE WITHIN THE ACADEMIC AND BROADER COMMUNITY, continued

### 2. Service within the Broader Community:

As a representative of the University, list significant contributions to local, national, or international communities that have not been listed elsewhere. This can include (but is not restricted to) outreach, MSU Extension, Professional and Clinical Programs, International Studies and Programs, and Urban Affairs Programs. Appropriate contributions or activities may include technical assistance, consulting arrangements, and information sharing; targeted publications and presentations; assistance with building of external capacity or assessment; cultural and civic programs; and efforts to build international competence (e.g., acquisition of language skills). Describe affected groups and evidence of contributions (e.g., evaluations by affected groups; development of innovative approaches, strategies, technologies, systems of delivery; patient care; awards). List evidence, such as grants (refer to Form D-IVE), of activity that is primarily in support of or emanating from service within the broader community.

I have been active in outreach activities, including running sessions at Grandparents University. One of my largest efforts recently has been to develop and run workshops on racial equity in physics education. This workshop has been run locally in the MSU Physics & Astronomy Department as well as at three national conferences for physics educators. It has been well received in all of these environments, and I have been invited to run this workshop again at the American Association of Physics Teachers' national meeting in the summer of 2018.



## FORM D - IV D ADDITIONAL REPORTING

### 1. **Evidence of Other Scholarship:**

Cite evidence of “other” scholarship as specified on p. 2 in the “summary rating” table (i.e., functions outside of instruction, research and creative activity, and service within the academic and broader community). Address the scholarship, significance, impact, and attention to context of these accomplishments.

### 2. **Integration across Multiple Mission Functions:**

Discuss ways that your work demonstrates the integration of scholarship across the mission functions of the university—instruction, research and creative activities, and service within the academic and broader community.

One of the features of my research program is the inclusion of undergraduates as integral members of the scientific process. As mentioned in the *Academic Advising* section above, I have supervised eight undergraduate research assistants who have all played important roles in my physics education research lab. Two of these students (██████████ and ██████████) have made significant contributions to scholarly articles published in my time at MSU, and another (██████████) is contributing to another article currently in the submission process.

### 3. **Other Awards/Evidence:**

Cite other distinctive awards, accomplishments of sabbatical or other leaves, professional development activities, and any other evidence not covered in the preceding pages. (If the reporting period differs from the usual review period, then justify and support that period here.)

I have attended several workshops that have helped me improve my instruction and improved my expertise in inclusive learning:

- STAF – Strategies and Tools Across Fields: Teaching with Writing (May – Aug, 2015)
- Structural Racism workshop from ERACCE (Feb 25 – 27, 2016)
- Queer Inclusive Learning and Leadership Foundations Training (March, 2016)
- STEM Teaching Essentials Workshop: How Undergrad Research Impacts Faculty (January 17, 2017)

**FORM D - IV E GRANT PROPOSALS**

List grant proposals submitted during reporting period relating to teaching, research and creative activities, or service within the academic and broader community. Include grants in support of outreach, international, urban, and extension activities.\*

Name of Granting Agency (Grantor:) Focus of Grant (Focus:)	Date Submitted	\$ Amount Requested	Status			\$ Amount Assigned to Faculty Candidate (if Applicable)	Principal/Co-Investigators (if not faculty candidate)
			Pending	\$ Amt Funded	Not Funded		
<b>I. Instruction</b>							
Grantor: MSU – S3	10/3/16	\$10,000	<input type="checkbox"/>	\$10,000	<input type="checkbox"/>		[REDACTED]
Focus: Vital Signs – Bridging and Democratizing Physics							
Grantor: MSU – S3	10/1/14	\$10,000	<input type="checkbox"/>	\$10,000	<input type="checkbox"/>		[REDACTED]
Focus: Interdisciplinary Modules							
<b>II. Research/Creative Activity</b>							
Please see attached form for a list of research grants submitted through Michigan State University Office of Sponsored Research during the Review Period.							
Grantor: NSF	3/29/17	\$4,998,113	<input type="checkbox"/>	\$4,998,113	<input type="checkbox"/>	\$780,000	[REDACTED]
Focus: National Science Transfer Scholars							
Grantor: NSF	11/14/16	\$138,000	<input type="checkbox"/>		<input checked="" type="checkbox"/>		[REDACTED]
Focus: Characterizing Consequential Mindset Moments in College Physics Course Trajectories							
Grantor: NSF	10/26/15	\$223,196	<input type="checkbox"/>		<input checked="" type="checkbox"/>		[REDACTED]
Focus: Developing New Methodologies for Mindset: Growth Mindset Improvement Explored Through In-Depth Projects in College Physics							
Grantor: MSU – LPF-CMP2	4/15/15	\$99,926	<input type="checkbox"/>	\$100,000	<input type="checkbox"/>		[REDACTED]
Focus: Investigating How Students Connect Essential Ideas Across the Science Disciplines							

\*Anyone with an MSU Net username and password can log onto the web-based Information Reference database, maintained by the Office of Contract and Grant Administration, to search for records of proposals and grant awards by principal investigator. Printouts may be attached to this page.

**FORM D - IV E GRANT PROPOSALS**

Name of Granting Agency (Grantor:) Focus of Grant (Focus:)	Date Submitted	\$ Amount Requested	Status			\$ Amount Assigned to Faculty Candidate (if Applicable)	Principal/Co-Investigators (if not faculty candidate)
			Pending	\$ Amt Funded	Not Funded		
Grantor: MSU – LPF-CMP2	4/15/15	\$108,894	<input type="checkbox"/>		<input checked="" type="checkbox"/>		[REDACTED]
Focus: Toward Greater Coherence: Characterizing Students' Cross-Disciplinary Experiences in Gateway STEM Courses							
<b>III. a. Service – Academic Community</b>							
Grantor:			<input type="checkbox"/>		<input type="checkbox"/>		
Focus:							
<b>III. b Service – Broader Community</b>							
<b>i. MSU Extension</b>							
Grantor:			<input type="checkbox"/>		<input type="checkbox"/>		
Focus:							
<b>ii. Professional/Patient Care Activities</b>							
Grantor:			<input type="checkbox"/>		<input type="checkbox"/>		
Focus:							
<b>iii. International Studies and Programs</b>							
Grantor:			<input type="checkbox"/>		<input type="checkbox"/>		
Focus:							
<b>vi. Urban Affairs Programs</b>							
Grantor:			<input type="checkbox"/>		<input type="checkbox"/>		
Focus:							
<b>v. Other</b>							
Grantor:			<input type="checkbox"/>		<input type="checkbox"/>		

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**FORM D - IV E GRANT PROPOSALS**

Name of Granting Agency (Grantor:) Focus of Grant (Focus:)	Date Submitted	\$ Amount Requested	Status			\$ Amount Assigned to Faculty Candidate (if Applicable)	Principal/Co-Investigators (if not faculty candidate)
			Pending	\$ Amt Funded	Not Funded		
Focus:							

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