

Systemic Reform In Science Project

**Evaluation Report
2000-2001 Academic Year**

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June 30, 2001
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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 project, which is partially supported by the National Science Foundation (NSF), is part of a district effort to improve student outcomes in science through changes in curriculum and pedagogy that are aligned with national systemic reform initiatives.

Three major focus areas for the SyRIS project are:

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

The SyRIS project director and the project management team, which consists of key science faculty from several MCCCDC colleges, work with the faculty at each campus in these focus areas.

The original proposal to NSF called for nine MCCCDC colleges to participate in the SyRIS project. However, one of these colleges, Rio Salado, was unable to participate because, as a distance-learning campus, it does not have an adequate number of full-time science faculty to work on the project. This has the effect of reducing the number of participating colleges to eight. Accordingly, the project management reduced the number of interdisciplinary science modules to be developed for the two-year project to 16, based on two modules per college.

This document is the evaluation report prepared by the project evaluators for academic year 2000-2001, the first year of the project. The purposes of the report are 1) to present an audit and

evaluation of progress on the project for academic year 2000-2001 and 2) to provide recommendations for activities that may contribute to the future success of the project. An earlier status report was prepared by the evaluators and submitted to the SyRIS project director in January 2001.

The remaining sections of this report briefly describe the evaluation procedures used to date, report the evaluation and audit results in three focus areas of the project, and discuss these results and their implications for future project activities.

EVALUATION PROCEDURES

Two evaluators, an internal MCCCDC staff member from the Maricopa Center for Learning and Instruction and a faculty member from Arizona State University, serve as the SyRIS project evaluators. The evaluators performed a number of tasks during the 2000-2001 academic years, culminating in the writing of this report. As part of their duties, the evaluators consulted regularly with the SyRIS project director to obtain his advice and reviews of the evaluation plans and instruments.

The first task for the evaluators was to develop an evaluation plan for the two-year period of the SyRIS project. The evaluation plan was based primarily on a Project Management and Monitoring Plan, which the evaluators derived in modified form from the MCCCDC proposal to NSF. This plan served as the basis for evaluation activities and will continue to guide subsequent activities and reports.

The January 2001 evaluation status report covered SyRIS activities to that time in selection and training of peer mentors and collaborative learning teams at each campus, faculty

development, and development and implementation of the interdisciplinary science modules. The results for this earlier period are described very briefly in the results section of this report.

The primary emphasis of the SyRIS project during the spring semester of 2001 was on development and field-testing of the modules. Evaluation data were collected on the stage of development of the modules and on the field-testing of the modules that were field-tested during the semester. Attitude data were also collected on one of the two faculty development workshops held during the semester.

RESULTS

The results for academic year 2000-2001 are reported below for the three major focus areas of the project, first for module development and implementation, then for peer mentors, and finally for faculty development.

Module Development and Implementation

The timeline for development of the first eight SyRIS modules called for the modules to be developed, field-tested, and revised by the end of the spring semester of 2001. These eight modules were then to be available for general use by the beginning of the fall semester of 2001. The remaining eight modules were to be developed during the 2001-2002 fiscal year, the final scheduled year of the project.

Six of the eight participating colleges developed their modules to the point where they were ready for field-testing, conducted field-tests with them during the spring semester, and submitted their field-test data to the project director or evaluators. The field-tests were conducted in a total of 15 class sections, ranging from one section to five separate sections per college, at the

individual colleges where the modules were developed. Approximately 320 students participated in the field- tests. At the colleges where multiple sections were involved, the sections typically represented different subject-matter areas. For example, at the college where five sections participated, two sections were in Biology and one each in Physics, Chemistry, and Engineering.

One of the two remaining colleges also field-tested its module during the spring semester, but has not submitted data from its tests as yet. The other college did not conduct a field-test of its module during the 2000-2001 academic year.

Student Achievement. Student achievement data were collected for three of the six modules during their field-tests. All three of these modules were field-tested in multiple sections at their respective colleges. The mean percentage scores for student achievement at each of the three colleges are shown in Table 1.

