ASEE 2022 ANNUAL CONFERENCE
Excellence Through Diversity
MINNEAPOLIS, MINNESOTA, JUNE 26TH-29TH, 2022 ASEE
Paper ID #38259

US-Sweden Bioinformatics NSF-IRES Year 1: Program Development and Initial Lessons Learned

Mark A Chapman (Assistant Professor)

Mark Chapman is an assistant professor at the University of San Diego in the Department of Integrated Engineering. His interests lie in the fields of skeletal muscle mechanics, muscle disease, exercise physiology, international education and engineering education. He earned his MS and PhD in bioengineering from the University of California, San Diego and a B.S. in biomedical engineering from the University of Minnesota.

US-Sweden Bioinformatics IRES Year 1: Program Development and Initial Lessons Learned

Abstract

This National Science Foundation (NSF) project focuses on creating an immersive international summer research experience for students enrolled in a primarily undergraduate institution (PUI). Over the course of a three-year grant period, this research seeks to: (1) train and mentor 18 diverse undergraduate students from PUIs in Southern California in bioinformatics research in a collaborative and international setting; (2) disseminate the research outcomes at conferences and in peer-reviewed journals; (3) encourage and prepare undergraduate students from PUIs for enrollment in graduate programs in bioinformatics, bioengineering, or related fields; (4) foster existing collaborations and develop new research collaborations between the PI at the University of San Diego (USD) and scientists at the Science for Life Laboratory (SciLifeLab) in Sweden; and (5) develop a diverse cohort of globally engaged scientists/engineers that seek career opportunities and collaborators throughout the world. This paper reports on the first year of the grant.

Program preparations

The first year of this program took place during the summer of 2021 from March-August. Program activities included a 6-week virtual training series (March-May), a 1-week in-person pre-departure symposium (June) and a 10-week research experience in Sweden (June-August). These preparatory activities are described in full detail previously [1]. Briefly, during the virtual training series, the 6 IRES students became acquainted with each other, and learned about: Sweden, the institute they would be working at, as well as program travel/housing logistics. Additionally, students led a group discussion of an article from the lab they would be joining to ensure they were acquainted with their research group's work. Upon completion of the virtual training series, the students traveled to USD where the program director hosted a 1-week pre-departure symposium. This symposium primarily consisted of professional development activities focused on: presenting scientific findings, making and presenting scientific posters, applying to and succeeding in graduate school, and applying for graduate research fellowships.

Summer program

Following the pre-departure symposium, the IRES students and program director traveled together to Sweden where the students spent the next 10 weeks working on bioinformatics research projects in a host lab at SciLifeLab in Stockholm, Sweden. Students were mentored directly by the host lab, but the program director was extensively involved throughout the summer. The program director was on site in Stockholm for the first two weeks of the program. During these three weeks he had 1:1 meetings with each IRES student to confirm everything was going well for the students (both professionally and personally) before heading back to the U.S. Specifically, the program director required students to describe their research projects and their role on the project to ensure that they would have a productive summer. This is a critical step in guaranteeing that students do not spend the entire summer working on an ill-defined research project. For students that could not describe their project clearly, the director followed up with

the students on a later occasion. Additionally, these 1:1 meetings were spent discussing how they have acclimated to their new surroundings and if they needed any personal support.

To monitor student progress, weekly update emails were sent to the program director with lab mentors cc'd. At the end of every week, students sent an email containing the following sections:

1. *Project title*
2. *Summary: include a summary of this week's work related to your project.*
3. *Other activities: include a summary of work you completed unrelated to your work - i.e. helping on a different project, coursework your lab had you involved in, or coding exercises. Write 'N/A' if you weren't involved in other activities.*
4. *Plan for the following week: include a description of what your goals are for the coming week.*
5. *1 fun thing you did in Stockholm: describe a fun outing you had during the week/previous weekend.*

These emails provided an avenue for the program director to ensure the IRES students were making progress on their projects and that they were having a good time while abroad.

