Annual Report
Project # 0101725
July 2002

Part I. Participants and Partners
San Juan College is partnering with Maricopa Advanced Technology Education Center (MATEC) on this project.

San Juan College:

Doyle Meyer is project PI with primary responsibility for project instructional design and project management.

Charles Woodall assisted in development with primary responsibility for the graphical components of the project.

MATEC:

Mike Lesiecki is responsible for oversight of MATEC's participation in the project.

Joe Matoon acted as an instructional design consultant. He assisted in modifying the competency based distance learning model developed by MATEC and in the development of the template used for this project.

An advisory committee representing a majority of technology employers in the San Juan Basin was involved in developing the original project concept and twice provided formative evaluations of the in process work. This committee will also have significant responsibility during Beta testing of the courseware starting in August. The Controls Technology and Computer Science departments also participated in the Alpha test after the template and first module were completed.

Part II Executive Summary

Overview

The rapid growth of web-based education has created a need for a revised methodology in educational curriculum and delivery. This project addresses the crucial experiential component for the education of technicians. Hands-on laboratory exercises traditionally ensure that the learner is able to transfer theoretical knowledge into practical application. We believe this hands-on laboratory experience is critical to the development of a quality site-based program. If we are to effectively educate a technician through distance education, we need to re-create these experiential curriculum components for an intra/internet curriculum. Without this experiential component, education for technicians will need to be partially to totally site-based.

This purpose of this Adaptation and Implementation project is adapt the processes developed by the Maricopa Advanced Technology Education Center (MATEC) to create experiential modules for a Web based Controls Technology curriculum. These experiential modules are the traditional laboratory exercises of a site based technology curriculum.

We believe we have developed a successful methodology and model for delivering the experiential educational components of a technology curriculum and that this model has broad applicability for any technical discipline.

Major Accomplishments

In the first year of a two-year project, we developed the Virtual Laboratory Exercises for an Introduction to Programmable Logic Control (PLC) class. This class teaches technicians how to program PLC's. The exercises provide an environment in which the student users can write their programs and to test them in realistic process simulations.

We developed 15 virtual laboratory exercises that test student competency in the use of fundamental instructions, combination logic, counters, timers and sequencers.

Impact

At the current time, the software has been through 'look and feel' testing with sixteen students and two faculty members. Beta testing of the complete package will begin in August with testing to include both current students and industry representatives. The Advisory Committee will have significant responsibility in facilitating this testing. We are also conducting preliminary discussions with a courseware vendor interested in distributing the final project.

Measures

We have successfully created virtual 'hands on' lab exercises that allow students to demonstrate the same competencies as they currently do in the site based exercises. We have yet to fully test the exercises on live students.

Part III. Narrative of Report:

Major achievements and progress to date.

The goal for the first year was to complete the virtual lab exercises for an Introduction to Programmable Logic Control class. In the first year of a two-year project, we developed the Virtual Laboratory Exercises for an Introduction to Programmable Logic Control (PLC) class. The class teaches technicians how to program PLC's. The virtual lab exercises provide an environment in which the users can test their programs, internal feedback when a program is not working properly and a mechanism by which an instructor can assess competencies.

We developed virtual laboratory exercises that assess student competency in the use of fundamental PLC instructions, combination logic, counters, timers and sequencers.

There are 6 Units with a total of 15 exercises. The units contain introductions written in Macromedia Authorware and simulations written in RSView - Rockwell Software's MMI package. There are 15 simulations containing 86 displays and approximately 3000 lines of code. We also completed 15 introductions to the simulations in Macromedia Authorware with approximately 180 displays, associated text and illustrations. Contained within the Authorware presentation are approximately 55 Macromedia Flash animations.

Each exercise contains an introduction with a brief review of the associated content, an assessment of content comprehension and instructions for completion of the exercise. The students must pass the assessment activities with a score of 80% or greater to access the next section.

The student activity for each exercise is to write a PLC program that meets the specified design criteria. The exercises are designed to perform specific process tasks. When the program has been written, it must be loaded into a PLC processor and tested.

