

Collaborative Research: Longitudinal Impact of PLTL on Student and Peer Leader Retention of General Chemistry Concepts and Attitudes toward Chemistry

References

1. National Research Council, *Discipline-based education research: Understanding and improving learning in undergraduate science and engineering*, S.R. Singer, N.R. Nielsen, and H.A. Schweingruber, Editors. 2012, Committee on the Status, Contributions, and Future Directions of Discipline-Based Education Research: Washington, DC.
2. White, R.T. and Azri, H.J., (2005). *Longitudinal studies: Designs, validity, practicality, and value*. Research in Science Education. 35, p. 137-149.
3. Novak, J.D., (2010) Learning, creating, and using knowledge. Second ed. New York, NY: Lawrence Erlbaum Associates, Inc.
4. Gosser, D.K., Kampmeier, J.A., and Varma-Nelson, P., (2010). *Peer-led team learning: 2008 James Flack Norris award*. Journal of Chemical Education. 87, p. 374-380.
5. Wilson, S.B. and Varma-Nelson, P., (2016). *Small groups, significant impact: A review of peer-led team learning research with implications for STEM education researchers and faculty*. Journal of Chemical Education. 93, p. 1686-1702.
6. Akinyele, A.F., (2010). *Peer-led team learning and improved performance in an allied health chemistry course*. Chemical Educator. 15, p. 353-360.
7. Hockings, S.C., Deangelis, K.J., and Frey, R.F., (2008). *Peer-led team learning in general chemistry: Implementation and evaluation*. Journal of Chemical Education. 85, p. 990-996.
8. Lewis, S.E. and Lewis, J.E., (2005). *Departing from lectures: An evaluation of a peer-led guided inquiry alternative*. Journal of Chemical Education. 82, p. 135-139.
9. Tien, L.T., Roth, V., and Kampmeier, J.A., (2002). *Implementation of a peer-led team learning instructional approach in an undergraduate organic chemistry course*. Journal of Research in Science Teaching. 39, p. 606-632.
10. Wamser, C.C., (2006). *Peer-led team learning in organic chemistry: Effects on student performance, success, and persistence in the course*. Journal of Chemical Education. 83, p. 1562-1566.
11. Chan, J.Y.K. and Bauer, C.F., (2015). *Effect of peer-led team learning (PLTL) on student achievement, attitude, and self-concept in college general chemistry in randomized and quasi-experimental designs*. Journal of Research in Science Teaching. 52, p. 319-346.
12. Lewis, S.E., (2011). *Retention and reform: An evaluation of peer-led team learning*. Journal of Chemical Education. 88, p. 703-707.
13. Mitchell, Y.D., Ippolito, J., and Lewis, S.E., (2012). *Evaluating peer-led team learning across the two semester general chemistry sequence*. Chemistry Education Research and Practice. 13, p. 378-383.
14. Lewis, S.E., (2014). *Investigating the longitudinal impact of a successful reform in general chemistry on student enrollment and academic performance*. Journal of Chemical Education. 91, p. 2037-2044.

15. Gafney, L. and Varma-Nelson, P., (2007). *Evaluating peer-led team learning: A study of long-term effects on former workshop peer leaders*. Journal of Chemical Education. 84, p. 535-539.
16. Lewis, S.E., Shaw, J.L., and Freeman, K.A., (2010). *Creative exercises in general chemistry: A student-centered assessment*. Journal of College Science Teaching. 40, p. 18-23.
17. Lewis, S.E., Shaw, J.L., and Freeman, K.A., (2011). *Establishing open-ended assessments: Investigating the validity of creative exercises*. Chemical Education Research and Practice. 12, p. 158-166.
18. Linn, M.C. and Eylon, B.-S., (2011) Science learning and instruction: Taking advantage of technology to promote knowledge integration. New York, NY: Routledge.
19. Marton, F. and Saljo, R., (1976). *Outcome as a function of the learner's conception of the task*. British Journal of Educational Psychology. 46, p. 115-127.
20. Staver, J.R., (1998). *Constructivism: Sound theory for explicating the practice of science and science teaching*. Journal of Research in Science Teaching. 35, p. 501-520.
21. Stevens, S.Y., Delgado, C., and Krajcik, J.S., (2010). *Developing a hypothetical multi-dimensional learning progression for the nature of matter*. Journal of Research in Science Teaching. 47, p. 687-715.
22. Derbentseva, N., Safayeni, F., and Canas, A.J., (2007). *Concept maps: Experiments on dynamic thinking*. Journal of Research in Science Teaching. 44, p. 448-465.
23. Safayeni, F., Derbentseva, N., and Canas, A.J., (2005). *A theoretical note on concepts and the need for cyclic concept maps*. Journal of Research in Science Teaching. 42, p. 741-766.
24. Hay, D.B., (2007). *Using concept maps to measure deep, surface and non-learning outcomes*. Studies in Higher Education. 32, p. 39-57.
25. Ruiz-Primo, M.A. and Shavelson, R.J., (1996). *Problems and issues in the use of concept maps in science assessment*. Journal of Research in Science Teaching. 33, p. 569-600.
26. Ye, L. and Lewis, S.E., (2014). *Looking for links: Examining student responses in creative exercises for evidence of linking chemistry concepts*. Chemistry Education Research and Practice. 15, p. 576-586.
27. Warfa, A.-R.M. and Odowa, N., (2015). *Creative exercises (CEs) in the biochemistry domain: An analysis of students' linking of chemical and biochemical concepts*. Chemistry Education Research and Practice. 16, p. 747-757.
28. Oskamp, S. and Schultz, P.W., (2005) Attitudes and opinions. 3rd ed. Mahwah: Lawrence Erlbaum Associates.
29. Gable, R.K., (1986) Instrument development in the affective domain. Boston: Kluwer Nijhoff Publishing.
30. Salta, K. and Tzougraki, C., (2004). *Attitudes toward chemistry among 11th grade students in high schools in Greece*. Science Education. 88, p. 535-547.
31. Eagly, A.H. and Chaiken, S., (1993) The psychology of attitudes. Fort Worth, TX: Harcourt Trade Publishers.
32. Bong, M. and Skaalvik, E.M., (2003). *Academic self-concept and self-efficacy: How different are they really?* Educational Psychology Review. 15, p. 1-40.

