Collaborative research skills should be meaningfully incorporated into undergraduate programmes

Scientific research has changed, now being largely conducted in collaborative teams. However, undergraduate student training has not necessarily kept pace with these changes. In order to work effectively in collaborative settings, students need to develop not only the technical skills related to their discipline, but also communication and interpersonal skills needed to work in teams. ***Nora J. Casson*** *reports on research which proposes a model for explicitly teaching collaborative skills, while engaging students in meaningful scientific research. Skills such as managing data from multiple collaborators or giving and receiving feedback via file-sharing platforms should be taught as explicitly as traditional skills such as how to use a pipette or how to formulate a hypothesis.*

The way that science is done is changing. More and more, research is conducted in collaborative teams, pulling together scientists from a variety of areas of experience and geographic locations. This is particularly true in environmental sciences, where the types of complex, multifaceted issues faced by society can only be addressed by bringing together researchers with multiple perspectives. Across a wide range of fields, there is evidence that multi-authored research is more highly cited, suggesting that this shift in the culture of science is producing novel and exciting results.

Undergraduate student training has not necessarily kept pace with the changes in how science is done. There are many benefits to engaging undergraduate students in research experiences, including better academic performance and increased job opportunities, and there are many recent examples of programmes which help students to engage in meaningful science during their undergraduate careers. However, in order to work effectively in collaborative settings, students need to develop not only the technical skills related to their discipline, but also communication and interpersonal skills needed to work in teams. Skills such as managing data from multiple collaborators or giving and receiving feedback via file-sharing platforms need to be taught as explicitly as traditional skills such as how to use a pipette or how to formulate a hypothesis.

To address this problem, we propose a model for explicitly teaching collaborative skills, while engaging students in meaningful scientific research. We conducted a collaborative science project that engaged faculty advisors and upper-year undergraduates at four institutions across North America. Students collaboratively developed and implemented a common experimental protocol, and through regular video teleconferences, students and faculty advisors were able to share data, write collaboratively, and build collaborative and communication skills that go above and beyond the benefits of a typical undergraduate project.

This particular project, named “LUGNuts” (Linked UnderGraduate experiments on Nutrients) investigated the impacts of climate change on nutrient cycling in ponds and streams. Implementing this model of collaborative science across regions has a specific benefit in this type of environmental science, namely that it allows data collection from different geographic regions. A major challenge with site-based environmental research is that the results from one region may not be transferable to another region where the climate or geology could be quite different. Engaging undergraduate students on a project of this scale gave them a taste of the challenges and opportunities that come from big, distributed projects. Because of the capacity to collect and synthesise data from different regions, the impact of the project exceeded that which would typically be possible with a single student, and led to all students involved contributing to authorship of a collaborative, peer-reviewed publication.

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In addition to participating in the research project, students also took part in bi-weekly sessions designed to build collaborative skills. We built from published frameworks for research skills development in undergraduate students, and designed learning objectives for these sessions which spanned five themes: intellectual skills, practical skills, numeracy, communication skills, and career development. While a typical one-on-one supervisory model might teach an undergraduate student how to define research questions and critically evaluate scientific literature, in our collaborative model, students built on these skills and learned to collaborate and brainstorm online and to use tools for sharing literature and online writing. Similarly, where typical undergraduate programmes have students communicate their results through a written thesis or an oral presentation, in our programme students also developed the skills to give and receive feedback from multiple collaborators, and to effectively use online presentation software to deliver presentations remotely. These types of skills are novel, even to many experienced researchers, but are fundamental to participating in collaborative research projects.

Both students and participating faculty advisors reported substantial benefits to participating in the LUGNuts network. Students indicated that by being part of a larger project they were invited to consider the complexities inherent to conducting research spanning multiple regions, collaborators, and institutions. Additionally, the students found value in having had the opportunity to connect to multiple faculty mentors, each with different skills, areas of expertise, and perspectives on research. Expanding professional networks at an early stage can lead to more varied opportunities for students as they progress through their careers. Faculty advisors felt that their students benefited from more continuous support from the network, and demonstrated more progress than students not participating in the network. Spreading out the responsibilities for different aspects of the project among multiple mentors was at times logistically challenging, but allowed for flexibility during busy parts of the academic year. The advisors also observed rapid development of research skills among the students, in most cases exceeding their expectations of students at that level.

This model for training undergraduate students in collaborative science is well-suited to our particular field of environmental science, but could be readily adapted to other disciplines where team research is becoming the norm. The communication and collaborative skills developed in this type of project are highly transferable, and are highly valued by supervisors and employers. Explicitly training undergraduate students to work in highly collaborative and networked environments will benefit them as they progress in their future careers, whether in academic institutions, governmental organisations, or private industry. Furthermore, these skills are highly transferable to other situations.

This blog post is based on the author's co-written article, "A model for training undergraduate students in collaborative science", published in Facets (DOI: 10.1139/facets-2017-0112).

Note: This article gives the views of the author, and not the position of the LSE Impact Blog, nor of the London School of Economics. Please review our comments policy if you have any concerns on posting a comment below.

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About the author

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