

Immersing students in authentic experiences and scientific practices to increase achievement, motivation, and attitudes towards science

Research Question

How will implementing active-learning strategies that focus on engaging students in science practices, such as inquiry and authentic learning, increase student achievement, motivation, and attitudes towards science?

Student population

The intervention was administered to 11 students at Great Falls College Montana State University that were enrolled in an introductory biology course. Because most, if not all, students are non-science majors, misconceptions about the nature of science are common, as are low levels of achievement and motivation.

Intervention

The intervention was implemented over 15 weeks and involved active-learning and exposure to scientific practices.

Lecture

- 4 videos highlighting work of scientists
- Group activity on identifying scientific statements
- Class debate

Lab

- 10 labs that required data collection and analysis
- Including 1 open-inquiry lab
- 2 fieldtrips

Data collection

Students were given the following both before and after the intervention:

- Biology Motivation Questionnaire II¹
- Nature of Science Survey (created specifically for this study)
- 20-question content assessment

Following the intervention, 5 students were randomly selected for a 10-question interview.

References

1. Glynn, S. M., Brickman, P., Armstrong, N., & Taasoobshirazi, G. (2011). Science Motivation Questionnaire II: Validation with Science Majors and Nonscience Majors. *Journal of Research in Science Teaching*, 48, 1159-1176.

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Students participated in an open-inquiry lab that allowed them to test water samples for *E. coli* (above, in bright green)



Results

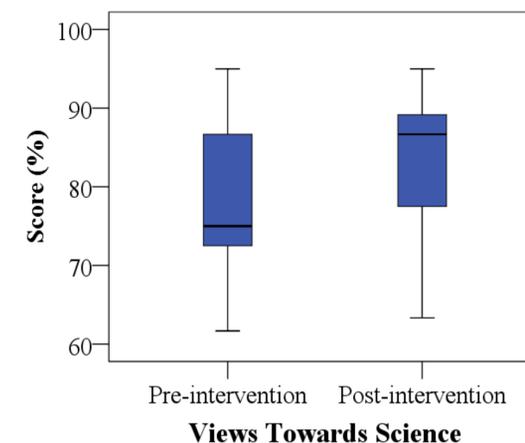


Figure 1. Results from the nature of science survey ($N = 11$; ANOVA, $p = 0.269$).

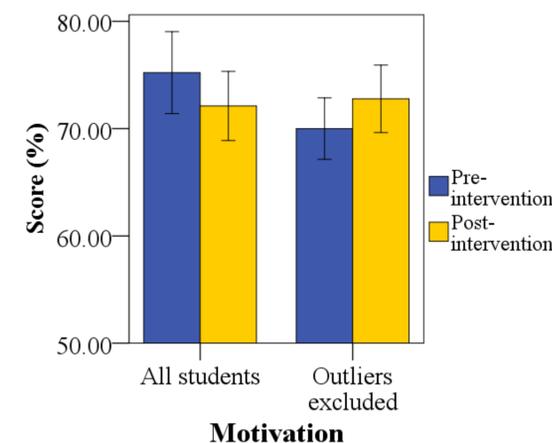


Figure 3. Results from the motivation survey¹. Two students showed very large decreases in survey scores, despite saying in interviews that their motivation did not change. The analysis on the right removed these two outliers. No significant differences were found in either case; “All students”: ANOVA; $p = 0.721$, $N = 11$; “Outliers excluded”: ANOVA, $p = 0.523$, $N = 9$.

Conclusion

While the surveys showed no significant increase in motivation and views towards science, students indicated in interviews that class activities such as the field trips and inquiry labs had a positive impact. Meanwhile, students made a large, statistically significant increase on the content assessment. The authentic nature of the intervention may have contributed to this. In the future, motivation might be increased by making lecture more relevant, while views towards science can be improved through reflection on the values and habits of mind exhibited by scientists.

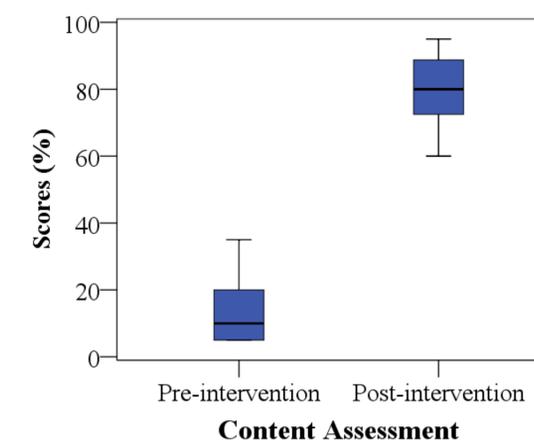


Figure 2. Results for the content assessments ($N=11$; Mann-Whitney U test; $p < 0.001$).

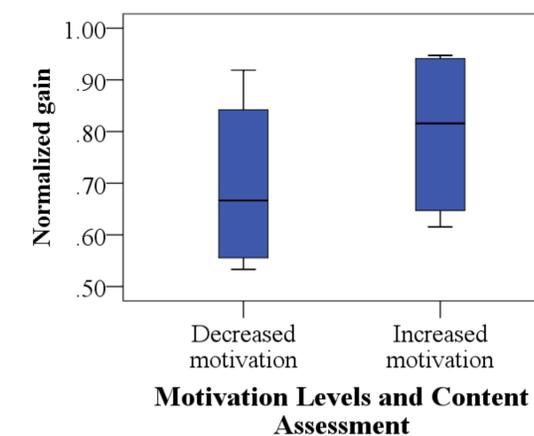


Figure 4. Comparison of normalized gain on the content assessment between students that reported a decrease ($N = 5$) in motivation¹ versus those that reported an increase ($N = 6$). No statistically significant difference was discovered between the two groups ($p = 0.347$).