CALIFORNIA COMMUNITY COLLEGES
AND
RANCHO SANTIAGO
COMMUNITY COLLEGE DISTRICT

#92-0026
**92-0026 --- FII --- SUMMARY**

California Community Colleges  
Curriculum and Instructional Resources Division

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**PROJECT TITLE**

**CNC Laboratory Improvement**

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<th>PROJECT DIRECTOR</th>
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<td>James R. Dunn, Instructor Machine Technology</td>
<td>Marilyn Brock, Asst Dean Science &amp; Technology</td>
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**PROPOSAL DESCRIPTION**

This proposal is a grant request. This project addresses the special learning needs of educationally disadvantaged students because it devises a means for effectively presenting complicated, technical materials to students with limited English skills. This also addresses the Board of Governors’ Agenda items of student preparation for employment and increasing underrepresented student success in vocational education by designing a manual for Computer Numerical Control (CNC) that meets the specific requirements of employers as well as takes into account the particular learning styles of culturally different and educationally underprepared students.

To alleviate these problems, this project will:

1. Develop a student manual illustrating Fanuc controls that clarifies the material presented and improves retention in the course by 20% and reduces by 25% the number of students receiving D's and F's.

2. Include in the manual curriculum materials which addresses job-related and employment requirements, gender equity and the needs of academically disadvantaged students to improve the retention of nontraditional students by 20%.

3. Pilot test the manual to ensure that it meets the measurable objectives of improving student retention and success.”
This project addresses the special learning needs of educationally disadvantaged students because it devises a means for effectively presenting complicated, technical materials to students with limited English skills. This also addresses the Board of Governors' Agenda items of student preparation for employment and increasing underrepresented student success in vocational education by designing a manual for Computer Numerical Control (CNC) that meets the specific requirements of employers as well as takes into account the particular learning styles of culturally different and educationally underprepared students.

Rancho Santiago College enrolls an average of 350 students every semester in CNC. The first course, Machine Technology 071, Program Writing, is difficult because the basic principles are presented. The attrition rate is high, an average of 45 + do not receive credit for the course; 27% receive grades of D or F, and the rest withdraw. An average of 90% of the students enrolling in this class are of Vietnamese origin and speak English as a second language. Finally, there is no textbook that teaches the specifics of Fanuc controls, the controls used by 75% of the employers, which makes the class difficult for all students.

To alleviate these problems, this project will:
1. Develop a student manual illustrating Fanuc controls that clarifies the material presented and improves retention in the course by 20% and reduces by 25% the number of students receiving D's and F's.

2. Include in the manual curriculum materials which address job-related and employment requirements, gender equity and the needs of academically disadvantaged students to improve the retention of nontraditional students by 20%.

3. Pilot test the manual to ensure that it meets the measurable objectives of improving student retention and success.

The expected outcome of this project will be a student manual that can be used by all machine technology programs teaching Fanuc controls and that have students with English as a second language or inadequate educational backgrounds.

The evaluation will include: meeting the designated development milestones, approval of the manual by the Machine Technology Advisory Committee, pilot testing of the manual in the
classroom with identified learning milestones, computer simulations of the programming work assignments, a 20% decrease in the number of withdrawals from the class and a decrease by 25% of the number of D’s and F’s earned, positive responses to a student survey which assesses clarity of the materials and relevance to the job place, and the correlation between achievement and gender, level of educational preparedness and language.

The manual and evaluation results will be disseminated to the Chancellor’s Office and ERIC. In addition, the project director will send an abstract about the manual and project to other instructors across the state. He will send a copy of the manual to interested instructors.
CNC Laboratory Improvement

1. Specific Educational Program Being Addressed

ELIGIBLE PROGRAMS AND SERVICES

This project addresses the special learning needs of educationally disadvantaged students because it devises a means for effectively presenting complicated, technical materials to students with limited English skills. This also addresses the Board of Governors’ Agenda items of student preparation for employment and increasing underrepresented student success in vocational education by designing a manual for computer numerical control (CNC) that meets the specific requirements of employers as well as takes into account the particular learning styles of culturally different and educationally underprepared students.
2. Specific Problems Being Addressed

SPECIFIC PROBLEM ADDRESSED BY THIS PROPOSAL

Computer Numerical Control (CNC) programming systems have replaced manual systems of operation in manufacturing and industrial applications. As part of this development there has been a need to train students in specific uses of these machines and the controls that operate them. Fanuc CNC controls are the most widely used controls in the western United States. This control may represent 75% of all controls currently used in California. A large proportion of newspaper advertisements for job openings in the CNC field specifically require knowledge of Fanuc controls.