Table 1. Module Mean Test Scores by College

College	Number of Sections	Total Students	Number of Items	Pretest Score	Posttest Score
1	2	21	25	N/A	87%
*2	1	30	30	N/A	83%
	2	58	21	N/A	80%
	2	36	20	N/A	77%
3	5	88	10	46%	63%

*Note: Scores are reported separately by subject area for this college because the number of test items varied by area.

Table 2 reveals that the mean posttest scores across the three schools ranged from a high of 87% to a low of 63%. It is inappropriate to compare these scores across colleges, of course, because no effort was made to coordinate development of the tests or to attempt to equate the test

difficulty across modules. The tests undoubtedly varied with regard to their difficulty as well as with regard to student performance on them.

Student Attitudes. Student attitudes toward the modules were assessed using a 19-item attitude survey consisting of 16 five-choice Likert-type items and three open-ended questions. The response choices on the Likert-type items ranged from “strongly agree” (scored as 5) to “strongly disagree” (scored as 1) with positive statements about the module.

The number of subjects completing the survey and the overall mean attitude rating for each module are shown in Table 2 below in descending order from the highest-rated module to the lowest-rated one.

Table 2. Student Attitude Ratings for Each Module

Module Rank	Number of Students	Mean Rating	Module Rank	Number of Students	Mean Rating
1	32	4.53	4	104	4.09
2	24	4.46	5	44	4.04
3	94	4.16	6	24	3.96
			Totals	322	4.16

The table shows that the overall mean rating across all six modules was 4.16, a rating somewhat above the choice of “agree” (scored as 4.0 on the five-choice Likert-scale) in response to the positive statements on the survey. The table also shows that two modules were rated very highly, 4.53 and 4.46, by participants in the field-tests at the colleges where they were developed. The ratings of the lowest-rated modules were also positive, falling very near the 4.0 level of agreement.

The student attitude data from the field-tests were also summarized across all six field-tested modules on an item-by-item basis. The mean rating for each item, based on a 5 (“strongly agree”) to 1 (“strongly disagree”) scale, is shown in Table 3 on page 8.

Table 3 indicates that the overall mean rating across all 16 items was 4.16, of course, because it is based on the same student ratings as the data in Table 2. The two highest-rated items, both of which were rated above 4.50, were for the statements “The instructor knew the content well” (mean=4.68) and “I worked cooperatively with other students during the module” (4.52). The two lowest ratings were for the last two items on the survey, “What I learned in this module was relevant to my real life” and “I will use what I learned in the future,” both which had mean ratings of 3.86. The three items that are perhaps the strongest general indicators of students’ attitudes toward their module (“I learned a lot in the module,” “I would recommend this module to other students,” and “I liked this module”) received similar ratings of 4.04, 4.06, and 4.04 respectively. These three ratings are very slightly above the “agree” level on the scale.

Students also answered three open-ended items asking them what they liked best about the module, what they liked least, and what could be done to improve the module. The most common responses for “what students liked most” were the realistic or real-life content, working with other students or with a group, lab experiments and demonstrations, and hands-on activities. The most frequent response to what they liked least was working with others or with a group. Responses to the “what could be done to improve the module?” question were too module-specific to be useful generally.

Table 3. Student Attitude Ratings by Item

Item	Mean Ratings
1. I understood what I was supposed to learn in this module.	4.21
2. The concepts in the module were important for me to learn.	4.21
3. The instructor knew the module content well.	4.68
4. The teaching for this module was better than the teaching in most of my courses.	3.92
5. The teaching method for the module was a good way for me to learn.	4.24
6. I was actively involved in the learning process during much of the module.	4.30
7. I worked cooperatively with other students during the module.	4.52
8. There was enough opportunity to interact with the instructors.	4.23
9. There was enough opportunity to interact with other students.	4.26
10. The class worked on real-world problems in this module.	4.18
11. I learned a lot in the module.	4.04
12. I would recommend this module to other students.	4.06
13. I liked this module.	4.04
14. I can think of ways to apply what I learned in this module to other situations.	3.94
15. What I learned in this module is relevant to my real life.	3.86
16. I will use what I learned in the future.	3.86
Overall Mean	4.16

17. What did you like best about the module?
 The most common responses to this question are shown below.
- The content was realistic or related to real life.
 - Working with other students or with a team or group.
 - Lab-experiments and demonstrations.
 - Hands-on activities.
18. What did you like least?
- Group projects/working with others.
19. What could be done to improve the module?
- Responses to this question were too module-specific to be useful generally.

