

“This is not a Weed Course”: Reducing Attrition in Hydrology I

Steven H. Emerman, Department of Earth Science, Utah Valley University, Orem, Utah

E-mail: StevenE@uvu.edu, Tel: (801) 863-6864

Problem

Hydrology I is taught every semester at Utah Valley University and is a required course for majors in both Environmental Management and Geology. This is not a “weed course,” but a gateway course to more advanced hydrology courses. Prior to Fall 2010, the mean success rate (defined as passing) in the course was $(31 \pm 2)\%$ (see Fig. 1) with mean enrollment of 21 ± 7 (see Fig. 2). I believed that the success rate should be about 70% and hoped that an increase in the success rate would result in higher enrollment in Hydrology I and in the Environmental Management and Geology majors.

Root Cause

I believed that students withdrew from Hydrology I because they found solving problems on their own to be a frustrating and frightening experience.

Countermeasure

Beginning in Fall 2010, I replaced the usual practice of in-class lectures and out-of-class problem sets with out-of-class assigned reading and in-class group problem-solving with coaching from me. Some of these in-class group problem-solving sessions were hydrologic calculations for which there was essentially only one correct answer, while others were open-ended scenarios for which multiple approaches were possible and expected.

Results

For the period Fall 2010 to Spring 2012, the success rate was $(65 \pm 25)\%$. The increase in the success rate was statistically significant at the 92% confidence level ($P = 0.08$) according to the Student’s t-test (see Fig. 1). Comparing the period before Fall 2010 to the period Fall 2010 and later, the mean success rate weighted by enrollment rose from 32% to 76%. Following the Fall 2010 course, it was known among Environmental Management and Geology majors that Hydrology I had been re-organized and that the success rate was now about 70%. However, the change in the course enrollment following Fall 2010 was not statistically significant ($P = 0.35$) according to the Student’s t-test (see Fig. 2). Apparently, the increase in the success rate in Hydrology I has not resulted in a perception among UVU students that either Environmental Management or Geology is a more desirable major.