The program director left Sweden during weeks 4-7 of the program. During these weeks, he met with each student 1:1 on Zoom for 15 minutes to make sure everything was going well. These quick check-in meetings were helpful to make sure students were making good progress on their projects and it also was a way for students to get career advice or just talk about their latest adventure in Sweden. The program director returned to Sweden during week 8 of the IRES and met with each student individually to help prepare them for their final presentations which took place during week 9. During these meetings, the director gave students feedback on their presentation slides, presentation style and how best to present complex scientific figures. During the 9th week of the program, the students gathered together with their laboratory mentors and presented their work. Each student presented for 15 minutes and gave an overview of: the background and significance related to their project, scientific methods, results, discussion, conclusions and next steps, and a personal reflection on their time abroad. The program concluded a week after their final presentations and all students traveled together back to the U.S. Upon their return, all 6 students presented their work at the annual Biomedical Engineering Society Meeting in October of 2021.

Program evaluation

An external evaluation of all program activities took place at the end of the first year. This evaluation focused on student perceptions of program activities, personal and professional gains from the program's activities and student satisfaction with travel and housing. Quantitative data from the first year's external evaluation are presented in Figure 1. Undergraduate Research Student Self-Assessment (URSSA) survey questions were used to assess participant gains in research-related competencies as a result of their international research experience [2]. Participants self-reported gains in four areas on a scale of 1 (no gains) to 5 (great gain) (Table 1). Overall, results were favorable in all four areas. In particular, participants reported very high gains in: engaging in real-world research, interacting with scientists outside their school, comfort

in working collaboratively with others, confidence in their ability to do well in future courses, and taking greater care in conducting lab procedures. To further improve participant gains in the area of Attitudes and Behaviors, all mentors should try to give the participants more independence on aspects of the research project so that they feel a sense of responsibility, will be motivated to work harder, and can test their own ideas and/or methods.

Table 1: External program evaluation questions asked to assess student gains in numerous areas as a result of their participation in the IRES program. Evaluation questions were sourced from the Undergraduate Research Student Self-Assessment (URSSA) verified tool [2].

Thinking and Working Like a Scientist	
Q1: How much did you GAIN in the following areas as a result of your most recent research experience? 0 (no gains)-5(great gain)	
1.1	Analyzing data for patterns
1.2	Figuring out the next step in a research project
1.3	Problem-solving in general
1.4	Formulating a research question that could be answered with data
1.5	Identifying limitations of research methods and designs
1.6	Understanding the theory and concepts guiding my research project
1.7	Understanding the connections among scientific disciplines
1.8	Understanding the relevance of research to my coursework
Personal Gains	
Q2: How much did you GAIN in the following areas as a result of your most recent research experience? 0 (no gains)-5(great gain)	
2.1	Confidence in my ability to contribute to science
2.2	Comfort in discussing scientific concepts with others
2.3	Comfort in working collaboratively with others
2.4	Confidence in my ability to do well in future science courses
2.5	Ability to work independently
2.6	Developing patience with the slow pace of research
2.7	Understanding what everyday research work is like
2.8	Taking greater care in conducting procedures in the lab or field
Skills	
Q3: How much did you GAIN in the following areas as a result of your most recent research experience? 0 (no gains)-5(great gain)	
3.1	Writing scientific reports or papers
3.2	Making oral presentations
3.3	Defending an argument when asked questions
3.4	Explaining my project to people outside my field
3.5	Preparing a scientific poster
3.6	Keeping a detailed lab notebook
3.7	Conducting observations in the lab or field
3.8	Using statistics to analyze data
3.9	Calibrating instruments needed for measurement
3.10	Working with computers
3.11	Understanding journal articles
3.12	Conducting database or internet searches
3.13	Managing my time
Attitudes and Behaviors	
Q4: During your research experience HOW MUCH did you: 0 (none)-5(a great deal)	
4.1	Engage in real-world science research
4.2	Feel like a scientist
4.3	Think creatively about the project
4.4	Try out new ideas or procedures on your own
4.5	Feel responsible for the project
4.6	Work extra hours because you were excited about the research
4.7	Interact with scientists from outside your school
4.8	Feel a part of a scientific community

