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Letter to the Editor

Teaching Team Science Through Hackathons

Sandra G. Porter and Todd M. Smith

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Open a current issue of a top tier journal and you are likely to see one or more tour de force publications with a multitude of data types. At least one article will have a combination of wet bench data, images, bioinformatics results, and computational analyses on existing data sets. These kinds of interdisciplinary studies would be impossible for a single investigator, and rely on contributions from multiple people with diverse skill sets. Today's science depends on teams of collaborators with complementary skills, who are often located all over the globe. However, although it is clear that modern science is conducted by multidisciplinary teams, our classroom practices fail to reflect this reality and treat students as if they will be individual investigators.

Course-based undergraduate research experiences (CUREs), as exemplified by SEA PHAGES and Tiny Earth (Hurley et al, 2021; Jordan et al, 2014), are highly structured projects that create opportunities for students to carry out original research. But this is not enough, especially considering the lessons learned from the COVID-19 pandemic. In particular, we need to bring together independent artisan science and global team science to address large-scale biological, ecological, and societal problems.

We argue that the emphasis on individual ownership and laboratory work in modern day science, technology, engineering, and mathematics education ought to expand beyond the unchecked assumption that science is an individual endeavor that requires a laboratory. Students need opportunities to work in multi- and interdisciplinary teams to carry out research and contribute to a project.

Introducing students to working collaboratively and learning how to participate in ''team science'' through a Hackathon-like approach are timely in the current historical moment of the COVID-19 pandemic (Ströckl et al, 2022). Such approaches can provide a model and new ways of thinking to the real world of large-scale biology/ecology research through intensive research projects, where teams collaborate, combining benchwork, bioinformatics, and existing data. These research-focused hackathons can themselves be hacked to create a new model for science education where multi- and interdisciplinary teams use diverse methods to address a scientific problem while learning how to work together.

In our ongoing work on Antibody Engineering Hackathons, teams of faculty, students, and industry members work together on current topics related to antibody engineering (National Science Foundation, 2021). As a focus, antibody engineering supports both computational projects and laboratory activities such as screening libraries, purifying antibodies, and immunoassays. Our current projects are a mix of virtual and laboratory work that includes machine learning, nanobody purification, modeling immune escape from anti-SARS-CoV-2 antibodies, and comparing antibodies from different species.

Working in multilevel teams gives students an opportunity to develop many nontechnical skills. Whether students go on to work in research laboratories or biotechnology companies, employers request the same skills that are needed for team science–communication, knowing when to ask questions, time management, leadership, systems thinking, and documentation. Students in our first hackathon were able to practice their communication, teamwork, problem-solving, and leadership skills (Personal communication; Candiya Mann, 2022). Although our main goal is to have the projects we develop be implemented by instructors as research experiences and CUREs, we have learned that for students, participating in the hackathon and working in a team to develop a project may be an equally valuable experience.

Digital World Biology LLC, Seattle, Washington, USA.

To truly prepare students for team science and ecological crises in the 21st century, teaching and undergraduate research practices need to evolve beyond the model of individuals working by themselves.

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Address correspondence to:
Sandra G. Porter, PhD
Digital World Biology LLC
2442 NW Market St, PMB 160
Seattle, WA 98107
USA

E-mail: sandra@digitalworldbiology.com

Todd M. Smith, PhD
Digital World Biology LLC
2442 NW Market St, PMB 160
Seattle, WA 98107
USA

E-mail: todd@digitalworldbiology.com

Abbreviation Used

CURE = course-based undergraduate research experience