Student-Centered Learning Framework for Science Narratives[i]

Eunbae Lee
The Catholic University of Korea
elee@catholic.ac.kr

Abstract: This study examines the effectiveness of a student-centered learning design framework to facilitate learning the process of science in postsecondary sciences. 24 undergraduate and graduate students in a biology class wrote a narrative communicating a process of science to lay audiences. Students' engagement and performances with this student-centered learning activity was examined by in-depth interviews, field observation and quantitative self-determination inventories. This study reports that how various scaffolding components, including autonomy support and authentic audiences, play a role in student engagement and performance. This study informs science educators ways to scaffold student engagement in student-centered learning environments, specifically by writing stories about science.

Keywords: Instructional design, Student-centered learning, Process of science, Narrative writing

INTRODUCTION

Student-centered learning approaches have become increasingly popular in science education (Walczyk & Ramsey, 2003), especially through writing assignments (Tessier, 2006). The research narrative is largely open-ended and promoted students' autonomy in identifying the topic of their interest and allowing creative freedom to craft a story.

In the previously conducted needs assessment, students lacked meaningful engagement with the narrative assignment, reported difficulty conducting independent inquiry and blending science into narratives, and requested structured guidance throughout the process, without which some found it difficult to engage in this autonomous, non-traditional assignment (Lee & Maerz, 2015). This study adopted a three-stage design framework--Own it, Learn it, and Share it (OLSi) (Lee & Hannafin, 2016). The scaffolding activities of the three stages were evaluated for its influence in student engagement and performance.

THEORETICAL FRAMEWORK

This study was framed within student-centered learning environments (SCLEs), in which students assumed increased autonomy and responsibility for their learning (Land, Hannafin, & Oliver, 2012). While external learning goals may be imposed in SCLEs, students determine the process by which they pursue the goals. Students constantly make decisions about what, how, when, and whether to proceed based on their emergent understanding; determine which tools and resources are useful and apply them to solve a problem; keep track of findings; monitor progress; and reflect on what is being learned (Hannafin, Hill, Land, & Lee, 2014).

Self-Determination Theory suggests that individuals' experiences of autonomy foster the most volitional and highest quality forms of motivation and engagement with activities and result in enhanced performance, persistence, and creativity (Deci & Ryan, 2000). Research shows that learning environments that are autonomy supportive fulfill students' innate need for autonomy (Reeve & Jang, 2006). In other words, when students make autonomous decisions regarding what to do and how to do it with support from their teachers, they assume greater responsibility to direct their learning, become more committed, and deepen their understanding.

DESIGN FRAMEWORK

This study adopted a three-stage design framework--Own it, Learn it, and Share it (OLSi) (Lee & Hannafin, 2016). In the Own it stage, students were provided with the opportunity to internalize the value of the assignment and personalize the specifics of the assignment to address individual needs and interests. In the Learn it stage, several scaffolds were offered for students to identify and evaluate information with respect to the research topic of their narrative and conduct an effective interview with their choice of researcher. In the Share it stage, students wrote their narratives to publish for their target audience.

Purpose of study

This study examined the effectiveness of Own it, Learn it, and Share it framework for student-centered science narrative writing engagement and performance.

Research Question: To what extent does the OLSi model influence student's engagement and performance in a postsecondary, student-centered, science course?

METHOD

This template is Wherever Times is specified, Times Roman or New Times Roman may be used.

Participants and Context

This study took place in an organismal biology course for both majors and non-majors at a research-intensive university in the United States. The class consisted of two weekly 90-minute lectures and a weekly three-hour lab. Twenty-four undergraduate and graduate students participated.

Research Design and Data Sources

A mixed-method study was employed to investigate the research question. Intrinsic motivation questionnaires including Intrinsic Motivation Inventory (choice, relatedness, competence, interest, value, and effort), Learning Climate Questionnaire (autonomy support), and Self-Regulated Learning for Learning were used to measure the influence of a variety of motivation factors on engagement and performance. The qualitative study consisting of an in-depth interviews and participant observation field notes added depth and anecdotal evidence to findings from quantitative measures (Creswell, 2013). This study was approved by the University's Institutional Review Board.

