CALIFORNIA COMMUNITY COLLEGES
AND
VENTURA COUNTY
COMMUNITY COLLEGE DISTRICT

#92-0035
# Increasing Student Success in Remedial Mathematics Through the Use of A Self-Paced Alternative Instructional Program

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<th>FISCAL YEAR</th>
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<td>1992-93</td>
<td>92-0035</td>
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**Proposal Description**

More than half of entering community college students have been assessed at pre-collegiate math levels but over 50% of these students are not successful in completing their first math course. This project represents a 3-year effort to identify and pilot test the best methods and materials for improving student success in pre-collegiate math courses. All CA C.C. could use the project’s in-service/class products.
Increasing Student Success in Remedial Mathematics Through the Use of a Self-Paced Alternative Instructional Program

This proposal presents a model nontraditional method of instruction for remedial mathematics: the Moorpark College Self-Paced Instruction Method. The Method emphasizes individualized study plans; progressive worksheets; frequent instructor instruction and feedback; and an emphasis on building confidence in the student’s own ability to do math.

This proposal is the result of three years of effort by two of Moorpark College’s full-time math instructors to investigate and pilot test various methods and materials that can be used to teach remedial level students to be successful in Math. The two faculty members, Jane Broadbooks and Ben Rode, started with the Japanese/Kumon method and successfully adapted this method in 90-91 for Community College level instruction at the Pre-Algebra level. Follow-up research studies on participants yielded valuable feedback to the curriculum development team. They took the best parts of the Kumon method and combined them with custom textbooks, and specialized instructional and testing materials and pilot tested the adapted model in 91-92 and are proposing the implementation of this very successful adapted model of mathematics instruction at the pre-algebra, elementary algebra, and intermediate algebra level. This implementation includes a complete program design, materials development, training of instructors, and a program follow-up plan. The importance of using nontraditional methods of instruction for these courses is great. At our college, the number of students entering the elementary algebra level course is large (56%) but this group has an over fifty percent (50%) failure/noncompletion rate.

Another key feature of this Project is its cost-effectiveness. The Project Team has been granted extensive price concessions and, in some cases, free use of products, for test development software from IPS and for videos and textbooks on computer from McGraw-Hill. In addition, all pilot testing and student follow-up has been carried by the College or at the instructors' own personal costs. The Project seeks funds to train other instructors in the Self-Paced Method and to expand the method beyond the pilot stage. Continuation funds have been built into the Project. Dissemination to other colleges with similar needs is an important part of this project.
The following specific measurable outcomes are anticipated from this project:

1. Increase the overall percentage of students who successfully complete Math 9, Pre-Algebra, Math 1, Elementary Algebra, and Math 3, Intermediate Algebra (F92 vs F91) by at least 10%.
2. Document through a 1-year tracking process that a minimum of 100 students who complete Math 9, 1, and 3, Moorpark Self-Paced method, have greater success with subsequent math courses than a cohort of students with similar high school characteristics and placement test scores who took the Math 9, 1, and 3 by the traditional lecture method.
3. Reveal a higher increase in students' self-perceived self-confidence and mathematics ability for those who completed the Self-Paced Method of Math 9,1, and 3 over those who finished the traditional lecture method of Math 9. 1. and 3 in Fall 1992.
4. Double the number of instructors utilizing the Self-Paced Method in F92 math courses.
Increasing Student Success in Remedial Mathematics Through the Use of a Self-Paced Alternative Instructional Program

1. Specific Educational Program Being Addressed

EDUCATIONAL PROGRAM ADDRESSED:

Nontraditional forms and methods of instruction; improving faculty and traditional courses; and programs that address special learning needs of educationally disadvantaged and older students.

Moorpark College, like the majority of the other California community colleges, is facing an ever-escalating level of educationally disadvantaged students. The department most impacted by this increased demand for precollegiate curricula is Mathematics. However, even after additional sections of remedial courses were added to the class schedule, it became apparent to instructors that the majority of basic skills students were not only weak in mathematics but were also unprepared to succeed in the traditional lecture format that these courses were taught in.

