The 2023 DREE Workshop on Designing and Running Project-Based Courses in Software Engineering Education

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***Abstract*— In this workshop, we introduce participants to the accomplishments and lessons learned from our ongoing NSF IUSE education research project, which is focused on supporting undergraduate project-based learning in computing education by developing and piloting a set of scaffolded course projects. The workshop has two main goals. One is to facilitate exchange of experiences on project-based learning among workshop participants. The other is to encourage adoption of the developed course projects by the broader computing education community.**

Keywords—Project-based learning, computing, scaffolding

I. Workshop Goals

The goals of this workshop are to share accomplishments and lessons learned from the organizers' US NSF IUSE (Improving Undergraduate STEM Education) education research project on project-based learning (PjBL), and to solicit feedback and experience sharing from the broader education community related to PjBL. These goals would align well with those of FIE 2023, which aims to "*continue a long tradition of disseminating results in engineering and computing education. [FIE] is an ideal forum for sharing ideas, learning about developments, and interacting with colleagues in all fields*."

II. Workshop Topics

Software engineering and computing courses in general should prepare students for industrial careers. Ideally, students should work with industrial-scale projects that are being actively developed. Unfortunately, implementing this in the context of a course can be challenging, and so many courses only work with greenfield projects, shielding students from the complexity and scale they are likely to encounter in industry. The few courses that do utilize real-world software often work with older projects, and once projects have been used once, solutions begin to appear online.

In spite of these myriad challenges, software engineering and computing educators often do manage to design and run engaging, project-based courses where students develop the skills that are necessary for the industry. The purpose of this workshop is to learn from the hard-fought lessons of these project-based courses, reflecting upon successes and challenges faced in our daily struggle to prepare the next generation.

The workshop will be structured into multiple talks where the presenter team will introduce experience in creating, piloting, and assessing and evaluating project-based learning in undergraduate computing classes. The talks will be based on the team's collaborative efforts in the last two years in an NSF IUSE project on supporting PjBL, which aims to develop and test in classrooms a dozen of software engineering course projects ([1], [2]). The talks will be used to prompt feedback and experience sharing from the audience. The team will solicit experience learned during a single class iteration, strategies used to create engaging project across multiple years, and giving students the necessary support they need to be successful in a project-based course. A secondary goal is to introduce and encourage broader community adoption of the course projects that the team has developed, beyond the few initial institutions that have tried these projects.

III. Presenter Qualifications

The team of presenters are to present the US NSF education research project that the team has collaborated on since 2021. The research project aims to support project-based learning by developing, piloting, and sharing high-quality software projects with the computing education community.

Daqing Hou is Professor and Director of Software Engineering at Clarkson University. He is the PI for the US NSF education research project at Clarkson University. His research interests include software engineering, cyber security, and education.

Jan DeWaters is Associate Professor in Clarkson University's Institute of STEM Education. She is a Co-PI of the project. Her research specialization is in engineering education.

Mary Margaret Small is an independent program evaluator for the research project. She was an educational specialist in Clarkson University's Institute of STEM Education. She has strong interests and experience in program evaluation.

Yu Liu is Assistant Professor in Clarkson's Electrical and Computer Engineering Department. He is a Co-PI of the project. His research interests include software engineering education, computer architectures, and high-performance computing.

David Shepherd is Associate Professor of Computer Science in Louisiana State University. He is the PI of the project at LSU. His research interests include computer science education and software engineering.

IV. Session Agenda and Interaction Expected During the Session

As shown in Table 1, the workshop will be structured into five 30-minute talks to introduce the presenter team's experience in creating, piloting, and assessing and evaluating project-based learning in undergraduate computing classes in the last two years.

TABLE I. Workshop Agenda

Title	***Facilitator***	***Time***
Welcome and workshop overview	Daqing Hou	30 minutes
Introduction to free course projects	Daqing Hou	30 minutes
Coffee Break		15 minutes
Large-scale scaffolding in real classes	David Shepherd	30 minutes
Experience of piloting course projects	Yu Liu	30 minutes
Coffee Break		15 minutes
Assessment and evaluation	Jan DeWaters & Mary Margaret Small	30 minutes

The talks will be used to prompt feedback and experience sharing from the audience. The team will solicit, from the audience, experience learned during a single class iteration, strategies used to create engaging project across multiple years, and giving students the necessary support, they need to be successful in a project-based course. A secondary goal is to encourage broad community adoption of the course projects that the team has developed.

V. Anticipated Audience

The workshop organizers anticipate a diverse audience, but most of them should be existing or prospective course instructors who have used, or are interested in using in future, project-based learning in classroom teaching. The maximum number of participants should be capped at 25 to allow for proper interaction among the workshop attendees.

VI. Takeaway Skill, Knowledge or Material that Attendees will Acquire

The workshop aims to produce the following takeaways for the attendees:

1. The attendees will develop an awareness of the structure and process of project-based learning and the kinds of issue/problem that they should plan to deal with when running project-based learning in their own classes.
2. The attendees will learn a set of best practices for running project-based learning that they could use in their own classes.
3. The attendees will be introduced to a set of developed sample course projects that they could adopt in their own classes.

VII. Special Requirements

Standard audio/video setup for conference presentation is requested.

Acknowledgment

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References

[1] NSF Award # 2111318 - Collaborative Research: Supporting Project-Based Learning in Undergraduate Software Engineering Courses. https://www.nsf.gov/awardsearch/showAward?AWD_ID=2111318 (accessed Aug. 25, 2023).

[2] NSF Award # 2111294 - Collaborative Research: Supporting Project-Based Learning in Undergraduate Software Engineering Courses. https://www.nsf.gov/awardsearch/showAward?AWD_ID=2111294 (accessed Aug. 25, 2023).