Introducing a structured design assignment to an intro water resources engineering course: effects on cognitive skills, self-efficacy, and perception of value

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BACKGROUND

Course Description: CEE 311 Hydroscience is an introductory water resources engineering course at UW-Madison required for civil engineers. There are 60-70 students each semester, mostly junior civil engineers.

Fall 2016 Student Demographics

Issue: Many civil engineering students at UW-Madison specialize in an area other than water resources engineering and do not necessarily see CEE 311: Hydroscience as something that will be valuable to their future career. The urban hydrology topic in particular is perceived by many as challenging, not valuable, and in need of improvement.

Spring 2016 Student Attitudes (end-of-semester)

In which topic did you make the LEAST gains in understanding? Select three of 12.

1 in 4 students select Urban Hydrology

Which topics were the LEAST valuable to your future academic and professional career? Select three of 12.

1 in 5 students select Urban Hydrology

Which topic should we improve next year? Select one of 12.

Urban Hydrology is the 2nd most common choice

How confident are you that you understand water resources engineering?

Self-efficacy related to designing stormwater management practices increased in Fall 2016 (with intervention) vs. Spring 2016 (without intervention), but there were mixed changes in confidence in other areas.

RESULTS

How would you rank the gains in understanding you made in Urban Hydrology relative to all 12 topics?

How would you rank the value of the Urban Hydrology topic to your future professional career relative to all 12 topics?

How confident are you that this class will be valuable to your future professional career?

Student self-efficacy related to designing stormwater management practices increased in Fall 2016 (with intervention) vs. Spring 2016 (without intervention), but there were mixed changes in confidence in other areas.

How much confidence do you have in your ability to do each of the following? (see detailed learning outcomes above in 'Approach')

The Urban Hydrology topic led to more gains in understanding and was perceived as more valuable to students in Fall 2016 (with intervention) vs. Spring 2016 (without intervention)

Students overwhelmingly gained confidence that they understand water resources engineering, but their perception of value declined over the course of the Fall 2016 semester

RECOMMENDATIONS

Based on the results from this teaching-as-research project, I recommend that future courses:

1. Retain the structured design homework, since it seems to contribute substantially to student understanding and is perceived as valuable by students.
2. Make more explicit connections to other civil engineering specialties in assignments (including the design assignment) to engage those that will specialize in other areas
3. Provide additional resources for excel assignments (e.g., cheat sheets, video tutorials) so that technical obstacles do not prevent students from understanding the main objective of assignments.
4. Reduce the weight given to exams in the overall course grade, so that students are rewarded more for effort on time-consuming, "real-world" assignments.

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