This proposal is the result of three years of effort by two of Moorpark College's full-time math instructors to investigate and pilot test various methods and materials that can be used to teach remedial level students to be successful in Math. The resulting model, the Moorpark Self-Paced Alternative Instruction Method for Remedial Mathematics, uses a combination of student self-paced work and instructor lectures and emphasizes individualized study plans; progressive worksheets; frequent instructor feedback; and an emphasis on building confidence and facility with mathematical skills. Two of Moorpark College's full-time mathematics faculty members, Jane Broadbooks and Ben Rode, both experienced Kumon teachers, started with this Japanese-originated method and successfully adapted this method for Community College level instruction at the Math 9 Pre-Algebra level and taught three sections of Moorpark Self-Paced pre-algebra in 1990-91. Follow-up research studies on participants yielded valuable feedback to the curriculum development team and they took the best parts of the Kumon method combined with specialized textbooks, instructional and testing materials and pilot tested the adapted model on Math 9 Pre-Algebra, Math I, Elementary Algebra and Math 3, Intermediate Algebra in 91-92. Results of the pilot test were very
successful and yielded mostly A and B grades with a small number of students choosing to extend their completion into two semesters instead of one. These instructors are proposing to develop a complete set of materials and to train other instructors to also implement this method as a self-paced approach to the Math 9, Pre-Algebra, Math 1, Elementary Algebra, and Math 3, Intermediate Algebra curricula. This is especially important in these courses because they draw large numbers of beginning students but have an over 50% failure/noncompletion rate. All proposed changes are supported and have been approved by Moorpark College's Vice President of Instruction, Darlene Pacheco, the Science/Math Division Head, Floyd Martin, and the Mathematics Department Head, Christine Aguilera.
2. Specific Problems Being Addressed

SPECIFIC PROBLEM:

The high level of student nonsuccess (defined as: grade below C or withdrawal) in Math 9, Pre-Algebra, Math 1, Elementary Algebra, and Math 3, Intermediate Algebra.

Moorpark College has an enrollment of over 12,000 full and part-time students. Upon registering, students are encouraged to take placement tests in math, English, and reading. As the graph on the following page shows, fifty-six percent (56%) of those tested in 1990-91 scored at the Math 1, Elementary Algebra or Math 9, Pre-Algebra levels. Every year, between 1500 to 2000 students enroll in Math 9, Math 1, or Math 3 lecture sections, but over fifty (50) percent of students who enroll do not successfully complete the course. Counselors and instructors report that this has often led to a cycle of failure for students: noncompletion of Mathematics leads to an inability of the student to complete further work in Mathematics and Science and can also discourage students from remaining in school and completing broader educational goals.

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SENIOR DAY ASSESSMENT DATA --- MATH
Total Participants: 1,421
Math9  231 students 16%
Math 1  567 students 40%
Math 2,3  286 students 20%
Math 5,-15  266 students 19%
Math 16,25  71 students 5%

Over the last two years departmental meetings and focus groups of instructors have met to discuss the reasons behind the lack of student success and possible solutions to this extremely serious problem. Specific problems identified by these investigations are listed below, with the Self-Paced Project's solutions to the problems following in the next section:

1. Deteriorating Progress through Precollegiate Math Courses:
   Alberto Beron, MC Full-time Mathematics Instructor, has analyzed mathematics class records and has presented a strong case showing that students who do not progress well have an identifiable pattern: early success in the first part of a precollegiate math course (usually due to familiarity with or ease of material) followed by progressively deteriorating understanding which will culminate in either a late withdrawal or a failing or low averaged grade. Even if the student passes the course (sometimes resulting from instructors who allow a student to drop the grade from their lowest test score), the
student is usually unprepared to progress to the next course. Many unsuccessful students repeatedly attempt the same course because of this pattern.

2. Limitations Placed on Instructors due to the Materials Currently Available for their Courses:
A persistent problem for precollegiate math instructors is their limitation in time and funds to develop better exercises and tests for their courses. Most textbooks come in a set order of chapters with only one set of exercises and one set of tests attached. Instructors find themselves unable to meet the student requests for additional learning materials and cannot allow students to take home copies of finished tests and materials to review and learn from because the tests must be reused in the next course.

SOLUTION TO THE PROBLEM: Create a self-paced, modular Math course which allows students to move through each precollegiate course in a structured manner with the ability to succeed in each Math area before progressing to the next level.

After two years of curriculum development, pilot testing, and revision, the Project's team has created a new method of addressing the approved mathematics curricula in Math 9, Pre-algebra; Math 1, Elementary Algebra; and Math 3, Intermediate Algebra. It will solve the above problems in the following ways:

PROBLEM:

