

Year 2 Annual External Evaluation Summary Report for NRT-HDR: Intersecting computational and data science to address grand challenges in plant biology

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Year 2 Summary

During Year 2 of grant activities, the external evaluators at the University of Northern Iowa Center for Social and Behavioral Research (CSBR) consulted with the IMPACTS leadership team on their internal evaluation activities and observed internal processes. The project leadership team has shown a high level of engagement and enthusiasm and has used their evaluation activities as an integral part of their programming and planning. An inventory of all internal evaluation activities has been created and shared with the external evaluators, and is maintained by the project coordinator. Assessments have been conducted regularly for courses and activities, and have been constructed with consultation from the external evaluators. The leadership team has also held regular check-ins with the evaluators via video conference to receive feedback on specific elements of evaluation assessments, which have also led to meaningful conversations about the strengths of the program as well as areas for improvement. One member of the evaluation team has also sat in on Executive Committee (EC) meetings, held monthly during the academic year, to observe internal decision-making processes.

The leadership team has embraced the recursive design of their evaluation assessments, which has served as a guide while navigating unanticipated issues and challenges. Assessments have been used to solicit mid-course feedback for the three program-specific courses offered: Foundations in Computational and Plant Sciences (Fall 2019); Frontiers in Computational and Plant Sciences (Spring 2020); and Forum in Computational and Plant Sciences (Fall 2019). Feedback from each of these has allowed for adaptive planning to incorporate student suggestions regarding the pace and content of the course (specifically, the Foundations course taught in Fall 2019). Using course feedback and instructor reflections from mid-course assessments and semester-end focus groups for the Foundations course, instructors were able to implement many of the suggestions from trainees into the Spring 2020 Frontiers course to better facilitate active engagement and leadership within the course from the trainees themselves. The students have shown initiative in the Forum class by identifying gaps in the content of their courses, and have used that as the starting point for collaborations intended to contribute to student-led sections of future courses, and manuscripts for STEM pedagogical publications.

The EC continues to recruit new trainers, with EC members approaching potential candidates individually. EC members have also been reaching out to other departments to help spur diversity in both trainee discipline and demographics. The leadership team along with the EC have responded to and prepared for changes for the coming year, both planned and unplanned. The PI (Shiu) will be on sabbatical for the 2020-2021 academic year. He will still be actively involved in the administration of the program, but has handed over the day-to-day tasks to co-PIs Long and Morris who will serve as co-Directors, with others from the executive committee stepping in to fulfill his sections of teaching in the IMPACTS courses. Another co-PI (Chitwood) will also be on a leave of absence for the 2020-2021 year, but has continued to help

plan for the coming year and will continue to contribute to the program, particularly the Foundation course that he taught in the 2019-2020 year.

While the COVID-19 pandemic interrupted some project plans for Spring 2020, the leadership team adapted their strategies to maintain as much consistency as possible in both programming and communication with student trainees. Classes were moved to an online format in March 2020, and all meetings have since been held virtually. Program Coordinator Kumar and co-PI Long coordinated regular virtual Happy Hour meetings for the trainees, which had strong attendance and positive feedback from students who were pleased to maintain contact with one another as well as program faculty and staff. Kumar has also reached out to students individually via email to check in on their academic status as well as their personal welfare. At the time of reporting, it is assumed that classes will be held in-person for Fall 2020, however the leadership team and executive committee are making plans to accommodate public health requirements for social distancing and considering how to continue should class mode need to shift once again to be held virtually.

Key Themes of Internal Evaluation Assessments

Throughout the year, student trainees participated in several surveys and focus groups to provide feedback on the three courses offered throughout the year. Overall, student feedback was positive about the classes provided in the 2019-2020 school year, and students were able to identify a number of strengths for each course. They also provided constructive feedback for areas which could be improved, which was shared with course instructors. Instructor reflections as provided to the evaluation team suggest that this feedback was integral to deciding on mid-course adaptations to better enhance student progress, and will be used to adjust classes for future years. Several key themes came from these assessments:

- Students and instructors acknowledge the challenges of providing instruction to students from different disciplinary backgrounds and with varying levels of experience in the cross-disciplines.
 - Students appreciate the ability to work in small groups for coursework, which provides the basis for peer-to-peer learning, facilitating the program goals for development of transferrable skills: mentorship, teaching, leadership and communication.
 - One instructor noted that more could be done to facilitate each of those skills, particularly by restructuring the Frontiers course with an opportunity to build their projects into publishable reports.
- Relatedly, instructors are working to find the balance of disciplinary instruction/knowledge when teaching applied skills: students requested more theoretical and contextual information regarding the biological data used for computational modeling in the Foundations class.

- The instructors' reflections show an understanding of this, and indicate that they are seeking to improve this with the intentional grouping of students for peer-to-peer instruction.
- The challenges with disciplinary balance also illustrate the complex nature of the big questions cutting across the computational and plant sciences, creating an authentic collaborative environment where students learn to work through barriers to answering these questions.
- Students felt they had achieved their professional development goals through the Forum class, which had elements related to science communication, project management and leadership skills, either through specific workshops or in planning the Data Carpentry workshop.
 - Students identified pedagogy as a desired area of training that was missing from the Forum, and they took the initiative to develop a training module for the next Forum class, which also serves as the basis of a manuscript that has been submitted to a journal on STEM teaching.
- Surveys completed after the move to online instruction after the pandemic began suggest that many students felt less motivated and less enthusiastic about course activities and requirements; however, this did not keep students from completing course requirements.

