

## **Hands-On Laboratory-Driven Electrical Engineering Curriculum (Pandora)**

### **First-Year Progress Report**

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### **INTRODUCTION**

The Hands-on Laboratory-driven Electrical Engineering Curriculum (Pandora) seeks to address the need for skilled workers in electrical and computer engineering. The Pandora project creates distance learning curriculum with initial motivating experiments that use reasonably priced instrumentation tool kits. Funded by FIPSE, the courses map to the ABET Learning Outcomes and target students in two-year and four-year institutions and those who are in geographically remote communities.

#### **Project Goals:**

1. Develop a laboratory-driven curriculum for four-year universities and community colleges to include hands-on hardware-based laboratory experience. The curriculum may be delivered on-site or synchronously on-line.
2. Adapt and enhance this laboratory-driven curriculum to target students in geographically remote communities without convenient physical access to nearby post-secondary educational institutions. This curriculum is delivered asynchronously on-line.
3. Establish a laboratory-driven curriculum development methodology common to two-year and four-year institutions, to provide hands-on laboratory experience (lab kit) at a reasonable cost.

### **METHOD**

The first year of the Pandora Project has focused on curriculum development and the production of the lab kit. Monthly meetings of the project team track progress and provide a venue for communicating developments and clarifying strategies.

### **FINDINGS**

#### ***Lab Kit***

A major effort for the project has been the lab kit development. In autumn quarter, a very early version of the signal-generating box was unveiled at one of the regular monthly meetings. Because it had wires and control knobs springing out on all sides it was immediately nick-named "Pandora." The box has since been refined and a prototype assessed for usability.

Four student volunteers from the spring quarter EE 371 class tested the lab kit by conducting experiments they had previously done in class. The first test was performed by an individual student and took an hour; the second test was conducted by a team of three students and lasted about two hours.

The prototype had mechanical controls to set signal parameters (amplitude, frequency, offset, signal type, duty cycle), whereas the final design will be completely controllable from a PC, without any mechanical devices. The students were asked to read about the project on the Pandora web site and were given a one-page user's guide. The students were observed during their experiments and were asked to complete an [assessment questionnaire](#).

The individual student was very careful in using the box and discovered very few problems using it. The three-student team manipulated the mechanical controls simultaneously and discovered several problems with the controls. This is not the proper way to use the kit, but most students seem to do this in the lab with regular equipment. Students' verbal reactions during the test were enthusiastic and suggested that the lab kit was much easier to use than current instrumentation in the lab. [Responses to the questionnaire](#) identified areas in need of improvement, but were highly positive overall. Especially significant are student statements concerning how their use of the lab kit would enhance their education:

*Having a consistent measurement device would be great. It is a pain to switch from one device to another in the current labs.*

*I would be able to implement my own ideas and be able to test them.*

*Practical experience with signal operators and discrete components is valuable.*

*I could experiment with other things besides class projects at my convenience.*

It is worthy to note that all of the students eagerly volunteered to test the next model. From the evaluation of this part of the project, several actions will be taken:

- The electronic version will eliminate all mechanical controls and their associated problems.
- The timing control is critical and will be revised to avoid problems in operation of the lab kit.
- The user interface will be redesigned in response to student feedback.
- Triggering the oscilloscope needs to be designed carefully since it still poses problems for students in getting a stable display of the signal waveforms.

### **Curriculum Development**

The pilot of the first course, EE215, will be winter quarter 2002. [UW EDGE](#) is developing the online version of the course using materials supplied by Engineering faculty. The current EE courses are mapped to the ABET learning outcomes and include learning objectives. The online curriculum designer hopes to develop one lesson in online format, then review it with project directors. Some problems have emerged when converting formulas to web formats; parts of the formulas seem to disappear or appear in different formats. The need to scan or hand-enter formulas has been discussed. One point of discussion has been the development of the interactive component of the online course. Instead of designing a course using SQ4R (survey, question, read, recite, rite, review), designing a course with an interactive component, where students interact with the web as an aid to their understanding, seems to require not only different ways of thinking about teaching and learning, but also a web interface system. Recently, a UW graduate student has been asked to help design the web interface for the interactive part of the class.

An unforeseen outcome of the project is that members of the project team are connecting with other innovative individuals and programs on campus. Project members have attended *UW Catalyst* workshops to learn about *Epost*, *WebForum*, and *WebQ* (online interactive instructional aids) and have initiated conversations with *Catalyst* personnel about their new *Virtual Cases*, a method to facilitate online problem-based learning. Team members have also met with a UW faculty member who is developing a speech recognition program that the Pandora project might use to help summarize lecture information.

The first draft of handbooks for faculty and students has been developed for EE 233. An instructor at the Alaska site and one on the UW campus are piloting the materials in their summer and/or autumn courses. Every two weeks this summer, the project evaluator is meeting with the UW instructor to obtain formative feedback on the materials. Initial reports from the UW instructor suggest that the handbooks are well written, lucid, and well laid out. Email communication with the Alaska instructor has been initiated to gather additional information. A possible site visit to Alaska by the online curriculum designer may also take place.

Pandora Project leaders seem to have a clear picture of their vision for the project. Questions have been raised about the viability of the project timeline, but it is hard to know at this point whether the timeline is too optimistic. Developmental efforts will be intensified if necessary – the initial offering of the online version of EE 215 has been submitted for listing in the *UW Time Schedule* for winter 2002.