

Supporting Undergraduate Students' Developing Water Literacy During a Global Pandemic: A Longitudinal Study

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Abstract

To prepare students to address water-related challenges, undergraduate STEM education must provide them with opportunities to learn and reason about water issues. [COURSE NAME] is an introductory-level, innovative, and interdisciplinary undergraduate course offered annually at a large midwestern university. The course focuses on both disciplinary concepts and civic engagement, and is designed around a variety of interactive, research-based practices to support students' learning, engagement with authentic data, scientific models and modeling, and collaboration and learning among peers. This study aims to evaluate, "*how have student outcomes and perceptions changed over five years of the course?*". The results are based on data from students ($n = 326$) in five consecutive years of the course, during which time the course transitioned from a face-to-face model to fully asynchronous online model due, in part, to impacts of the COVID-19 pandemic. The particularly rapid and abrupt transition between 2020 and 2021 in response to COVID-19 led to many course changes, including modes of communication between instructors and students and opportunities for collaboration. Here,

multiple measures are used to evaluate students' learning about water concepts, model-based reasoning about socio-hydrologic systems, and perceptions of the course across all five years. By the end of each iteration of the course, students improved their knowledge of hydrologic concepts, independent of the course format or other student-level variables. However, results also show that students' performance on complex socio-hydrologic systems modeling tasks, as well as their overall satisfaction with the course, decreased in Year 5 when the course was fully online. Results provide insight into efforts to move undergraduate STEM courses online and specific evidence of the COVID-19 pandemic's impacts on undergraduate STEM teaching and learning about water.

Keywords: Water literacy, water-based models, course effectiveness, COVID-19