AC 2005-712: AN EXAMINATION OF CHANGES IN BIOENGINEERING FACULTY PEDAGOGY WITHIN "HOW PEOPLE LEARN" ENVIRONMENTS

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AN EXAMINATION OF CHANGES IN BIOENGINEERING FACULTY PEDAGOGY WITHIN "HOW PEOPLE LEARN" ENVIRONMENTS

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Introduction

Developed in 1990 for use in bioengineering classrooms within the VaNTH (Vanderbilt University, Northwestern University, the University of Texas at Austin, and the Harvard/Massachusetts Institute of Technology Division of Health Science and Technology) Engineering Research Center, the VaNTH Observation System (VOS) is a four-part direct observation instrument that examines faculty and student interactions, students' academic engagement levels, the lesson content and context of a class, and global ratings of effective teaching.[1] In addition, the VOS reports information about faculty members' use of the "How People Learn" (HPL) framework, a framework, that when coupled with traditional teaching techniques, are expected to optimize student learning.

The first part of the VOS, the Classroom Interaction Observation (CIO), records (1) who is initiating in-class comments or questions, (2) to whom in-class comments or questions are initiated, (3) what types of interactions are occurring, (4) the presence of "How People Learn" dimensions and organization, and (5) the type of media that is used during a class session. For three minutes, CIO data is recorded in four- to six-second code strings. Following the CIO, observers use the Student Engagement Observation (SEO) portion of the VOS to take a thirty- to sixty-second "snapshot" of the number of students engaged in sanctioned or unsanctioned activities. Following the SEO, observers use the Narrative Notes (NN) portion of the VOS to type information about the content and context of a class as well as any extenuating circumstances that might have occurred within that class. After a cycle of collecting CIO, SEO, and NN data throughout a class session, observers rate the cumulative aspects of a class session using the final portion of the VOS, the Global Ratings (GR).

Of the four components of the VOS, the CIO provides specific information about the presence of classroom organization and the four dimensions of the "How People Learn" (HPL) framework—knowledge-centeredness, learner-centeredness, assessment-centeredness, and community-centeredness.[2] Knowledge-centered environments promote student learning with understanding about the application of key course concepts. Learner-centered environments probe students' academic perceptions, misconceptions, learning styles, beliefs, and prior experiences. Assessment-centered environments formatively and summatively assess students' understanding of course concepts. Community-centered environments encourage students,

teachers, and other interested participants to (1) share norms that value learning and high standards, (2) interact, (3) receive feedback, and (4) learn.

After several revisions of the VOS, the CIO portion of the VOS achieved 95% to 100% inter-rater agreement for written classroom vignettes and achieved 85% to 95% inter-rater agreement for videotaped classroom vignettes.[3] Observers began using the revised version of the VOS beginning in the spring semester of 2002. For the CIO portion of the VOS, the percent of observed instances of knowledge-, learner-, assessment-, and community-centeredness has been computed. Within the CIO, the HPL dimensions are not mutually exclusive, however. For this reason, the sum of the percent of observed instances of knowledge-, learner-, assessment-, and community-centered activities during a class session is greater than 100%.

Several faculty have been observed using the VOS, and information about the presence of HPL dimensions has been reported in both HPL-oriented and traditional, nonHPL-oriented bioengineering classes. Although the presence of HPL-oriented instruction within bioengineering classes has been connected to increased student engagement,[4] higher faculty ratings by students,[5] and increased student collaboration,[6] little information has been reported about how the implementation of these instructional changes has affected professors over time.

Therefore, the purpose of this paper is to use current CIO data to explore bioengineering professors' pedagogical patterns as they initially implement HPL-based educational materials in their classes and professors' pedagogical patterns after they have taught at least one semester using HPL-based educational materials. In addition, information will be reported about professors who have taught in an HPL manner for at least one semester but must teach a traditional course the following semester. Because of an unexpected small sample size and because of content inconsistencies across classes, however, this study is a "Work in Progress" that may provide a foundation for future studies.

Sample

The original sample for this study consisted of seven biomedical engineering professors within Vanderbilt University's Biomedical Engineering Department. Several limitations, however, prevented the original sample from being used. First, although three bioengineering professors teaching nonHPL classes were observed in the spring and fall of 2000, the 2000 data was not available for use within this study. In addition, revisions were made to the Classroom Interaction Observation portion of the VOS during this time. Of the four remaining professors within the sample, three professors began teaching HPL-oriented classes without extensive knowledge of the HPL framework, and one professor began teaching HPL-oriented courses at the college level after using HPL-oriented materials at the high school level. Two professors in this sample taught the same course for two semesters, and two professors taught other courses after their initial exposure to HPL instruction.