PLC program testing is completed in realistic simulations of processes. The simulations have all the functionality of plant processes. The simulations are thus able to interact with the user program and test the full functionality of the program. The simulations are the heart of the exercise and have multiple functions:

1. The simulations provide an environment in which the student users can test the functionality of their programs in realistic process simulations.
2. The simulations interact directly with the PLC. The PLC program controls the observed functionality of the simulated process. Any errors in the user program will cause problems to occur in the process. The user can observe in real time how well the program is running; which functions are correct and which have bugs in them.
3. The simulations have routines running in the background that 'observes' the program activity and assess the functionality of the user program and upon request provide troubleshooting feedback to the user when the program is not responding correctly. The user can then correct the problem and retest the program.
4. Incorporated into the simulation is a reporting mechanism that informs the instructor of student progress.

We believe this model has broad applicability for the experiential or laboratory exercised of other technical disciplines.

Training and development opportunities for faculty and teachers.

At present, the only faculty involved in the project are the developers and collaborators. We will be soliciting instructors for Beta testing at the Advanced Technological Education in Semiconductor Manufacturing Convention.

Processes used in materials development including alpha testing, field testing, and validation by industry.

The concept was first presented to the advisory committee of the Controls and Manufacturing Technology Department of San Juan College. The committee also reviewed the first working prototypes.

We conducted an alpha test for 'look and feel' when we had completed the PLC Counters unit. The results of the alpha test were used to fine-tune the unit. This unit then provided the template from which the rest of the units were developed.

Field testing will be included in the Beta test scheduled to begin in August 2002. This test will be conducted with both college and industry representatives. The Advisory committee will facilitate the industry participation and be directly involved in testing, feedback and modifications made to the project.

Dissemination activities such as presentations, outreach to schools, work with other institutions, work with industry.

We will be making a presentation at the national Convention on Advanced Technological Education in Semiconductor Manufacturing. (http://atesm2002.com). We have also submitted a proposal to present the project for the Gulf Coast Process Technology Alliance and the International Process Technology Alliance.

Cisco Learning Systems has expressed significant interest the model we have developed and also indicated an interest in participating in the project at some point. Stottler Henke Associates Inc. (SHAI) has also expressed interest in the model and is willing to participating in the project. Specifically, SHAI has an Intelligent Tutor authoring system that could significantly improve the embedded feedback of the simulation.

Dissemination activities such as publications, videos, software, Web site, and major articles or publications.

The courseware is ready to package in CD version and we will be imbedding the project in Web CT for Fall 2002 delivery. We are in the preliminary discussions with Prime Media as a potential marketing agent.s

Impact information on students, faculty, and institutions, including numbers (i.e., Include information on how faculty, students, and institutions have changed and how many of each where impacted.)

It is too early to ascertain the impact or numbers. We anticipate a large audience for this project.

Awards, special contributions, major innovations, etc.

In discussions with industry representatives, it appears that using the simulations to both demonstrate and evaluate is an innovation. The simulations provide the same type of interactivity as the site based PLC class.

Evaluation activities.

Activities up to this point have been primarily formative evaluation. The advisory committee provided baseline information about the expected shortage of process technicians and the type of training required. They also provided feedback after evaluating the prototypes. The Alpha test provided additional feedback and allowed us to make mid-course corrections before finalizing the template.

We have also demonstrated the project to Cisco, SHAI, Primemedia and Rockwell Software.

Cost Sharing sources and amounts (per award letter).

Year 1 cost share was $25,530 per the award letter. Actual cost share was $28,061 with categories shifting somewhat due to a Los Alamos National Laboratory group losing funding and being disbanded and the Beta testing coming after the end of Year One.

Additional support from sources other than NSF (e.g., industry, academic, government).

No additional support came from sources outside the Cost Share contributions.

Aspects where the project is either on schedule or ahead of schedule.

The project is approximately 1 month behind schedule. We had originally planned to do the Beta testing in July. At this point the only component left to be completed is the audio recording of the soundtrack for the Authorware piece.

Small additions to or small changes to project.

No significant changes have been made to the project goals.

Difficulties in achieving milestones and potential solutions.

The primary difficulty has been hiring a graphical design technician. We hired a person about 1 month late and lost him in May. We have since selected a replacement that should start in mid July. As a result the PI has had to pick up the slack. We should be back on schedule by late August.

Major changes in scope of project

No major changes.

Significant carry-over of funds (> 20%).

Year one carry-over of funds is $11,349 due primarily to the personnel changes and delay in Beta testing.