Looking for Convergence: Laboratory Learning and Classroom Learning

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Abstract – Over the last two years we have been conducting NSF-sponsored research on learning in engineering research laboratories so as to identify the activities and tools used to support engineering learning outside the classroom. At the same time, we have been using a Problem-based Learning approach in our undergraduate biomedical engineering curriculum. Our goal is to identify ways in which these two sites for learning converge and diverge. Session participants will help us with this task by examining and analyzing data from both sites.

Index terms: Laboratory learning, Problem-based Learning, ethnography, biomedical engineering

Session Rationale

Over the last two years we have been conducting NSF-sponsored research on learning in engineering research laboratories. Our goal has been to understand how a novice enters the lab, and develops technical skill and conceptual knowledge that helps her become a full-fledged lab member. The data we have collected has been ethnographic in nature. That is, we have spent long hours in the labs as participant observers, writing field notes on activities and interactions. We have conducted open-ended interviews with lab members. We have attended and taped lab meetings which we later transcribe and analyze. Various engineered artifacts that support the work and the learning have been a focal point. We have also followed specific learners from their first days in the lab to a time when they have their own project and research agenda. From this, we have developed a provisional account and theory of laboratory learning, which we characterize as cognitive partnerships.

We are now interested in identifying aspects of this learning environment that can be replicated in engineering classrooms and educational laboratories. Of particular interest is the comparative likeness between lab learning and the Problem-based Learning (PBL) classroom. Participants in this FIE session will operate as a working group aiming to take first steps towards finding convergence between successful lab learning and classroom learning.

Session Description

The session will begin with a brief overview (30 minutes) of the labs we are investigating and the research-to-practice model we are using for this study. Discussion will center on expert/novice studies from cognitive science and how these are useful in designing optimal learning environments. Session leaders will also discuss the study methodology and rationale for its use. Participants will be encouraged to offer alternative research designs that might have also been useful here. Ideally participants will begin to see differences between ethnographic research and survey methods.

During the next hour, in groups of three, participants will examine various kinds of data collected from the two sites of learning—the lab and the PBL classroom. We will show short video clips from the laboratory and a PBL session. In addition, we will offer written texts from each site. They will be looking for instance of convergence and divergence between these sites. They will be making observations about the learning they witness in each setting and how the contexts are both similar and different.

The session will close with a general discussion that allows each group to present their preliminary insights about the data. Questions to be answered include: How close are these two environments based on the data? Is PBL as an environment for Biomedical Engineering learning doing what it should? What is missing? What worries you? We will also reflect on the value of this kind of research in moving towards convergence in other engineering learning environments.

Anticipated Audience

We anticipate the audience will consist of FIE participants who are interested in designing learning environments that more closely approximate engineering practice outside the classroom. Those interested in Problem-based Learning approaches in engineering education are another audience. And finally those interested in understanding the outcomes of ethnographic research methods.