Methodology

Given the unexpectedly small sample size and differences in course content for two of the four professors within the sample, this is a pilot study that addresses current research limitations

and offers recommendations for conducting a more comprehensive research study. The current CIO data was collected within classes that either used HPL-oriented pedagogical practices (experimental) or used traditional, nonHPL-oriented pedagogical practices (control). VOS observers were asked to observe on certain days requested by VaNTH researchers. Observers also collected data on additional days that were compatible with their schedules.

VOS classroom observations for the four professors were compared across two semesters. For the first professor in the sample, a Bio-Optics professor, eight observations were taken in the spring of 2002 and eight observations were taken in the spring of 2004. For the second professor in the sample, a Freshman Seminar professor, five observations were taken in the fall of 2003 and two were taken in the fall of 2004. For the third professor, nine Systems Physiology classroom observations were taken in the fall of 2002, and six Medical Imaging classroom observations were taken in the spring of 2004. For the final professor, four observations were taken in a Freshman Seminar class in fall of 2002, and seven observations were taken in a Systems Physiology class in the spring of 2003.

Since the sample size and the course content are consistent, however, for the Bio-Optics professor, only a figure showing differences in HPL dimensions for that professor will be presented. Initial findings for the second, third, and fourth professors will be discussed briefly, Since, for the remaining professors, there was no consistency in the length of time between observations, the content varied by semester, or the observation sample size, initial findings for the second, third, and fourth professors will not be discussed.

Results

Eight classes were observed within a Bio-Optics course taught by a professor during the spring 2002 semester, and eight classes were observed within the same course during the spring 2004 semester. Each of the sixteen VOS observations lasted approximately fifty minutes. Courses in both semesters were taught three days a week (Mondays, Wednesdays, and Fridays) during their respective semesters. For this particular class, from 2002 to 2004, the amount of learner-centeredness increased, the amount of knowledge- and assessment-centeredness decreased, and the community-centered activities remained constant (Figure 1). Recall that since the HPL dimensions are not mutually exclusive, the sum of the percent of observed instances of the dimensions can be greater than 100%.

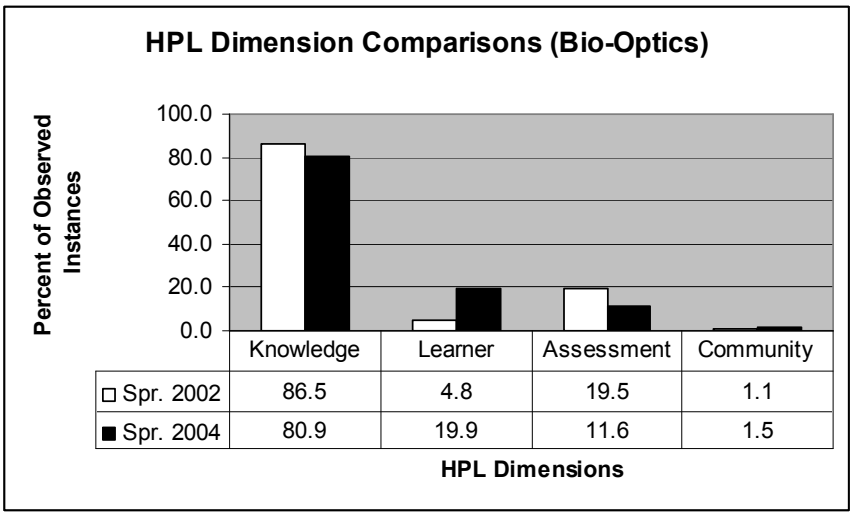

Figure 1- HPL Semester to Semester Comparisons (Bio-Optics)

Conclusions

Initial findings point to slight differences in the amount of knowledge-, learner-, assessment-, and community-centered activities that occurred within a Bio-Optics course taught by one professor in the spring of 2002 and the spring of 2004. Since this is the only professor and course in the sample, more observations need to be taken and compared.

Limitations

As a "Work in Progress," this research is not yet significant. First, the current sample size is too small across professors and within observations per semester. Since some professors began implementing HPL-oriented materials into their courses before complete sets of VOS data were collected, these professors were not included in this study. Since approximately thirty class sessions are taught for each fifty-minute Monday/Wednesday/Friday course, and since approximately twenty class sessions are taught for each ninety-minute course Tuesday/Thursday course, a larger number of observations might be taken across professors and courses in the future. Second, comparisons need to made between courses that have the same content. Since professors often change courses from year to year, however, it is sometimes difficult to predict who will teach certain courses in advance. A third suggestion would be to make the time between observations consistent. To do this, a formal research design needs to developed. A final limitation is the amount of time needed to increase the sample. Since the study is longitudinal, more observations of professors are needed across several institutions.

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