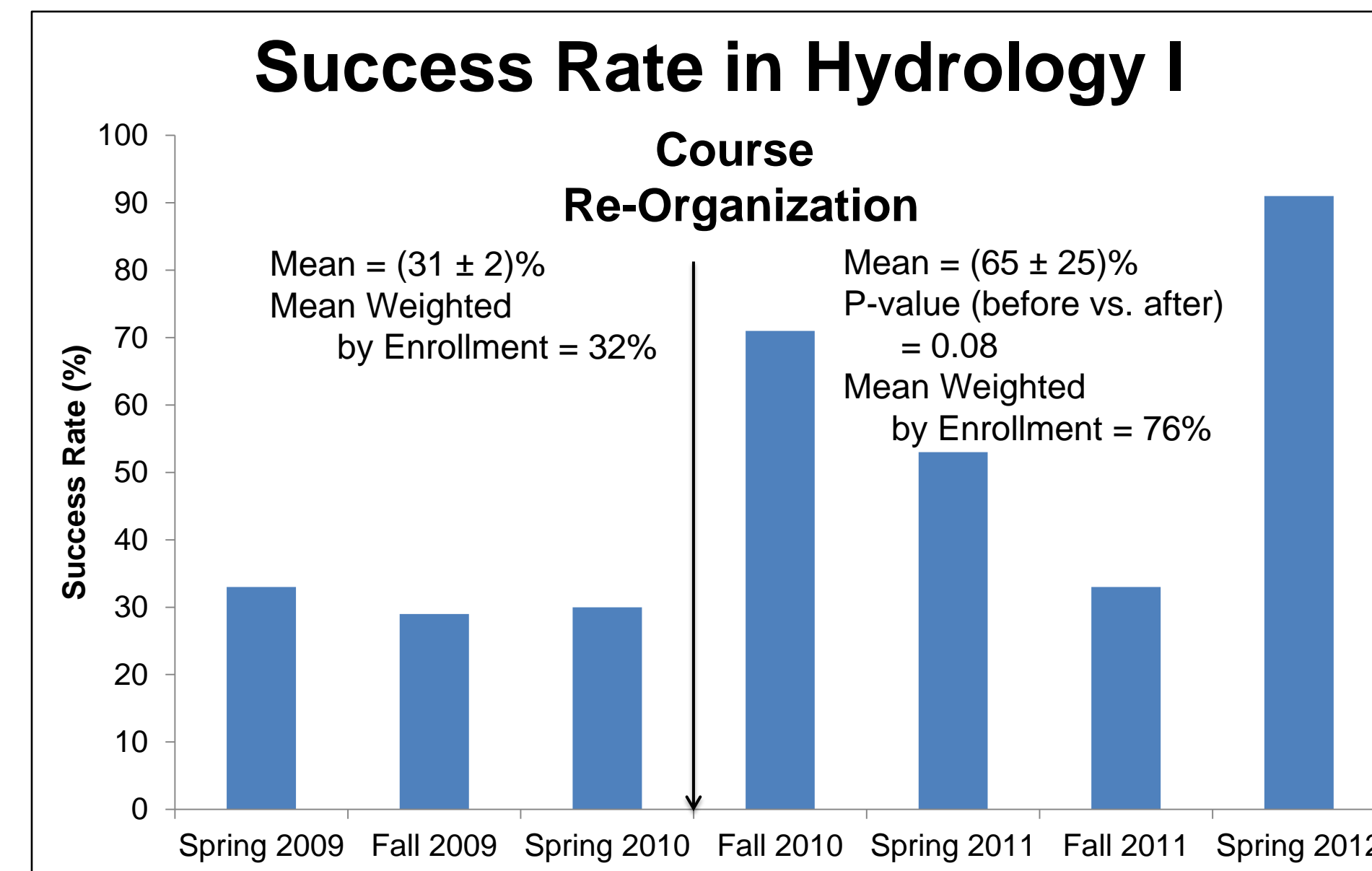


Fig.1. After Hydrology I was re-organized beginning in Fall 2010, the mean success rate (defined as passing) increased from $(31 \pm 2)\%$ to $(65 \pm 25)\%$. The increase was statistically significant at the 92% confidence level ($P = 0.08$) according to the Student’s t-test. The mean weighted by enrollment rose from 32% to 76%.