Five years ago, Rancho Santiago College received a grant for $250,000, to give the Machine Technology program state-of-the-art CNC training capability. Four CNC machines were purchased that mirrored the equipment that students would use in industry. Along with these machines, sixteen computers were purchased to teach computer assisted CNC programming.

The college offers ten CNC programming courses each semester, an average of 350 students every semester. There are always waiting lists to get into these classes. The first course, Machine Technology 071, CNC Program Writing, is difficult because the basic principles are presented. The attrition rate is high, an average of 45% do not receive credit for the course, of which 27% receive grades of D or F, and the rest withdraw.

High attrition rates and low grades are a result, according to the instructors, of difficult material, the unavailability of a programming textbook that focuses on Fanuc controls and the language deficient skills of incoming students. Textbooks currently available are generic in nature, teaching CNC controls, methods and applications that are not up to date and do not meet the needs of a majority of the employers in the state. Furthermore, the operations manual provided by the manufacturer is complicated and not understood by the many non-native English speakers and the students with poor academic preparation enrolled in these courses. Additionally, many of the students enrolled in these classes are already involved in the industry and are looking for a way to acquire knowledge in a short period of time. Many of these industry-referred students have had little or no formal training and find the existing textbook impossible to comprehend.

Solution to the Problem

In response to the need for workers trained successfully in Fanuc controls, RSC proposes to develop and test a CNC programming laboratory manual specifically for Fanuc controls. The manual will address the needs of poorly prepared students. This population needs visual material rather than verbal material in order to successfully operate the Fanuc controls for the CNC equipment. This manual will improve students ability to successfully complete the CNC programming course and enable them to be readily employable in industry. In addition,
students will be able to use this manual as primary text or as reference material in all CNC courses they enroll in, as well as use it when they are on the job.
3. Population To Be Served

POPULATION TO BE SERVED

Approximately 800 students enroll in one of six CNC courses each year at RSC. Over 90% of these students are originally from Vietnam or have parents from Vietnam, and speak English as a second language. The problems these students are having in these courses are related to their lack of understanding of the language. They are better able to understand material when it is presented in a visual, diagrammatic format.
4. Objectives

PROPOSAL OBJECTIVES

- By December, 1992, develop a student manual illustrating Fanuc controls that can be used in all machine technology classes, that clarifies the materials presented and that increases student success and retention by 20% and student success by reducing by 25% the number of students receiving D’s and F’s.

- By December 1992, develop curriculum materials within the manual that will address job-related and employment requirements, gender equity, and the needs of academically disadvantaged students and that improve the retention of nontraditional students by 20%.

- By June, 1993, complete the pilot test of the manual developed, using students enrolled in Machine Technology 071. The success of this manual will be measured by a comparison of student grades from previous semesters when this material was not available, to the Spring semester ‘93 students using the new material. Program retention and job relevance will also be tracked. The expected results are that 20% more of the students will complete the course, the number of students in the lower 25th percentile will decrease and that students surveyed will indicate that the material in the new manual is relevant to their jobs.
5. Workplan Narrative

WORK STATEMENT NARRATIVE

The activities outlined on the following pages will be accomplished during the time period of July 1, 1992 through June 30, 1993. The summer and fall will be spent developing the chapters of the manual, working with the college Diversity Resources Specialist to design strategies to best portray the materials, editing the manuscript, designing the cover, and having it printed. The manual will be pilot tested during the spring semester to two classes of students. Evaluation and revision of materials will be completed by May and the final document will be ready for dissemination by the end of June.
6. Expected Outcomes

THE EXPECTED OUTCOMES

a. Objectives

1) Develop a student manual illustrating Fanuc controls that can be used in all computer machine technology courses. The manual that is completed will be used as a primary text in Machine Technology 071, the first course in CNC. It will strengthen students ability to grasp the concepts presented in this course because all concepts will be presented visually. Students continuing on in CNC will have this book to use as reference, or it may also be assigned as a text. The manual will be professional in appearance and sold in the college bookstore. The measurement of the effects on students success will be completed during the pilot test of this manual.