1. Deteriorating Progress through Precollegiate Math Courses:

SOLUTION:
The Self-Paced Alternative Project has developed a curriculum that allows students to approach each new concept area in their remedial math course as a separate module. Student progress is monitored weekly and students may not go on to new topic areas until they master at least 80% of the preceding concept area. Students are allowed to finish the course in one semester or to continue the course into the next semester without having to repeat modules already completed. The course provides the student with 5 hours of classwork each week: 2 hours of self-paced classwork with a teacher and assistant circulating and answering questions; 2 hours of structured instruction; and one hour of progress testing. This mix of both self-paced and lecture method is a direct result of last year's pilot testing and student evaluation of the Kumon (Japan-originated) Method of Math Instruction at Moorpark College. The Kumon Institute's completely self-paced, timed coursework (usually used with elementary and secondary-level students) was found to be only partially conducive to community college student success. The 1990-91 and 1991-92 research led the curriculum team to create a course that used the best parts of Kumon (individual worksheets and work sessions with instructors and assistants) and to follow student suggestions for less rigidity in timing tests and more structured lecture.
PROBLEM:
2. Limitations Placed on Instructors due to the Materials Currently Available for their Courses:

SOLUTION:
The Self-Paced Project curriculum team has investigated the types of texts, materials, and tests which would be best suited to a self-paced remedial math curriculum. Their primary concern was to promote student success (by finding multiple sets of materials which would allow students to take home their graded worksheets and tests) while providing instructors with enough resources to make grading and tracking of student progress viable within the constraints of up to five large remedial classrooms to teach. As detailed below, the curriculum development team has found a way of developing multiple tests, video modules, and individual worksheets at very low or no cost to the Project. This will allow the Project costs to be focused on teacher training, integration of materials into the curriculum, and follow-up and evaluation.

Two suppliers of educational texts and software have been found to be very cooperative and have entered into a commitment to this Project. First, McGraw-Hill Publishers agreed to adapt their math texts which are available on computer to the order that the curriculum revision team found most conducive to self-paced work. Next, they agreed to allow the separate printing of exercises from their books so that students could use them as worksheets. This became a successful part of last year’s pilot test. Now, McGraw-Hill has agreed to waive the fees on some of the video modules which are matched to the texts and donate them to the Self-Paced Project to allow an additional, visual support for the remedial math curriculum. The Project will test this year the best use of these video modules in reinforcing student skills.

Second, IPS Software Corporation of Oregon, has agreed to provide test generating software at very reduced costs. This software will enable Prof. Ben Rode of the Project Team to develop algorithms which can generate an infinite number of tests and subtests from each math section. Students would now be able to bring home their tests and worksheets or retake different versions of tests in areas in which they did not achieve a passing grade.

All of these Project accomplishments would be readily adaptable to other California community colleges. With the current focus on improving basic skills, the Project would be able to have a high level of impact in a short amount of time.
3. Population To Be Served

POPULATION SERVED:

As stated in the Problem description, over 56% of Moorpark College's entering students test at the Math 1 or below level. The 1500 to 2000 students served each year by these mathematics courses represent a cross section of the entire student population and an alternative instructional program has the potential to impact the majority of students who attend the College in the coming years. Students testing at Math 1 or below are entering college with weak, precollegiate-level mathematics skills and are especially at risk for dropping out or failing. The high rate of student noncompletion in Mathematics courses, especially these two lowest level courses, has led to a continual cycle of failure for the 40% noncompleters. A success-focused/self-paced model such as the Moorpark Self-Paced method could change the pattern of achievement for entry-level students who choose a Moorpark Self-Paced class over a lecture-based class. Both counselor, instructor, and student self-selection will be used to place students in the Self-paced sections and additional instructors have expressed interest in expanding the Moorpark Self-Paced offerings as demanded by enrollments. The curriculum materials will also be easily transportable to other community colleges with similar needs. Letters of support written by current and past Self-paced Project students are attached as Addenda. They reveal the wide range of students who can benefit from a self-paced curricula including: students with weak high school math skills, older adults who have been away from math studies for a time and students who need to review and complete a course in less than, or longer than one semester.
OBJECTIVES:

The primary objective of this project is to develop and implement a success-based alternative curriculum delivery system for Math 9, Pre-Algebra, Math 1, Elementary Algebra, and Math 3, Intermediate Algebra using the Moorpark Self-Paced Method, inservice faculty on the usefulness of this Method, and to track and document student success using this model. The following is a breakdown of the primary objective. Activities, target dates, responsible personnel, and budget by objective follow in the attached Work Statement.

1. Offer an alternative to the traditional lecture course in a minimum of four sections of pre-algebra, elementary algebra, and/or intermediate algebra by coordinating and implementing a proven self-paced approach called the Moorpark Self-Paced Method at Moorpark College and train at least 10 additional faculty to improve their students' success by using this Method.

2. Provide the opportunity for success of at least 100 mathematics students who are entering college with precollegiate-level skills.

3. Develop for distribution an alternative curriculum which will use an open-ended timetable for completion of the course requirements, allowing completion in greater or less than one semester if necessary.

4A. Acquire a set of 62 video tapes to be used for reinforcement of key concepts, integrate them into the Self-Paced curriculum and make them available for review at the students' convenience.

