CONCEPT PAPER

The UH PEEC Math Emporium

The University of Hawai‘i Pre-Engineering Education Collaboration

The University of Hawai‘i plans to redesign and evaluate our Pre-Engineering Calculus Series using a Math Emporium Model that will allow students to individually, or in cohorts, progress through the math courses required for the Pre-Engineering Education Collaboration (PEEC) program. The model reduces or eliminates formal class meetings and replaces them with a learning resource center (O‘ahu) featuring online materials and on-demand personalized assistance from faculty and peer mentors (Hawai‘i Undergraduate Interns, HUI) using a required attendance model. Detailed information regarding the Math Emporium Model and its successes can be found at the following website: http://www.thencat.org/R2R/AcadPrac/CM/MathEmpFAQ.htm. Much of the information describing the Math PEEC Emporium comes from this text.

The traditional format for teaching Calculus at UH does not take into account the range of academic preparation and learning styles that students embrace. For many Hawaiian students, as well as other minority students, difficulty arises either due to weak backgrounds in math or problems with the lecture format. Teachers in advanced math, science, and engineering courses have expressed frustration at the inability of students who have passed Calculus to retain certain skills, recall material, and apply what they have learned.

Using the Emporium Model, the Calculus course material will be organized into topics that students cover at the rate of one or two topics per week, depending upon the students’ preparation and commitment to learning. All class meetings will be replaced with Web-based resources from experienced faculty, interactive tutorials, computational exercises, an electronic textbook, and practice exercises, applications, and online quizzes. Multiple sections will be assigned to faculty in an open lab format. Faculty and peer mentors will point students toward appropriate resources and strategies. Students can communicate on a completely flexible time schedule through e-mail, synchronous online whiteboards, or in person with faculty and peer mentors at the PEEC Math Emporium. Calculus students will be required to work in the PEEC Math Emporium with flexible attendance for a minimum of 4 hours per week (a four-credit course requires 4 documented hours working on math in the Emporium). Students are encouraged to spend as much time as they want. In the first year of the UH PEEC grant, the Math Emporium will occupy two rooms containing ~80 computers in the newly renovated ‘Iliahi building on the KapCC campus. KapCC currently offers this math emporium learning model for developmental math courses and has many of the resources necessary to employ the model. Other UH PEEC campuses have adopted the math emporium model (Maui College and Leeward CC) and will begin using it in subsequent semesters.

Each topic will end with a short, electronically graded quiz. Once all topics are covered, students will be assessed with a final test on that module at the emporium. Quizzes are preparation for tests and students will be given many attempts to retake quizzes and redo homework assignments. Questions on quizzes will be pooled so that additional attempts allow students to see a range of exercises within one objective. Students will not be able to go back and rework individual exercises on a quiz to improve their grade. Quizzes will be timed to give students a more realistic sense of the upcoming test situation. The best score will be kept to encourage students to continue to take a quiz to improve their grade or to get additional practice without penalty. Tests can be attempted just once or multiple times depending on whether or not a plan is created that would allow students time to re-prepare for a retake. Multiple testing opportunities are necessary if mastery is required

The impact of the PEEC Math Emporium model on student learning will be assessed by looking at final exam grades, statistics on retention and success, the ratio of initial enrollees to completers, and the ratio of no-shows for the final exam to students still registered in the course. Uniformity will be assessed by comparing grade outcomes with standard predictors and with results of the common exams. Qualitative data from faculty will be gathered via surveys and discussion with math and other partnership faculty who teach courses that require the retention of math skills. Student perceptions will be assessed by pre- and post-surveys. Qualitative data from students will be gathered through focus groups.

The PEEC Math Emporium model proposed here has great potential to be transformative for the Tribal Colleges and Universities Programs, as well as all engineering programs in general. First, the model will evaluate technology-enhanced, engaged learning, and will focus on diminishing the disconnect that often emerges between STEM faculty who solely emphasize the transmission of "high content" canonical science and minority students. More specifically, the students we are referring to are the Native American, Native Alaskan, and Native Hawaiian (NH) college students, who have been shown to thrive in high context, engaging, real world learning environments (Ibarra, 2001). Second, the model supports cohort education. The anchor of the NH PEEC cohort experience will be annual Summer Engineering Experiences (SEE 1, 2, 3) that lead to the completion of a 39-credit pre-engineering core curriculum. All three SEE programs will run for 6 weeks, 5 days a week, from 9:00 am to 4:00 pm. Based on student levels of math and calculus preparation, NH high school graduates and current community college students will be placed into and will move through each of the three SEE over a three year period. **The modular design of the UH PEEC Math Emporium allows the cohorts to be maintained and allows the students to move through the Pre-Engineering curriculum together.** If a student in a cohort falls behind in math, s/he can catch up to the rest of the cohort by spending additional time at the emporium on failed modules. Third, this model is optimal for nontraditional students who have difficulty in regularly attending scheduled math classes.

Ibarra, R. A. (2001). *Beyond affirmative action: Reframing the context of higher education*. Madison, Wis. ; London: University of Wisconsin Press.