Analysis

Quantitative data were entered into SPSS for regression. Due to the small number of participants, principal component analysis was conducted to reduce six motivation factors to three factors including effort, interest, and competence. The engagement component was regressed on each student's changed score from the first draft to the final draft. Qualitative data from the interviews were transcribed and combined with observation field notes and document analysis data for coding. Thematic analysis through constant comparison and axial coding was used to analyze qualitative data from the constructivist perspective by which we interpret diverse notions of what occurred (Corbin & Strauss, 2008). The data were coded into conceptual clustered matrices to categorize key themes using inductive analysis.

RESULTS

Findings include students' effort, perceived competence and value, as well as having authentic audiences have a significant influence in engagement and performance. Scaffolding was essential in guiding independent inquiry of processes of science and writing stories for the general public. Implications for supporting autonomous motivation and scaffolding in constructionist learning environments are discussed. By supporting student autonomy, scaffolding student engagement, and transitioning from traditional academic requirements to real-world audiences, student performance and engagement should improve.

Students' failure to recognize the value of an activity influences their participation and investment in the assignment. While the instructor communicated a rationale for this activity to students and noted relevance regardless of individual majors and career goals, students reported lack of perceived value and relevance of the research narrative for science learning. However, students, who perceived value, enjoyed the assignment, and put efforts, exhibited higher engagement than those who did not. Although it was limited to generalize, autonomy support was not an influential factor in engagement and performance in this study. Students who chose to publish their stories in the public venue showed higher engagement and performance. Students who participated in the procedural and strategic scaffolding (Research 101 and story writing guidelines) demonstrated increased engagement and performance.

DISCUSSION

By supporting student autonomy, scaffolding student engagement, and transitioning from traditional academic requirements to real-world audiences, student performance and engagement should improve. Engaging students in writing a research narrative holds the potential for teaching the process of science while students have meaningful conversations with a scientist about his or her lived experience of conducting scientific research, conduct a student-centered inquiry into the scientist's research project, and communicate their science knowledge to a lay audience. This study conveys that it is worthwhile to closely examine students' varying levels of engagement in such active learning approaches by incorporating autonomy supports and scaffolding strategies prescribed in the self-determination theory and student-centered learning environments. The findings from this study inform science educators and instructional designers in the education community the systemic design and implementation of narratives as a way to teach the processes of science and promote student-centered learning in science education.

LIMITATION

This study was conducted in a single class when the assignment was offered for the first time. While we incorporated the triangulation measures

(e.g, diversified methods) to assure validity and reliability (Creswell, 2013), the generalization of the findings is limited due in part to the small number of participants.

CONCLUSION

This study sheds light on motivational, procedural, and strategic scaffolding in student-centered learning environments. This study was the first attempt to evaluate the influence of autonomous motivation and scaffolding and redesign the use of narratives in a science course. As we iteratively implement, evaluate, and refine, we can further inform implications of OLSi and recommend design principles for applications in broader settings beyond postsecondary sciences (The Design Research Collectives, 2003).

REFERENCES

Corbin, J. M., & Strauss, A.L. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Newbury Park, CA: Sage Publications.

Creswell, J.W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological inquiry, 11*(4), 227-268.

Design-Based Research Collective. (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher, 32*(1), 5-8.

Hannafin, M.J., Hill, J., Land, S.M., Lee, E. (2014). Student-centered, open learning environments: Research, theory, and practice. In M. Spector, M. D. Merrill, J. van Merrienboer, & M. P. Driscoll (Eds.), *Handbook of Research on Educational Communications and Technology*. (pp. 641-651). Springer: New York.

Land, S. M., Hannafin, M. J., & Oliver, K. (2012). Student-Centered Learning Environments: Foundations, assumptions and design. In Jonassen, D., & Land, S. (Eds.). *Theoretical foundations of learning environments*. Routledge.

Lee, E., & Maerz, J. C. (2015). Writing Stories in the Sciences. *Journal of College Science Teaching, 44*(4), 36-45.

Lee, E., & Hannafin, M. J. (2016). A design framework for enhancing engagement in student-centered learning: Own it, learn it, and share it. *Educational technology research and development, 64*(4), 707-734.

Tessier, J. (2006). Writing assignments in a non major introductory ecology class. *Journal of College Science Teaching, 4*(35), 25-29.

Reeve, J., & Jang, H. (2006). What teachers say and do to support students' autonomy during a learning activity. *Journal of Educational Psychology, 98*(1), 209.

Walczyk, J.J., & Ramsey, L.L. (2003). Use of learner-centered instruction in college science and mathematics classrooms. *Journal of Research in Science Teaching, 40*, 566–584.