Instructor Attitudes. Each instructor who taught a module during the field-tests filled out an instructor attitude survey after the test of his/her module. The field-test instructors in nearly all cases were SyRIS peer mentors or collaborative team members who participated in development of the module for their own college. A total of 16 instructors, 15 who taught a field-tested module and one who was on the module-development team and observed its field-test but did not teach it, completed the survey. The instructor responses to the survey are summarized in Table 4.

Table 4 reveals that the overall mean rating by instructors on their attitude scale was 4.38, a positive rating falling between the “agree” and “strongly agree” levels on the 5-point Likert-type scale. The highest levels of agreement were with the items “The material is worthwhile for students to learn” (mean=4.75), “The materials were interesting and appealing” (4.56), and “I liked this module” (4.56). The lowest-rated item was “The instructor’s manual was easy to use,” with a mean rating of 3.81. As major strengths of the module, three instructors each cited the laboratory experiment, hands-on student activities/active participation, and the interdisciplinary nature of the instruction. Three instructors also reported a major weakness to be either time required by the module or that the recommended time was too short.

Peer Mentors

The proposal to NSF called for one faculty member from each participating college to be selected and trained as a peer mentor. Each peer mentor was to form a collaborative learning team at his/her campus that would develop and implement an interdisciplinary science module at the campus.

Table 4. Instructor Attitude Ratings by item

Item	Mean Ratings
1. The material is worthwhile for the students to learn.	4.75
2. The module was well organized.	4.38
3. The module outcomes were clearly stated.	4.13
4. I received adequate directions for teaching the module.	4.19
5. The instructor's manual was easy to use.	3.81
6. The individual practice helped students learn.	4.43
7. The group activities were effective in helping students learn.	4.50
8. The materials were interesting and appealing.	4.56
9. I would use this module again.	4.50
10. I liked this module.	4.56
11. I would recommend this module to other instructors.	4.38
Overall Mean	4.38

12. The module was too easy (N=1) About right (N=14) Too difficult (N=1)

13. What was the major strength of this module?

- The laboratory experiment. (N=3)
- Hands-on student learning/active participation. (3)
- Interdisciplinary instruction/integrating different disciplines. (3)
- Allowed students to apply/learn concepts covered in lecture/module. (2)

14. What was the major weakness of this module?

- Time required/recommended time too short. (3)
- One instructor commented that she questioned the entire module approach and believed it would be better to undertake the task of designing a two-semester interdisciplinary course.

15. How might this module be improved?

- Responses were too module-specific to be useful generally.

The peer mentors at each of the eight colleges were selected and trained at a two-day workshop at the beginning of the fall semester, as described in the January 2001 evaluation status report. Each peer mentor formed a collaborative learning team at his/her campus, and the peer mentor and learning team at each campus developed the module for their campus and were responsible for its field-test. The team members collected the achievement data for their own field-test using a test that they developed for their module and collected the student and instructor attitude data using surveys developed by the project evaluators. The project directors held monthly meetings with the peer mentors and collaborative learning teams throughout the 2000-2001 academic year.

Near the end of the academic year, the peer mentors and collaborative team members were asked to complete a survey assessing their perceptions of the SyRIS project for the 2000-2001 academic year. The responses of the 15 participants who completed the survey are summarized in Table 5 on the following page.

Table 5 reveals that the mean rating on the six Likert-type items on the survey, scored from 5 for “strongly agree” to 1 for “strongly disagree,” was 3.97, which corresponds closely to a response of “agree” with the positively stated items on the scale. The highest-rated item was “The faculty development opportunities were worthwhile,” with a mean rating of 4.38. The two lowest-rated items were “The criteria for module development were clearly defined” and “The module development guidelines were easy to follow,” both with mean ratings of 3.60.

