Group Learning

Josh Camburn, Heather Miller, Evan Spencer

Pennsylvania State University

Introduction

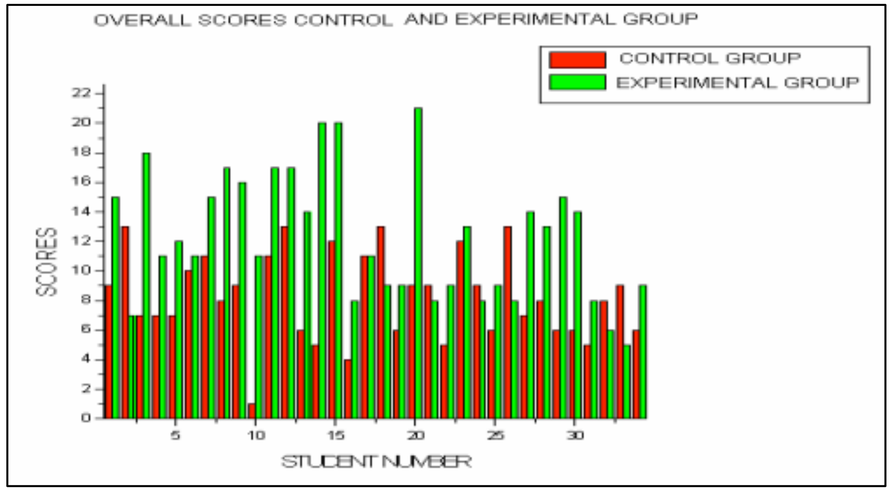
In Analytical Chemistry, Learning Assistants (LAs) have two main responsibilities. These responsibilities are leading problem set sessions on a weekly basis, outside the classroom, and lecture activities in the classroom setting. Both are large scale, 25 to 50 students, with a group learning setting. Through the science pedagogy course, required for all beginning LAs, some aspects of learning theory have been explored and an analysis of group learning was selected as it best explains what is happening in the analytical chemistry classroom.

Current Research

While group learning is normally studied in the context of students, it has been shown to be helpful in educators as well. For instance, the Dublin University of Technology (DIT) has implemented peer meetings for its teaching faculty to gauge the effectiveness of implementing group work in their courses and to address any problems they encounter.[1] These practices were so successful that they have now spread to other branches in the 13 technical university system of Ireland.

Research is also underway on improving the way groups work together. Civic engagement and technology-assisted "blended" activities have been shown to engage more students and help professors reach people who would otherwise be uninterested and unsuccessful. By going beyond traditional classroom settings, teachers can address different students' learning styles. For example, most textbooks are written by experts who have mastered the dominant learning style of a discipline. For students who can replicate this mode of thinking, these texts are effective but that approach to learning fails many students who can succeed under a different approach.[2]

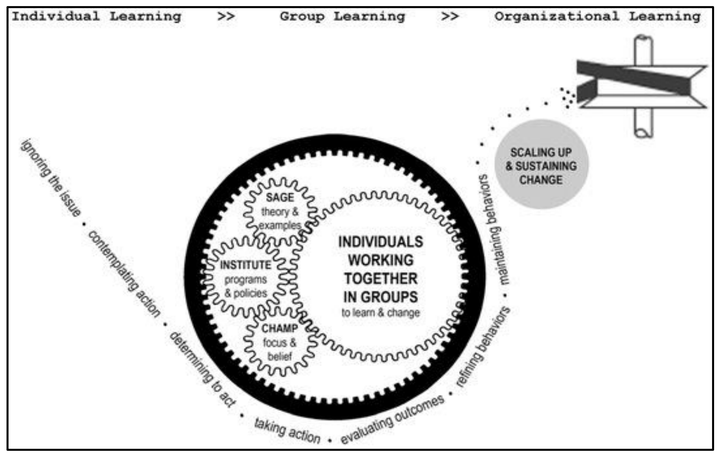
While conceptual analysis is important in any field, it must also be shown that these ideas are reflected in student outcomes. One such example is a study by the RAND Corporation and the Department of Education which shows that blended learning can improve test scores. 18,000 students in 147 schools across seven states were divided into two groups, one with normal, classroom-based curricula, and another using supplemental software two days and group work the remaining three days. After two years, average scoring students gained an average of **eight percentile points** in the second group.[4]



The figure above shows a similar study of blended learning when applied to elementary concepts in differential calculus. It can be observed that the experimental group had a tendency to excel when exposed to this learning method. [5]