33. Brandriet, A.R., Xu, X., Bretz, S.L., and Lewis, J.E., (2011). *Diagnosing changes in attitude in first-year college chemistry students with a shortened version of Bauer's semantic differential*. *Chemistry Education Research and Practice*. 12, p. 271-278.
34. Chan, J.Y.K. and Bauer, C.F., (2014). *Identifying at-risk students in general chemistry via cluster analysis of affective characteristics*. *Journal of Chemical Education*. 91, p. 1417-1425.
35. Freedman, M.P., (1997). *Relationship among laboratory instruction, attitude toward science, and achievement in science knowledge*. *Journal of Research in Science Teaching*. 34, p. 343-357.
36. House, J.D., (1995). *Noncognitive predictors of achievement in introductory college chemistry*. *Research in Higher Education*. 36, p. 473-490.
37. Weinburgh, M., (1995). *Gender differences in student attitudes toward science: A meta-analysis of the literature from 1970 to 1991*. *Journal of Research in Science Teaching*. 32, p. 387-398.
38. Bauer, C.F., (2005). *Beyond "student attitudes": Chemistry self-concept inventory for assessment of the affective component of student learning*. *Journal of Chemical Education*. 82, p. 1864-1869.
39. Neiswandt, M., (2007). *Student affect and conceptual understanding in learning chemistry*. *Journal of Research in Science Teaching*. 44, p. 908-937.
40. Marsh, H.W. and Yeung, A.S., (1997). *Causal effects of academic self-concept on academic achievement: Structure equation models of longitudinal data*. *Journal of Educational Psychology*. 89, p. 41-54.
41. Helmke, A. and Van Aken, M.a.G., (1995). *The causal ordering of academic achievement and self-concept of ability during elementary school: A longitudinal study*. *Journal of Educational Psychology*. 87, p. 624-637.
42. Chan, J.Y.K. and Bauer, C.F., (2016). *Learning and studying strategies used by general chemistry students with different affective characteristics*. *Chemistry Education Research and Practice*. 17, p. 675-684.
43. Lewis, S.E., Shaw, J.L., and Heitz, J.O., (2009). *Attitude counts: Self-concept and success in general chemistry*. *Journal of Chemical Education*. 86, p. 744-749.
44. Xu, X. and Lewis, J.E., (2011). *Refinement of a chemistry attitude measure for college students*. *Journal of Chemical Education*. 88, p. 561-568.
45. Seymour, E. and Hewitt, N.M., (1997) *Talking about leaving; why undergraduates leave the sciences*. Boulder, Colorado: Westview Press.
46. Robert, J., Lewis, S.E., Oueini, R., and Mapugay, A., (2016). *Coordinated implementation and evaluation of flipped classes and peer-led team learning in general chemistry*. *Journal of Chemical Education*. DOI: 10.1021/acs.jchemed.6b00395.
47. Lantz, J., Cole, R., Bauer, C., Dalton, C., Falke, A., Fischer-Drowos, S., Fish, C., Langhus, D., Riter, R., Salter, C., and Walczak, M., (2014) *Analytical chemistry: A guided inquiry approach*. Mahoney, New Jersey: John Wiley & Sons.
48. Cohen, J., (1988) *Statistical power analysis for the behavioral sciences*. Second ed. Hillsdale: Lawrence Erlbaum Associates.
49. Ye, L., Oueini, R., and Lewis, S.E., (2015). *Developing and implementing an assessment technique to measure linked concepts*. *Journal of Chemical Education*. 92, p. 1807-1812.