The survey also contained two open-ended questions and one multiple-response item. The most common responses (N=2 for each) to the question “What type of support from SyRIS worked least for you?” were: availability of the other instructors and interactions with them, availability and support of peer mentors, and individual meetings with Jeff and Maria. The most

Table 5. Peer Mentor and Team Member Ratings of SyRIS Project

Item	Mean Ratings
1. The goals of SyRIS were clear to me.	4.20
2. As a peer mentor, I understood clearly what was expected of me.	3.86
3. As a collaborative team member, I understood clearly what was expected of me.	4.27
4. The criteria for module development were clearly defined.	3.60
5. The module development guidelines were easy to follow.	3.60
6. The faculty development opportunities were worthwhile.	4.38
Overall Mean	3.97

7. In general, the amount of information provided was:
 not enough: 2 adequate: 12 too much: 1
8. In general, the amount of guidance was:
 simple: 1 moderately complex: 14 too complex: 0
9. What type of support from SyRIS worked best for you?
- Availability of other instructors and interactions with them. (N=2)
 - Availability and support of peer mentors. (2)
 - Individual meetings with Jeff and Maria. (2)
10. What can we do to improve the process for next year?
- Provide examples of good modules/development sequence. (3)
 - Make expectations, criteria, guidelines clearer. (3)
 - Keep additional tasks/requirements/expectations to a minimum. (3)
 - Hold shorter/fewer meetings of entire group. (3)
 - Hold more college-specific/face-to-face meetings. (2)
11. Which of the following would you like to see offered?
- Provide a short description of the eight modules developed this year. (14)
 - Provide one or two model sets of module specifications from this year. (12)
 - Provide one or two model interdisciplinary science modules from this year. (10)
 - Meet individually with your team on its planned module early in the year. (10)
 - Provide a list of faculty development workshops to be offered. (10) during the year.
 - Hold an assessment workshop for all peer mentors and team members. (10)
 - Provide a complete copy of all modules developed this year. (7)
 - Meet individually with your team on your assessment plan and data collection. (7)

frequent responses (N=3 for each) to the question “What can we do to improve the process for next year?” were: Provide examples of good modules/development sequence, make expectations/guidelines clearer, keep additional tasks and requirements to a minimum, and hold shorter/fewer meetings of the entire group.

The multiple-response item on the survey asked the question “Which of the following would you like to see offered for next year?” Fourteen of the 15 respondents wanted a short description of the eight modules developed this year. Twelve also wanted one or two model sets of module specifications from this year. Ten respondents each requested one or two model modules from this year, a list of faculty development workshops to be offered during the year, an individual meeting with their team on its planned module early in the year, and an assessment workshop for all peer mentors and team members. Seven respondents wanted an individual meeting with their team on its assessment plan and data collection.

Faculty Development

The faculty development events called for in the NSF proposal during academic year 2000-2001 included conducting faculty development workshops, linking with other Phoenix-area NSF projects, and accessing Maricopa County Community College District internal faculty development resources. Two faculty development workshops on science-reform initiative projects were held during the fall 2000 semester, linkages were established with other NSF-funded science and technology projects, and MCCCDC internal faculty development resources were accessed to assist with project instruction and assessment. These activities are described in greater detail in the January 2001 evaluation status report.

Two faculty development workshops, one on cooperative learning and one on multiple intelligences, of approximately three hours each in length, were held during the spring semester of 2001. Twenty-three faculty members attended the cooperative learning workshop and 67 persons attended the multiple-intelligences one. The latter workshop was opened to a broader audience and many of its attendees were not MCCC faculty members. SyRIS also offered a cooperative learning workshop during the fall semester, so the spring workshop was the second one on this topic.

Participant survey data were collected at the cooperative learning workshop but not at the multiple-intelligences one. The 11-item survey consisted of seven four-choice Likert-type items, scored from 4 (“strongly agree”) to 1 (“strongly disagree”), and four open-ended items. Only 11 of the 23 participants completed the survey. The overall rating of the workshop across all seven Likert-type items was 3.78, a very positive rating closest to the “strongly agree” level. What the participants liked best about the workshop were learning/sharing ideas (N=3) and working with others/new people (3). To implement learning strategies in their courses, participants indicated that they would like consultation (N=4), more workshops (3) and materials (3). A workshop on problem-based learning (2) was the only other type cited by more than one person as a topic that they would like to see offered.

