# Fostering Empowerment in STEM Education: Student-Led Curriculum Development

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This presentation features an interdisciplinary exchange program between a Norwegian university and a United States university that repositions students as curriculum developers. Students are commonly viewed as passive learners in STEM classes, an orientation which fails to incorporate outside knowledge or recognize the life experiences and expertise of students. By engaging in this exchange program, five postsecondary students collaborated to lead a lesson study specializing in an interdisciplinary (geology and mathematics) place-based lesson set along the Savannah River Watershed in the Southeastern United States. This short communication presents an initial summary of how students engaged in the co-creation of the curriculum and insights into the lesson study implementation.

## Introduction

In higher education, Science, Technology, Engineering, and Mathematics (STEM) courses follow a prescriptive curriculum implemented by instructors who commonly view themselves as a “sage on the stage” and students as passive learners. By positioning students as experts, curriculum co-creation has the potential to produce a transformative experience for students and instructors as well as empower students to develop a curriculum that directly benefits localized communities (Lubicz-Nawrocka & Bovill, 2023; Lubicz-Nawrocka, 2019). This course is situated within the realm of co-creation and lesson study, a Japanese professional development method concentrated on a group of instructors building, implementing, and evaluating a lesson over a long period (Stigler & Hiebert, 1999). The integration of co-creation and lesson study provided a unique opportunity for postsecondary STEM students to engage in curriculum development.

This co-creation lesson study is established within an exchange program between institutions in Norway and the United States. The program intends to engage students with an interest in STEM fields in building and assessing the implementation of a lesson with an emphasis on geology and mathematics in a localized context, centering place-based education (Bascopé & Reiss, 2021). The course was composed of five students, three of whom are current exchange students and two of whom are future exchange students, taught by a graduate student teacher of record and two faculty co-instructors.

## Discussion

After immersing themselves in the literature on integrated STEM frameworks in the K-12 realm, the class developed a working definition of integrated STEM: *combining two or more STEM subjects in an applied setting (e.g. real-world problem, hands-on experiences).* The class was divided into two groups and was tasked with creating a lesson integrating two randomly selected STEM fields from a stack of different discipline-marked index cards. One group combined geology and precalculus into an activity that utilizes soil identification techniques to identify soil types, build slopes in a competitive format (who can build the steepest slope?), and trigonometry to calculate the angle of repose despite having no prior knowledge of the phrase “angle of repose.”

The second group randomly selected physics and technology, two commonly combined STEM disciplines. The second group elaborated on a glider lab they had participated in during a previous physics course to introduce Newton’s Second Law. The group incorporated software to demonstrate the relationship between position, velocity, and acceleration to solidify students’ knowledge of derivatives and connections to calculus. The expansion included a synergistic seminar series to engage students in conversation about how engineers use the principles of physics in a non-isolated setting. The group developed student deliverable expectations such as a lab report, seminar series attendance, and a mathematics worksheet to solidify concepts.

The course shifted from addressing integrated STEM to defining place-based education and brainstorming possible location-based problems across the institutions in Norway and the United States. The process started broadly by defining global problems, then became more granular as the class narrowed down localized versions of these problems. Eventually, the class landed on the Savannah River Watershed, a localized source of pollution and flooding that runs through the Southeastern United States. Students categorized various stakeholders that could be affected by pollution and flooding citing communities along the banks, government agencies, and industries. Identifying possible stakeholders led students to think of questions they wanted to address with the lesson (e.g. “What are the factors contributing to water contamination?”) Students later identified algal blooms as a source of pollution they were interested in investigating and proceeded to grow algae from local water sources.

## References

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