Interdisciplinary Lesson Study: Building Graph Interpretation, Web Evaluation Skills and Enthusiasm

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ABSTRACT

We used the high quality process of lesson study to develop, evaluate, and revise an interdisciplinary non-majors biology lesson that teaches graph interpretation, critical analysis of internet information, and neurotransmitter action using a case study to compare different plant-derived compounds for treating depression. The lesson made coursework relevant to students, and stimulated student interest in biology. Lesson study observations revealed student group dynamics and provided us with ideas for quality improvement.
Keywords: STEM, student retention, teaching quality

INTRODUCTION & BACKGROUND

Enthusiasm for science, graph interpretation, and critical analysis of internet information can be challenging to teach non-science majors students. We used the lesson study process to develop, evaluate, and revise an interdisciplinary lesson for use in non-majors plant science and human biology courses with the overarching goal of further promoting student interest in science, technology, engineering, math (STEM)-related disciplines. The lesson was a case study comparison of different plant-derived compounds for treating depression. Lesson study is a comprehensive practice for examining and improving the teaching process. It has been long established in Japan and is becoming increasingly popular in the United States (Perry & Lewis, 2009). The lesson study process involves collaboratively developing a lesson with specific student goals. The lesson is then implemented with observers collecting data regarding the students' activities, which are later evaluated and analyzed for future revision.

METHODOLOGY

Our goals for the lesson were for students to better 1) connect to science, 2) interpret graphs, 3) understand neurotransmitter function, and 4) critically evaluate internet data. Groups of four explored the effects of St. John's wort (*Hypericum*), ayahuasca (*Banisteriopsis*), and marijuana (*Cannabis*) on depression. Students evaluated the validity of associated websites. They then explored how each plant compound affected neurotransmitters by interpreting scientific graphs synthesizing their findings. We collected pre- and post-survey and content knowledge data, answers to activity questions, student personal reflections, and themes from observation questionnaires. The data was analyzed using quantitative and qualitative methods.

FINDINGS

Following the lesson, students were better able to relate course material to the "real world," and recognize skills relevant to their futures. They were also significantly more likely to want to take another biology course (Figure 1). Students were more successful in completing internet research than graph interpretation activities. They also felt that they learned more about scientific information on the internet and about disease complexity than about "how science works" or the nervous system. The primary take-home messages for students were: 1) specific drug effects on

the body, 2) using the internet as a source of information, and 3) thorough drug investigations are important. Lesson study observations gathered by colleagues were most helpful in revealing student group dynamics (Table 1).

Table 1: Results of lesson study observations, n = 22 observers.

Observer comment	Percent comments
Students engaged in group work	50%
Students engaged in group discussion	51%
Students engaged in meaningful discussion	32%
Students experiencing difficulty with graph interpretation	50%

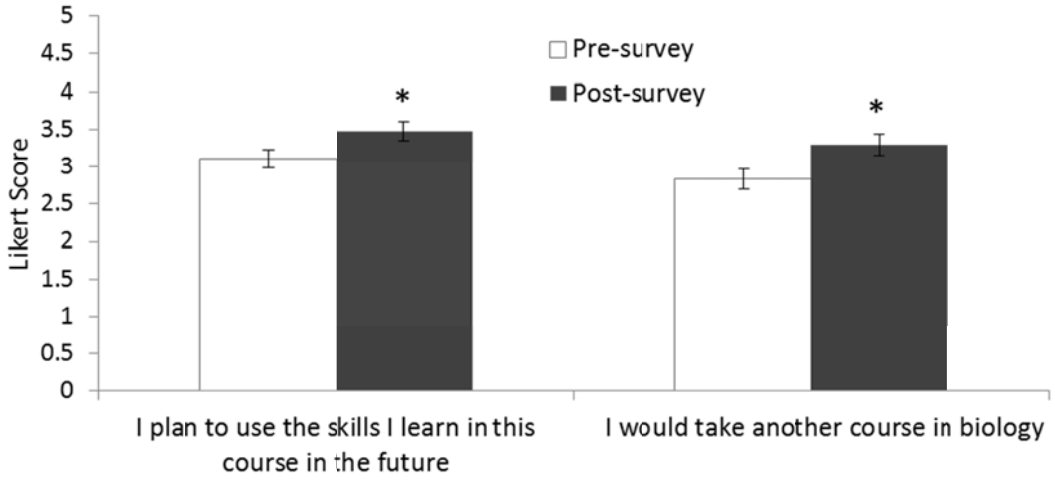

Figure 1: Student responses to attitudinal survey questions administered pre- and post-lesson. Question statements are provided. The Likert score ranges from 1 = strongly disagree to 5 = strongly agree. * $P < 0.05$, two-tailed t-test comparing pre- and post- means, n(pre) = 75, n(post) = 64 students. Error bars = one standard error.

SUMMARY

The lesson made the coursework relevant to the students, exposed them to the broad spectrum of scientific information on the internet, and challenged them with graph interpretation. The lesson study process transformed our teaching methods in terms of fostering superior group dynamics in order to maximize student performance. Most importantly, the lesson significantly increased student interest in further biology education. It is anticipated that promotion of these types of teaching practices will help to not only retain students within STEM fields but also serve as recruitment tools for non-science students.

SUGGESTIONS FOR BEST PRACTICES & CONCLUSIONS

Results from this lesson study show that the lesson significantly increased student interest in STEM. The process may also be used as a screening tool to identify dysfunctional student groups early in the semester, potentially increasing retention of students within STEM fields. Lesson study is a valuable teaching tool that can help to recruit and retain students within STEM.

FUTURE WORK

We plan to revise the lesson study by removing the web activity and include more graph related activities to allow further development of students' critical and analytical skills.

REFERENCES

Perry, R. and Lewis, C. (2009). What is successful adaptation of lesson study in the U.S.? *Journal of Educational Change*, 10(4): 365-391.

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