4B. Acquire appropriate test-generating software to facilitate testing and produce test algorithms for all 3 courses targeted in order to allow the return of tests for student subsequent study and reinforcement.

5. Improve the students' self confidence and attitude toward mathematics of at least 100 students as measured by the Student Self Confidence Survey.

6. Provide materials and advice to a minimum of 10 other community colleges who are considering using Self-Paced Method.
5. Workplan Narrative

[NO "WORKPLAN" ACCOMPANIES THIS DOCUMENT.]
6. Expected Outcomes

EXPECTED OUTCOMES

1. Increase the overall percentage of students who successfully complete Math 9, Math 1, and Math 3 as measured against the Fall 1991 completion rate.

2. Provide evidence that the percentage of successful student completers in the Moorpark Self-Paced Method classes (grade of C or better) is higher than the percentage successful completers in the lecture modes of Math 9, 1, and 3 as measured in the Fall 1992 semester.

3. Document through a one-year tracking process that students who complete Math 9, 1, and 3 Moorpark Self-Paced method, have greater success with subsequent college math courses than a cohort of students with similar high school characteristics and placement test scores who took the Math 9, 1, and 3 by traditional lecture method in the Fall 1992 semester.

4. Reveal a higher increase in students’ self-perceived mathematics ability and estimates of educational success for those who completed the Moorpark Self-Paced Method of Math 9, 1, and 3 over those who finished the lecture method of Math 9, 1, and 3 in the Fall 1992.

5. Increase by at least double the number of faculty who are utilizing this Method to improve student success in their courses and document their success in the Spring 1992 and Fall 1993 Math 9, Math 1, and Math 3 classes.
7. Evaluation Plan

EVALUATION:

The evaluation processes used in this project will provide for internal control by both Moorpark College Instructional Division Vice President, Darlene Pacheco, the Science and Math Division Head, Floyd Martin, and the Mathematics Department Head, Christine Aguilera. The Project Director and the two Instructors will meet on a monthly basis during the operation of the project and report to the Project Monitor in Sacramento on a monthly (phone), quarterly (written), and a final evaluation and audit of each of the objectives at the end of the project. In order to determine if the project has accomplished its objectives, the following on-going formative evaluation methods will occur:

1. Monthly progress reports by members of the instructional team to: review the operation of the model Moorpark Self-Paced Method approach, make recommendations for improvements; and review plans for adaptation and application of the approach.

2. Students in the Moorpark Self-Paced Method will be tracked for a minimum of one academic year against a cohort matched on 5 characteristics: high school g.p.a, math g.p.a, years since their last math course, math placement score and reading placement score.

3. Periodic monitoring of the number, racial and ethnic mix, sex, handicap status and age of each faculty and student user to insure that equal access and opportunity is granted to all of the College's disadvantaged.

The summative evaluation will consist of the final reports submitted by the individual project faculty team members, the students utilizing the Moorpark Self-Paced and lecture methods, and the project team committee. This report will address the achievement of the objectives as outlined in the proposal and the recommendations suggested for improvement, replication, and continuation of the project model in this County and in other locales.

Specific tracking of students using the Moorpark Self-Paced and lecture methods will be reviewed by the project's instructional and administrative members and Moorpark College's Coordinator of Research, Kathy Alfano, has agreed to provide a final analysis of data. All reports will be consolidated into a final report to the Ventura Community College District's Board of Trustees and to the State of California's Chancellor's Office.
Dissemination of this model approach to remedial mathematics instruction will be conducted in two phases:

1. Local dissemination will take place at within the Department of Mathematics with interim status reports made during the project and a final Flex Day inservice on the model made to a joint meeting of mathematics instructors from the three campuses in the Ventura County Community College District. A presentation on the success of the Moorpark Self-Paced Method will be made at the division, Faculty Senate, College Council, and Associated Student Board meetings at the end of the 1992-93 school year.

2. A workshop will be presented at the regularly scheduled state-wide California Mathematics Community College Council Meeting (CMC3) to allow instructors at other community colleges to learn about the model Project documents will be available at this time and also for distribution by mail as requested, upon approval of the Chancellor's Office Project Monitor. The monthly contacts with Chancellor's Office Project Monitor will also recommend other avenues for Statewide utilization of the Curriculum and inservice materials.

3. The Chancellor's Office will be provided with five copies of the final report, and four sets of all curriculum material and inservice products created by the Project. Additional Statewide distribution of Project Material will be completed upon recommendation of the Chancellor's Office's Project Monitor.
9. Budget Narrative

[NO “BUDGET NARRATIVE” ACCOMPANIES THIS DOCUMENT.]