SYSTEMIC REFORM IN SCIENCE PROJECT (SYRIS)

FINAL EVALUATION REPORT

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OVERVIEW

The Maricopa County Community College District's Systemic Reform In Science (SyRIS) Project is designed to contribute to the reform of teaching and learning in science throughout the district. The two-year project, which began in the year 2000 and concluded at the end of the 2001-2002 academic year, was partially supported by the National Science Foundation (NSF). The project was part of a district effort to improve student outcomes in science through changes in curriculum and pedagogy that are aligned with national systemic reform efforts in science.

The three major focus areas for the SyRIS project, as outlined in the proposal to NSF, were:

1. Selection and training of one or more peer mentors and collaborative learning teams at each of the district's community colleges,
2. Delivery of faculty development on reform initiative topics, and
3. Development of interdisciplinary science modules that include active and collaborative student learning.

The SyRIS project director, Dr. Jeffrey Pommerville, and the project management team, which consisted of prominent science faculty members at several MCCCD colleges, worked with faculty members at each college in these focus areas.

This document is the evaluation final report for the two-year project. Previous evaluation reports were submitted at the end of each academic-year semester in January 2001, June 2001, and January 2002. The present report is a summative evaluation for the spring semester of 2002. It also contains summary information from earlier semesters to provide a more complete analysis of performance across the two-year period of the project.

The remaining sections of this report briefly describe the evaluation procedures for the project, report the evaluation results for the three focus areas, and present a brief conclusion based on the project and its results.

EVALUATION PROCEDURES

A faculty member from Arizona State University and an MCCCD staff member from the Maricopa Center for Learning and Instruction served as the SyRIS evaluators throughout the project. The evaluators wrote the evaluation plan for the project, developed several of the data-collection instruments, collected the data or arranged for its collection, summarized it, and wrote the evaluation reports. They also attended the peer mentor meetings and consulted regularly with the project director to obtain his advice and reviews of the evaluation plan and instruments.

The primary focus of the evaluation was on the development and field-testing of the interdisciplinary science modules because development of these modules was the most complex and difficult project task. The evaluators consulted with members of each collaborative learning team on the development of an assessment instrument to measure student learning from their module. They also constructed a student survey to assess student attitudes toward each module and an instructor survey to assess instructor attitudes.

Typically, one or more members of the collaborative learning team that developed a module served as the instructor for its field test. Several of the modules were field tested in more than one class, with a different instructor for each class. The student performance data and the student and instructor attitude data were all collected at the end of the field test, except in cases where the student performance data were based on performance on a field project or in class project rather than a test.

RESULT

The results for the 2002 spring semester, supplemented in part by results from the earlier semesters of the project, are reported in this section. The results are reported for the three major focus areas of the project, first for development of the interdisciplinary science modules, then for peer mentors and collaborative learning teams, and finally for faculty development.

Module Development

A total of nine interdisciplinary science modules were developed during the 2001-2002 academic year by the eight participating colleges, two by separate collaborative teams at one college and one each by the teams at the seven other colleges. This brought the number of modules developed across the two-year period of the project to seventeen. A list of the titles of the 17 modules developed during the project is contained in Appendix A.

All nine of the science modules developed during the 2001-2002 academic year were field tested during the spring semester at the college at which they were developed. Approximately 450 students from 21 classes participated in the field tests of the nine modules. This brought the total number of students participating in the field tests of the 17 modules developed over the two-year period of the project to approximately 850.

Each module was revised following its field test, and the final version of its instructor guide was also developed. Thus, at the minimum each module consisted of a student booklet and instructor guide. Several modules also contained other instructional aids such as PowerPoint presentations and posters.

The data collected during the field tests of the nine 2001-2002 modules are reported below for student achievement, student attitudes, and instructor attitudes.

Student Achievement. Student achievement scores on the module posttests were submitted to the evaluators from four of the nine 2001-2002 field tests. The mean achievement scores from these field tests are reported in Table 1 in order from highest to lowest score. The overall mean was calculated by assigning equal weight to the mean for each college irrespective of its number of participating students.

Table 1. Module Mean Posttest Scores by College

College	No. of Class Sections	Total Students	Mean Posttest Score
1	1	12	96%
2	2	54	83%
3	2	38	71%
4	1	14	68%
Totals	**6**	**118**	**80%**

Table 1 reveals that student posttest achievement averaged 80% for the four modules on which achievement was reported. The mean posttest score by college ranged from a high of 96% to a low of 68%.

Mean posttest scores were previously reported in the January 2002 report for all eight modules developed during 2000-2001, the first academic year of the project. The mean score for 377 students participating in the field test of these modules was 84%. The overall posttest mean for the 12 field tests for which posttest scores were recorded and submitted to the evaluators over the two-year period was 83%.

Student Attitudes. Student attitude ratings were assessed at the end of the field test of each module using an attitude survey that contained 18 5-choice Likert-type items and three open-ended items. Responses to the Likert-type items were scored from 5 (strongly agree with each positive statement) to 1 (strongly disagree with the statement). The student attitude ratings are reported in this section in two ways: for each of the nine modules developed and field-tested in 2001-2002 and for each item on the survey.