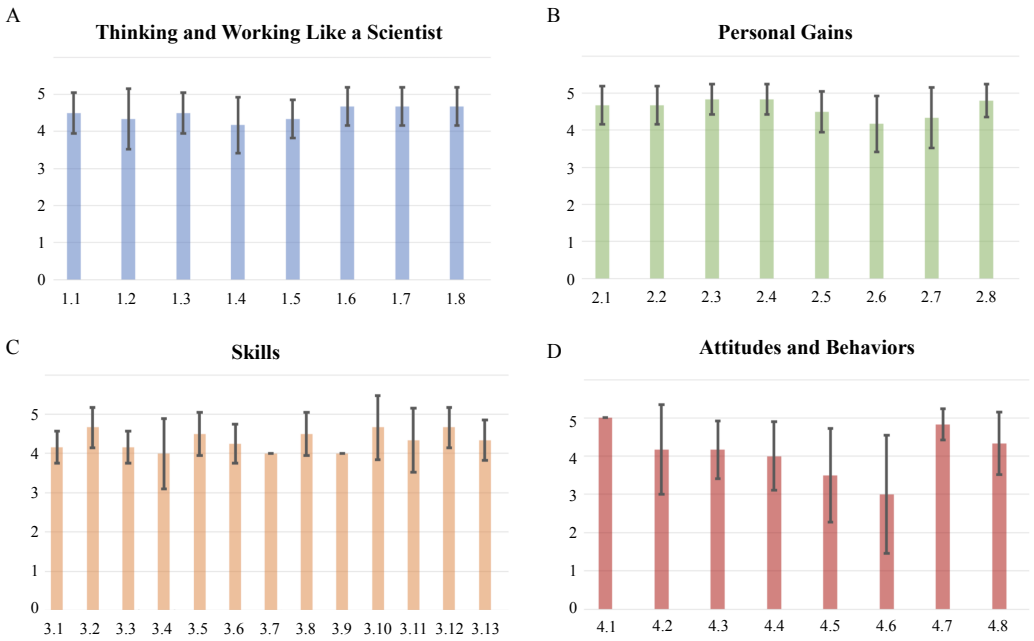

Figure 1: Undergraduate Research Student Self-Assessment (URSSA) survey results. Table 1 contains the corresponding questions. Data are presented at mean ± standard deviation

Free response answers from students in the external evaluation indicated a general satisfaction with how the program was run. Additionally, many of the IRES students indicated that they were now more inclined to pursue graduate studies following participation in the program. An area for improvement that was identified centered around how prepared students felt going into their research labs. Although an effort was made for students to have a good understanding of the necessary biological and programming knowledge to be successful, many felt that this preparation could have been more targeted toward their specific project. The program director will take this feedback into account for the 2022 program by redesigning the pre-departure symposium. Specifically, the program director will design short (1-2 days) projects individualized for each student. These projects will be designed with the mentors at the research site in Sweden to ensure the students gain skills important for their success during the summer.

Conclusions

Overall, the inaugural year of this IRES program was a success and, through the external evaluation process, the program director has identified areas for improvement to increase student preparedness for their projects. By increasing student preparedness, the program director hopes for a very successful 2022 program.

References

1. Chapman MA. Work in Progress: Development of a Training Program to Prepare Students for an Immersive Bioinformatics Summer Research Experience. ASEE Annu Conf Expo Conf Proc. 2021;
2. Weston TJ, Laursen SL. The undergraduate research student self-assessment (URSSA): Validation for use in program evaluation. CBE Life Sci Educ. 2015;14(3):1–10.