Conversations between the leadership team and external evaluators also provided several key takeaways:

- The leadership team and instructors for the core IMPACTS courses are enthusiastic and engaged with the program, and have learned a great deal from the past year of activities.
 - As described by the leadership team, decision-making has shifted from planning in the abstract to responding directly to student trainee feedback, using that to provide mid-course corrections and adapt courses and activities in real time to best serve the needs of the trainees.
 - Course adaptation based on feedback has been facilitated by the instructors' high level of engagement and quality of instruction, as noted by the leadership team.
 - Collaboration and communication amongs the leadership team and the instructors has been constructive, allowing for changes to be made to classes in progress as well as classes planned for subsequent semesters.
- One of the greatest strengths of the program, as identified by the leadership team and alluded to in instructor reflections, has been the cohort system for trainees.
 - Students have formed a cohesive group that fosters collaboration and an appreciation of the different strengths and backgrounds each brings to the group; they have also achieved a sense of camaraderie that is evident from

the monthly happy hours that have been scheduled since the global COVID-19 pandemic necessitated a shift to online classes and activities.

Plans for Year 3

The IMPACTS program is on track for the stated goals of the program, and activities will continue as scheduled for Year 3. The leadership team and program committees will continue to meet on a regular basis, and a member of the external evaluation team will continue to be present for all Executive Committee meetings. Given the uncertainties surrounding the COVID-19 pandemic, the external evaluation team will work with leadership as needed to adapt activities and assessments going forward, and reconsider specific measures and outcomes as the situation warrants.

The external evaluation team plans to meet at least quarterly with the leadership team to review evaluation activities and findings, and will continue to consult on specific issues if and when needed. A review of the logic model (Table 1) will be scheduled for late Summer or early Fall 2020, and any additional assessments or measurements will be planned at that time.

Table 1. IMPACT NRT – Michigan State Logic Model DRAFT 5/2/19

Inputs	Activities	Outputs	Short-Term Outcomes	Long-Term
<p>Trainers/Faculty – engaged, productive, with research expertise → including a science educator</p> <p>CMSE</p> <p>Large, successful, productive plant sciences including collaborations across departments and faculty</p> <p>Central administration support – includes student scholarships, funding for symposium</p> <p>Multiple existing outreach activities, opportunities</p> <p>Existing professional development activities offered by graduate school</p> <p>Internship opportunities at federal level</p> <p>Existing networks/relationships with industry</p> <p>Strong student pool across disciplines</p> <p>Historically strong relationships among Exec Committee and trainers</p> <p>Efforts focused on the HDR “big ideas” from NSF</p> <p>CSBR evaluation</p>	<p>Recruiting</p> <p>Bootcamp (?)</p> <p>Development and implementation of foundational courses</p> <ul style="list-style-type: none"> • Foundation in Computational and Plant Science • Frontiers in Computational and Plant Science • (Plant Science only, implementation only) Introduction to Computational Modeling <p>Forums – 1 credit, 2 required</p> <p>IMPACTS mentor training</p> <ul style="list-style-type: none"> • Peer mentoring, undergrads, REU mentoring (What else?) • Develop individual development plan (IDP)- trainees <p>Professional development workshops</p> <p>Interdisciplinary research experience with co-mentors</p> <p>Develop outreach</p> <ul style="list-style-type: none"> • Raspberry Pi Jam <p>Link trainees to existing outreach</p> <ul style="list-style-type: none"> • 4-H Garden • Girls Math and Science • Coding Camp • Darwin Days • MSU Science Day <p>Trainee subcommittee participation (1 year) or Symposium organization committee participation</p> <p>Social events</p> <p>Internship – link and expand</p> <p>Social media and blog presence</p> <p>Process and summative evaluation activities</p>	<p>Successful recruitment of trainees</p> <p>Boot camp attendance and reflections (?)</p> <p>Course performance and instructor reflections</p> <p>Forum attendance and reflections</p> <p>IDPs</p> <p>Occurrence of PD workshops, reflections of attendees, PD products</p> <p>Presentations, manuscripts, posters, dissertations, proposals</p> <p>Outreach attendance and reflections</p> <ul style="list-style-type: none"> • Video <p>Subcommittee attendance and reflections</p> <p>Social event occurrence and attendance</p> <p>Internship report (?), reflection Portfolios</p> <p>Social media and blog posts</p> <p>Evaluation reports</p>	<p>Increased recruitment and retention of good, engaged trainers</p> <p>Expanded trainer participation</p> <ul style="list-style-type: none"> • Including areas of need: ecology, computational engineering <p>IMPACT students can communicate and teach computational and plant science topics to diverse audiences</p> <ul style="list-style-type: none"> • Able to communicate across disciplinary fields <p>Strong project management, mentorship and leadership skills held by IMPACT students</p> <p>IMPACT students possess the knowledge and ability to do interdisciplinary research and collaborate</p> <ul style="list-style-type: none"> • Ability to generate important interdisciplinary research questions • Ability to conduct interdisciplinary research to answer the questions they have generated • Ability to collaborate effectively across multiple disciplines <p>Increased recruitment of URM</p> <p>Transferable skill set</p>	<p>IMPACT students possess the ability to advance solutions to grand challenges by incorporating plant biology and computational methods</p> <p>Increased diversity in the disciplines</p> <p>IMPACT students serve as leaders in collaborative science</p> <p>IMPACT students are employable across multiple STEM contexts</p>
<p>Evaluation</p> <p>Internal/External evaluation activities - formative, implementation, and progress evaluations in recursive design to inform and to guide project throughout planning and implementation phases</p>		<p>External/Contextual Factors</p> <p>University and departmental structure and expressed interest</p> <p>History of transdisciplinary work</p> <p>Proportion of underrepresented student populations in the state and region</p>		<p>Assumptions</p> <p>Secure funding throughout the project</p> <p>Buy-in from transdisciplinary faculty</p> <p>Institutional adoption of curricular changes</p>

