Water in Society: Undergraduate Learning & Reasoning about Socio-hydrological Issues

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WATER IN SOCIETY

• Introductory-level water course serving both STEM majors and non-majors focused on increasing student water literacy
• Course objectives: (1) Engage in Socio-hydrological reasoning to make informed decisions about water issues and (2) explain fundamental hydrologic concepts and engage in scientific practices
• Water literacy in the United States remains underdeveloped with many studies focusing on STEM-informed decision-making at the K-12 level (Christensen & Rundgren, 2015; Eggert & Bögeholz, 2009; Grace; 2009; Grace & Ratcliffe, 2002; Gresch & Bögeholz, 2013; Gresch et al., 2013; Limea’nez-Alexandre, 2002; Seethaler & Linn, 2004; Seigel, 2006); however, fewer studies have been conducted with undergraduate students (Halverson et al., 2009; Sadler & Zeidler, 2005)

RESEARCH QUESTIONS & METHODS

RQ1: At what level is students’ knowledge of fundamental hydrology at the beginning and end of the semester? Does students’ learning of hydrology concepts improve during the second iteration of the course?
• Pre-test, post-test, and change scores (Fig. 3 and 4)

RQ2: How did students perform on modeling tasks? What relationships are observed between students’ model based reasoning about socio-hydrological issues and other student assessments? Do students improve on these tasks in the second iteration of the course?
• Pre-test, post-test, change scores, Hydrogeology Challenge (Fig. 1), and Water Balance Model (Fig. 2)

RQ3: How did students perform on QuASSR? What relationships are observed between students’ SSR and other student assessments? What relationships are observed between students’ SSR and the QuASSR subscores?
• Pre-test, post-test, change scores, and QuASSR survey (Fig. 5 and 6)

FINDINGS

RQ1: Students scored lower on the pre-test (M = .737, SD = .090) than on the identical post-test (M = .934, SD = .069).
• Paired t-test results indicate students scores on the pre-and post-test were statistically significant (t(54) = -14.812, p < .001, d = 2.27) (Fig 3).

RQ2: Hydrogeology Challenge (HGC) (Fig 1, 4)
• There was a significant difference in performance on the HGC when compared to the post-test and change scores
• Results demonstrate no significant effect between the student tasks and the modeling task

Water Balance Model (WBM) (Fig 2, 4)
• There was a significant difference in performance on the WBM when compared to the pre-test, post-test, and change scores.
• Results demonstrate a significant effect between pre-test and post-test scores and the modelling task.

RQ3: QuASSR
• There was a statistically significant difference between students performance on the pre/post and change scores when compared to their performance on the QuASSR.
• Results demonstrate there is no significant effect between the pre/post and change scores compared to the QuASSR (Figure 4)

Subscores
• Results of an ANOVA show there is a significant difference between the QuASSR subscores (F(6,693) = 33.85, 6.59E-36) (Fig 6)
• Students scored highest on Perspective-Taking5 (Fig 5)
  • (M = 3.45, SE = 0.10)
• Students scored lowest on Skepticism (Fig 6)
  • (M = 1.21, SE = 0.12)

IMPLICATIONS

• Students increased their hydrological knowledge over the course of the semester.
• Students need more support learning to use computer-based water models and in interpreting the results of the models. This could be achieved through more direct instruction of the models and iterative practice using the models prior to completing the summative assessment.
• Finding suggest there are differences in student understanding and retention between the two computer-based water models. More work needs to be done to unravel the reasons for these differences.
• In order to increase students socio-scientific reasoning, the nature of science should be the focus of science classrooms

REFERENCES

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