50. Park, I. and Schutz, R.W., (1999). *"Quick and easy" formulae for approximating statistical power in repeated measures ANOVA*. *Measurement in Physical Education and Exercise Science*. 3, p. 249-270.
51. Torres, V. and Hernandez, E., (2007). *The influence of ethnic identity on self-authorship: A longitudinal study of latino/a college students*. *Journal of College Student Development*. 48, p. 558-573.
52. Mabrouk, P.A., ed. *Active learning: Models from analytical sciences*. 2007, American Chemical Society: Washington, DC.
53. Repice, M.D., Sawyer, R.K., Hoglebe, M.C., Brown, P.L., Luesse, S.B., Gealy, D.J., and Frey, R.F., (2016). *Talking through the problems: A study of discourse in peer-led small groups*. *Chemistry Education Research and Practice*. 17, p. 555-568.
54. Barbera, J., Perkins, K.K., Adams, W.K., and Wieman, C.E., (2008). *The Colorado Learning Attitudes about Science Survey: Modifications and validation in chemistry*. *Journal of Chemical Education*. 85, p. 1435-1439.
55. Brown, C.E., Hyslop, R.M., and Barbera, J., (2015). *Development and analysis of an instrument to assess student understanding of GOB chemistry knowledge relevant to clinical nursing practice*. *Biochemistry and Molecular Biology Education*. 43, p. 13-19.
56. Ferrell, B. and Barbera, J., (2015). *Analysis of students' self-efficacy, interest, and effort beliefs in general chemistry*. *Chemistry Education Research and Practice*. 16, p. 318-337.
57. Ferrell, B., Phillips, M.M., and Barbera, J., (2016). *Connecting achievement motivation to performance in general chemistry*. *Chemistry Education Research and Practice*. 17, p. 1054-1066.
58. Schwartz, P. and Barbera, J., (2014). *Evaluating the content and response process validity of data from the chemistry concepts inventory*. *Journal of Chemical Education*. 90, p. 630-640.
59. Wren, D. and Barbera, J., (2013). *Gathering evidence for validity during the design, development and qualitative evaluation of thermochemistry concept inventory items*. *Journal of Chemical Education*. 90, p. 1590-1601.
60. Wren, D. and Barbera, J., (2014). *Psychometric analysis of the thermochemistry concept inventory*. *Chemistry Education Research and Practice*. 15, p. 380-390.
61. Brown, C.E., Henry, M.L.M., Barbera, J., and Hyslop, R.M., (2012). *A bridge between two cultures: Uncovering the chemistry concepts relevant to the nursing clinical practice*. *Journal of Chemical Education*. 89, p. 1114-1121.
62. Lewis, S.E., (2014). *Examining evidence for external and consequential validity of the first term general chemistry exam from the ACS examinations institute*. *Journal of Chemical Education*. 91, p. 793-799.

Biographical Sketch: Scott E. Lewis

(i) Professional Preparation

University of South Florida	Tampa, FL	Chemical Engineering	B.S. 2001
University of South Florida	Tampa, FL	Chemistry	M.A. 2003
University of South Florida	Tampa, FL	Chemistry Education	Ph.D. 2006

(ii) Appointments

2016 – Present	Associate Professor, University of South Florida
2013 – 2016	Assistant Professor, University of South Florida
2012 – 2013	Associate Professor, Kennesaw State University
2006 – 2012	Assistant Professor, Kennesaw State University

(iii) Products

Products most closely related to the proposed project:

- (1) Ye, L., Shuniak, C., Oueini, R., Robert, J., & Lewis, S. *Can they succeed? Exploring at-risk students' study habits in college general chemistry*. Chemistry Education Research and Practice, 2016, **17**, 878-892.
- (2) Ye, L., Oueini, R., Dickerson, A.P., & Lewis, S.E. *Learning beyond the classroom: Using text messages to measure general chemistry students' study habits*. Chemistry Education Research and Practice, 2015, **16**, 869-878.
- (3) Lewis, S. E. *Investigating the Longitudinal Impact of a Successful Reform in General Chemistry on Student Enrollment and Academic Performance*. Journal of Chemical Education, 2014, **91**, 2037-2044.
- (4) Lewis, S. E. *Examining Evidence for External and Consequential Validity of the First Term General Chemistry Exam from the ACS Examinations Institute*. Journal of Chemical Education, 2014, **91**, 793-799.
- (5) Ye, L. & Lewis, S. E. *Looking for Links: Examining Student Responses in Creative Exercises for Evidence of Linking Concepts*. Chemistry Education Research and Practice, 2014, **15**, 576-586.

Other significant products:

- (6) Lewis, S.E., & Lewis, J.E. *Departing from Lectures: An Evaluation of a Peer-Led Guided Inquiry Alternative*. Journal of Chemical Education 2005, **82**, 135-139.
- (7) Ye, L., Oueini, R., & Lewis, S.E. *Developing and Implementing an Assessment Technique to Measure Linked Concepts*. Journal of Chemical Education, 2015, **92**, 1807-1812.
- (8) Mitchell, Y.D., Ippolito, J. & Lewis, S.E. *Evaluating Peer-Led Team Learning across the two semester General Chemistry sequence*. Chemistry Education Research and Practice, 2012, **13**, 378-383.