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Epistemology and Communities of Practice in Traditional and Online, Hands-On Undergraduate Physics Laboratories[1]

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In response to national calls for improving undergraduate physics education through fostering a communal learning environment and employing diverse teaching methods, this study explored affective outcomes in two types of calculus-based introductory undergraduate physics laboratory courses at Stony Brook University – (1) in-person and (2) online, hands-on. The two-phase, quasi-experimental observational study examined students' beliefs regarding physics epistemology, socialization with peers, and engagement with instructors in undergraduate physics laboratory coursework. In the first phase in 2019-20, students (N =998) were surveyed in the second half of the semester to elicit their epistemological beliefs about physics laboratory work and their views on social engagement and academic help-seeking in the laboratory. Results indicated that students in both types of laboratories had statistically similar views on physics epistemology and seeking assistance from instructors, however, in-person students expressed significantly higher perceptions of the value of socialization in the laboratory when compared to online, hands-on students, with a medium to large effect size. In the second phase, a social networking intervention was implemented (N =716) to improve students' engagement in communities of practice in online learning environments. Online students were introduced to a Slack channel for the purpose of fostering communication during the Fall 2020 semester. Results indicated online students experienced weaker levels of engagement with instructors that in-person students with a large effect size, even after the voluntary intervention was introduced. In-person students experienced stronger levels of engagement with peers than online students, and online students who participated in the social network experienced more social engagement than online students who did not participate; this was also a large effect size. Results suggest that online laboratories, which have proliferated extensively during the recent pandemic, may need formalized mechanisms and incentives to promote social interactions and foster communities of practice among peers. This is also the case for student-instructor interactions and communities of practice, which are often diminished in the online platform.

[1]SUNY Excels Project and Stony Brook University S-BOLD Initiative