2) Develop curriculum materials that will address job related and employment requirements, gender equity, cultural difference, and the needs of academically underprepared students. RSC has an established Machine Technology Advisory Committee consisting of representatives from industry who will make sure that the concepts included in the manual are accurate and relevant to job requirements. Over the last two years, this college has developed a resource library for faculty that contains literature on strategies that improve gender equity in the classroom, techniques that can be used to improve the success of culturally different students, and suggestions on how to best support poorly prepared students. The project director will use these materials to develop the manual, as well as input from the college's Diversity Resources Specialist. The result will be a manual that will improve the success of all types of students, by presenting a clearer, more visual review of the subject.

3) Complete a pilot test of the manual and evaluate its success. The expected outcomes of the pilot test are a marked improvement in student retention and success, compared to previous semesters. The number of dropouts will decrease by 20% and there will be a decrease by 25% in the number of students receiving F's and D's. The relevance of the materials to the work environment will be evaluated and shown to be highly appropriate.

b. Impact of the Project

RSC hopes to fill a large gap in the instructional materials available for CNC programming courses through the development of this student manual. To date, no manual exists to train students to work with a system used by approximately 75% of the manufacturing employers in the state. In addition, the manual will be specifically designed to meet the learning needs of underprepared possibly non native English speaking, and other nontraditional students. This manual should be in great demand by
colleges other than Rancho Santiago, with courses in Machine Technology.
7. Evaluation Plan

EVALUATION PLAN
The product of this project will be a Computer Numerical Control programming student manual which will be completed by May 1993, and will be applicable in theory to all CNC (Word Address) programming, but specifically to Fanuc controls. This manual will be used for all CNC classes at Rancho Santiago College (ten class sections per semester) as either the primary text or as reference material. This manual will be made available to other community colleges that teach CNC programming with Fanuc controls.

To evaluate the development of the student manual, milestone dates have been established. The Assistant Dean of Science and Technology will meet with the project director to ensure that progress is being made by the appropriate dates.

In order to evaluate the contents of the manual the project director will pilot test the manual in two sections of Machine Technology 071, CNC Program Writing. By the end of the 16 week semester students will be expected to successfully write a functional CNC program for Fanuc controls that will include:

a. Cartesian coordinate systems
b. Traverse moves
c. Linear and circular interpolation
d. Cutter compensation
e. Tool length compensation
f. Subprograms miscellaneous G-codes for successful operation

A computer simulation run of the program will be used to determine a successful program as well as comprehension of the manual material as evidenced by the final program. The students will have fewer than two alarm messages during the simulation run to be deemed successful.

Improvement to the course as a whole will be evidenced quantitatively by a 20% decrease in the number of withdrawals from the pilot tested classes and a decrease in the number of students finishing the course in the lower 25th percentile (D's and F's).

In addition, a student survey instrument will be used to determine satisfaction with the class, perceived clarity of the manual and its relevancy to the job site. Responses to the questions regarding gender, educational preparedness and language will be correlated with achievement results to determine whether the course content actually improves the ability of disadvantaged students. These results will be presented to the advisory committee. The committee will determine whether the project met its goals and will make suggestions, if necessary, as to how the manual could be improved.

The final test will be adoption of the manual by the machine technology department as a primary or reference text in all of the CNC programming classes offered by the college.
Ongoing monitoring of the CNC programming classes to document improvement in student success will continue beyond the project period.
8. Dissemination Plan

DISSEMINATION PLAN

The project director and Assistant Dean of Science and Technology will disseminate the completed manual and evaluation results to the Chancellor’s Office and to ERIC. The project staff will also develop an abstract about the manual for distribution to all California community college deans of Vocational Education and chairs of Machine Technology programs. Upon request, a copy of the manual will be sent to any college that finds the manual potentially useful. The project director will be available by phone to assist other colleges in implementing the manual into their curriculum. The project director will explain how it was developed, how it addresses gender equity issues, how it was designed to improve the success of underprepared students, and how it can be used in any CNC programming classes.
9. Budget Narrative

[NO “BUDGET NARRATIVE” ACCOMPANIES THIS DOCUMENT.]