The student attitude ratings on the 18 Likert-type items across all nine modules are shown in Table 2. The table shows that the mean rating for the nine modules was 4.04, with six modules being rated above 4.00 (agree with positive statements about the module) by the students

participating in the field test. The highest-rated module had a mean rating of 4.34 and the lowest-rated one was rated 3.57.

Table 2. Student Attitude Ratings for Each Module

Module Rank	Number of Students	Module Rating
1	15	4.34
2	21	4.31
3	44	4.27
4	45	4.08
5	52	4.02
6	47	4.01
7	30	3.96
8	128	3.83
9	54	3.57
Totals	**446**	**4.04**

Student attitudes were also calculated on an item-by-item basis across the 18 Likert-type items on the survey. These ratings by item are shown in Table 3, accompanied by the most common responses to the three open-ended items at the end of the survey.

Table 3. Student Attitude Rating by Item

Item	Mean Rating
1. The module was well organized.	3.97
2. I understood what I was supposed to learn in this module.	3.98
3. The module content was appropriate for me personally.	3.83
4. The content of the module was important for me to learn.	3.90
5. The instructor knew the module content well.	4.54
6. The teaching for this module was better than the teaching in most of my courses.	3.63
7. The teaching method for the module was a good way for me to learn.	3.86
8. I was actively involved in the learning process during much of the module.	4.10
9. I worked cooperatively with other students during much of the module.	4.37
10. There was enough opportunity to interact with the instructor.	4.27
11. There was enough opportunity to interact with the students.	4.24
12. The class worked on real-world problems in this module.	3.96
13. I learned a lot in this module.	3.77
14. I would recommend this module to other students.	3.81
15. I liked this module.	3.88
16. I can think of ways to apply what I learned in this module to other situations.	3.70
17. What I learned in this module is relevant to my real life.	3.57
18. I will use what I have learned in the future.	3.62
Overall mean	**3.94**

19. What did you like best about the module?
The content/information (N=53)
Group work (48)
Hands-on activities (18)
Real-life content/problems (15)
Field trips (15)

20. What did you like least?
It was disorganized/confusing (N=24)
Not enough time (18)
Group work (14)

21. What could be done to improve the module?
Better organization/information/explanation (N=35)
More time (22)
Nothing (18)

Table 3 shows that the overall mean rating on the student attitude survey, when calculated on an item-by-item basis, was 3.94. This rating is just slightly below an average (4.0) indicating that students agree with positive statements about the module. The highest-rated item at 4.54 was

"The instructors knew the module content well." Students indicated agreement that they worked cooperatively with other students (4.37) and that they were actively involved in the learning process (4.10). The lowest-rated items, which still received ratings closer to "agree" than to "neutral or no opinion," were "What I learned in this module is relevant to my real life" (3.57) and "I will use what I learned in the future" (3.62).

The mean student rating for the 396 students who rated the eight 2000-2001 modules was 4.08. Thus, the student ratings of the 17 modules developed over the two-year period of the project were approximately 4.0.

Instructor Attitudes. Table 4 shows the results of the Instructor Attitude survey submitted by 12 field-test instructors after they had completed the field test of their module. The overall rating of 4.52 on the eleven Likert-type items falls midway between "strongly agree" and "agree" on the five-point scale. The instructors rated all eleven items above 4.0. They agreed most strongly (4.76) that "The material is worthwhile for students to learn." They also agreed strongly that they liked the module (4.62), would use it again (4.57), and would recommend it to other instructors (4.57).

The overall instructor mean rating for the eight modules developed during the 2000-2001 academic year was 4.41. The instructor mean rating across all 17 modules, therefore, fell between 4.4 and 4.5.

Table 4. Instructor Attitude Ratings by Item

Item	Mean Rating
1. The material is worthwhile for the students to learn.	4.76
2. The module was well organized.	4.52
3. The module outcomes were clearly stated.	4.57
4. I received adequate directions for teaching the module.	4.48
5. The instructor manual was easy to use.	4.33
6. The individual practice helped students learn.	4.40
7. The group activities were effective in helping students learn.	4.33
8. The materials were interesting and appealing.	4.52
9. I would use this module again.	4.57
10. I liked this module.	4.62
11. I would recommend this module to other instructors.	4.57
Overall mean	**4.52**

The module was: Too easy (N=0) About right (N=12) Too difficult (N=0)

What was the major strength of this module?
Its content/relevance (N=6)
Amount/realism of the student practice (3)

What was its major weakness?
Students lacked the basic skills/students didn't get it (N=2)

Peer Mentors and Collaborative Learning Teams

Nine new collaborative learning teams were organized at the eight MCCCD colleges to carry out the module development for the 2001-2002 academic year, with each team including a peer mentor from its campus. Five teams had new peer mentors who did not serve in that role during 2000-2001. The peer mentors for the other four teams also served as peer mentors during 2000-2001.