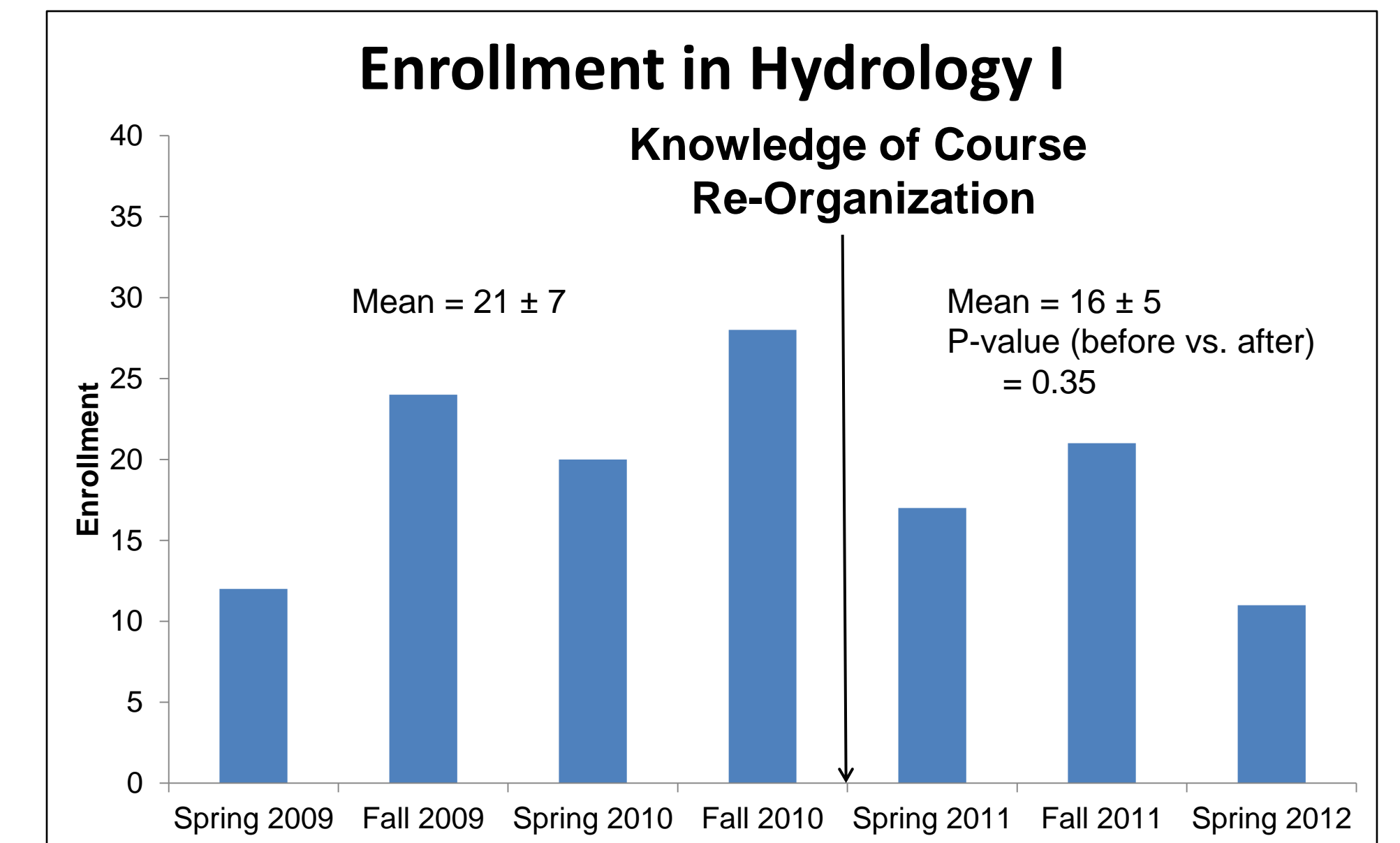


Fig. 2. Following the Fall 2010 course, it was known among Environmental Management and Geology majors that Hydrology I had been re-organized and that the success rate was now about 70%. However, the change in course enrollment following Fall 2010 was not statistically significant ($P = 0.35$) according to the Student’s t-test.

Benefits of In-Class Problem-Solving

- Students receive instant feedback on mistakes and misconceptions so that they do not practice mistakes at home.
- Students learn better by explaining concepts to each other.
- Students realize that everyone is having the same difficulties and that there is a predictable sequence of mistakes that everyone makes.
- I have real-time knowledge as to where students are having difficulties. For example, I realized in Fall 2010 that most hydrology students did not know how to use calculators (order of operators, exponents, use of the memory, etc.) and that many hydrology difficulties were actually calculator difficulties.
- Students can solve more challenging problems when I am providing coaching (just like a physical trainer).

Tentative Conclusions

- Students will focus on the interesting aspects of the course (see End-of-Course Survey) if they do not become overwhelmed by the frustration of problem-solving on their own.
- The perception that calculation-intensive science courses are too difficult is deep-seated and resistant to change.

End-of-Course Survey(beginning in Fall 2010)

Did you ever consider dropping this course? If so, why did you consider dropping the course and why did you decide not to drop the course?

45 respondents No: 42 (93%) Yes: 3 (7%)

Most common explanation (25%):

The course was too interesting to drop.

Sample Explanations

“No, I find the subject very interesting. The class was involving and it used applications in real world settings. I learned a lot about hydrology and ways to benefit the less fortunate.”

“No, the course was very interesting and sparked my interest in hydrology.”

“No, I found the topic of hydrology challenging but beneficial to my degree. I’m glad I took and completed the class.”

“I did not consider dropping this class, even though I thought it was a difficult one. I do not believe in quitting and I enjoy a challenge.”

“No, from the first week of this course I found the material covered to be very interesting so I had no intentions of dropping the course.”

“No, never considered, it was too interesting.”