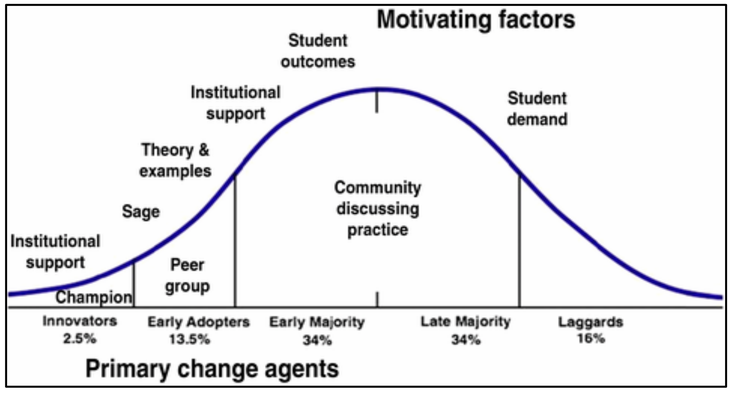
A Model for Multilevel Learning

The figure below shows a model for multiloop learning. In this model, group discovery is the primary driver of transformational learning among individuals and the overall organization. From changes that occurred at the Dublin Institute of Technology (DIT), they have employed a "head of learning development" for each college that works with the dean to facilitate multidimensional, multiloop learning. At DIT, more lecturers are implementing innovative pedagogy tools, and change is occurring. Faculty who were once skeptical are seeing beneficial changes in their classrooms. This system engages more individuals and more personal experience.[2]



A Model to Promote Adoption

The figure below shows a way to conceptualize the process of learning. The biggest challenge group learning faces, regarding future adaptation, is changing the current, entrenched system. Leaders can use this model to encourage adoption of new techniques by the masses (the early and late majority). Usually, the champion is the innovator, and leverages the work of early adopters of new pedagogical practices. This learning and development can further be enhanced by institutional support, which comes in the form of new policies, novel programs, and/or a sage adviser, someone who can highlight relevant theories and examples. Over time, more people join the process, and become the early majority. The late majority joins as they see improved outcomes in students and increased demand by the students. Consequently the most benefit will come from recruiting those who fall in the center of the bell curve, the early and late majorities.[2]



How Our Instruction Fits Into Ongoing Research

Group learning has been an area of research interest for several decades. In recent years it has been adopted in curriculums nationwide and across the globe. At Northern Arizona University and Emery University, students and faculty worked together on issues of environmental sustainability.[3] The LAs of analytical chemistry have tried to use their skills in the context of the research to guide analytical chemistry students here at Penn State. Consequently problem set sessions and in class lecture activities are run in group settings where collaboration is encouraged. The goals for these sessions are developing advanced problem-solving skills, as well as important group skills that are important in every discipline. The group sessions utilize problem-based learning, where the LAs merely direct the focus of the discussions and the students gain hands on experience solving problems with new material.

Conclusions

Problem set session and lecture activities enhance learning in analytical chemistry at least partly because they encourage collaboration and benefit from the aspects of group learning mentioned previously. Without these sessions student learning would be hindered. That problem would be reflected in comprehension as measured by tests and homework. These problems could then discourage students from becoming chemists or forensic scientists when they could achieve their goals with better instruction.

Future Directions

Given the success thus far, LA guided group learning should be expanded to other classes, as the results of analytical chemistry provide strong evidence that they can benefit students of all classes including rigorous science classes. This expansion would create more learning-rich environments and encourage students, especially those in "intimidating" majors like chemistry or forensic science. As seen in the research, adding more technology into classrooms may also show better outcomes with students and comprehension of tough material.

Citations

1 Chance, Shannon M., et al. "Policies that enhance learning and teaching." *Proceedings of the World Academy of Science, Engineering and Technology* (2013).

2 Chance, Shannon M. "Bringing It All Together Through Group Learning." *New Directions for Higher Education* (2014).

3 Chance, S.M., Duffy, G., Bowe., Murphy, M., & Duggan, T. (2013). A model for transforming engineering education through group learning. Proceedings of the International Conference on Engineering and Product Design Education, Dublin Institute of Technology, Dublin, Ireland, 5th-6th. September, 2013.

4 Sheridan, Kelly. "Blended Learning Improves Test Scores: Study" *Informationweek* (2013).

5 Naidoo, K., Naidoo, R. "First Year Students Understanding Of Elementary Concepts In Differential Calculus In A Computer Laboratory Teaching Environment." *Journal of College Teaching and Learning* (2007).

Further Exploration - Some of our sources created or cited deeper analyses
A discussion of learning overhaul in Ireland's technical institutes; Designing Together: Effective Strategies for Creating a Collaborative Curriculum to Support Academic Development