Thirty-eight MCCCD faculty, 26 of whom were new to the SyRIS Project this year, participated either as peer mentors or other members of the nine collaborative teams throughout academic year 2001-2002. The 26 new members, combined with the 30 faculty participants from

the first year of the project, brought the total number of peer mentors and collaborative learning team members to 56 over the two-year period.

The peer mentors and many of the new collaborative team members for 2001-2002 received initial training for their work at a one-day workshop conducted by the project director early in the fall semester. The peer mentors received further training and information related to systemic reform in science concepts and the SyRIS project at peer mentor meetings conducted twice a semester by the project director. Each peer mentor coordinated the work of the collaborative learning team at his/her college throughout the school year. In addition, the project director and/or the SyRIS internal evaluator met with each collaborative team for further training and information sharing at least twice during the academic year at the team's own college.

Faculty Development

The major activity related to faculty development during the spring semester of 2002 was the continuing work of the 38 science faculty members in developing, field testing, and finalizing their interdisciplinary science modules. Project records indicate that the nine peer mentors averaged 150 hours each in SyRIS training, working on their science module, and other SyRIS activities during the school year. The 29 other collaborative learning team members spent an average of 100 hours each on the same activities during the year.

Twenty-six of the 38 collaborative team members for 2001-2002 were new to the project this year. These 26 new members, combined with the 30 faculty participants from 2000-2001, brought the total number of peer mentors and collaborative team members to 56 over the two-year period on the project.

The time that peer mentors and collaborative learning team members spent on module development, their primary SyRIS activity, included a considerable amount of experience with science concepts related to the systemic reform movement. Each module was designed by the

learning teams to include cooperative learning groups and active learning. That these features were successfully incorporated into the modules is indicated by the fact that "I worked cooperatively with students during much of the module" was rated second highest (4.37) of the 18 items on the student attitude survey and "I was actively involved in the learning process during much of the module" was rated fifth highest (4.10).

In addition to the faculty development associated with development of the 17 science modules, three SyRIS faculty development workshops were conducted on reform initiative topics during the 2000-2001 academic year. Two workshops were on cooperative learning and one was on technology-integrated learning systems. A total of 53 participants attended the workshops.

Faculty activities related to the project also included presentations at national conferences. The SyRIS project director and participating faculty delivered three professional papers or workshops on science reform issues based on the project at national science conferences.

CONCLUSION

The results described herein and in earlier evaluation reports on the SyRIS project reveal that the project was quite successful in attaining its primary goals. These goals were to select and train one or more peer mentors and collaborative learning teams at each of MCCCD's colleges, provide faculty development on science reform initiative topics, and develop interdisciplinary science modules that incorporate active and collaborative student learning.

Undoubtedly, the most impressive accomplishment of the project was the development, field-testing, and revision into final form of the 17 science instructional modules. The module development was the driving force for the achievement of all three project goals. Development of the modules provided the rationale for the formation of the collaborative learning teams at each campus. Faculty training and participation in developing the modules was the primary activity contributing to faculty development on science reform initiative topics such as active and

collaborative learning. The general success of the modules was indicated by average posttest scores above 80% and by favorable student and instructor attitudes toward them.

The conclusion of the NSF-funded period of support for the SyRIS project raises certain questions about future MCCCD activities related to the project. These include:

1. What should be done to promote and distribute the science modules in the district?
2. What, if anything, should be done to market and distribute them nationally?
3. What, if anything, should the district do to capitalize on the success of the SyRIS project in an effort to obtain additional funding for the improvement of science instruction?

Careful consideration and appropriate actions based on questions such as these should help to determine the extent to which the SyRIS project has a continuing positive impact on science instruction in and beyond the Maricopa County Community College District.

APPENDIX A
SYRIS INTERDISCIPLINARY SCIENCE MODULES

2000-2001 MODULES

Catch the Waves
Chandler-Gilbert Community College

Water Purification
Estrella Mountain Community College

Energy and Thermodynamics
GateWay Community College

Global Warming
Glendale Community College

Cells As Digital Images: An Investigation
Mesa Community College

UV Radiation and Effects of Sunblocks
Paradise Valley Community College

The Problem with Pesticides
Scottsdale Community College

Don't Drink the Water
South Mountain Community College

2001-2002 MODULES

The Power of the Exponent: A Case Study
Chandler-Gilbert Community College

A Treasure Lost: Was the Site Viable for Copper Mine?
Estrella Mountain Community College

Breathless—A Disease Investigation
GateWay Community College

Evolution: The Only Constant Is Change
Glendale Community College

Enzyme Activity and Computer Modeling
Glendale Community College

Earth Fissures: Arizona's Crack Problem
Mesa Community College

Aerobic Fitness
Paradise Valley Community College

The Science of Survival: Thermal Exchange Across Surfaces
Scottsdale Community College

Air Pollution and Acid Rain
South Mountain Community College