DISCUSSION

The SyRIS project has three major focus areas: selection and training of peer mentors and collaborative learning teams, faculty development on science reform initiative topics, and development and implementation of interdisciplinary science instructional modules. The primary focus of the project during much of the 2000-2001 academic year was development and field-

testing of the modules. The selection and training of the peer mentors was completed early in the project, and the faculty development process is less demanding and perhaps less challenging than development and implementation of the modules.

The first-year goal of developing, field-testing, and distributing one module per campus has been only partially achieved. Modules were developed at all eight participating campuses and field-tested at seven, with six reporting field-test data. However, none of the eight modules is in a suitable form for distribution at this time. A uniform format has not been established for the modules, and the task of developing them in a final common format remains to be done. That task should be completed prior to distribution of the modules as described in the NSF proposal.

The field-testing did reveal certain positive aspects of the six modules for which data were collected and submitted. Student attitudes toward the modules were quite favorable, averaging somewhat above the “agree” level on positive statements about the modules. A number of students reported that they liked the modules because the content related to real-life and because of the laboratory experiments and hands-on activities. Several students also liked working with a cooperative group or with others, although other students reported that this was what they liked least about their module.

The favorable instructor attitudes toward the modules were another positive aspect of the field-tests. Instructors agreed quite strongly that they liked the module they taught, and several cited the laboratory experiment, hands-on student activities, and the interdisciplinary nature of the instruction as module strengths. Certainly these strengths are consistent with the reform-initiative intent of the SyRIS project.

The student-achievement data from the field-test had both positive and negative aspects. Student posttest scores averaged a very respectable 87% and 80% for two of the modules. The

posttest mean score on a third module was 63%, which represented a modest gain over the pretest mean of 46%. However, the fact that student achievement data were collected in only three of the six modules is a disappointing indication that further work remains to be done on the assessment component of the modules.

The project director and management team were successful in selection of peer mentors at each of the eight participating campuses and the peer mentors successfully formed a collaborative learning team at each campus. Much of the initial training of the peer mentors and learning teams took place early in the fall semester, although some additional training and technical assistance activities occurred at the monthly meetings and at meetings at individual colleges during the year.

The most commonly expressed needs of the peer mentors and learning team members were reflected in their end-of-year responses to the SyRIS project survey. Their ratings were relatively low (mean=3.60), but still on the positive side, on survey items dealing with the criteria and the guidelines for module development. On open-ended items, several respondents requested examples of good modules and clearer guidelines or expectations for next year. Respondents also asked that additional tasks and expectations be kept to a minimum and that fewer and/or shorter group meetings, and perhaps more individual campus meetings, be held. Peer mentors and team members indicated on their multiple-response item that, among other things, they would like to have one or two model modules from this year, a meeting early in the year with their own team on its planned module, and an assessment workshop or individual assessment meeting with their own team.

SyRIS-sponsored faculty development opportunities on science reform initiative topics were limited for district science faculty generally, as contrasted with those participating in the SyRIS

project. Three part-day workshops were held on reform initiative topics during the year, two on cooperative learning, and one on technology-integrated learning systems. A total of 57 participants attended these three workshops. Attitude surveys administered at the two cooperative learning workshops indicated that participants had very positive attitudes toward them. In addition to the three reform initiative workshops, the SyRIS project also offered a well-attended workshop on multiple intelligences.

A Science Method Survey completed by 63 full-time and part-time district science faculty during the fall semester revealed that more than half the respondents reported that they would like to learn more about active learning, collaborative learning, problem-based learning, web-based learning, and case studies. The first three or four of these topics are science reform initiative areas that are potentially appropriate for faculty development activity. The project director and management team may want to consider these topic areas to expand faculty development opportunities in the second year of the project.

The development and distribution of the science modules and the number of faculty development opportunities at the end of the 2000-2001 academic year are somewhat behind the schedules included in the MCCCCD proposal to NSF. Several steps could be taken in the summer and fall of 2001 to address this situation. The evaluators offer the following recommendations for potential improvements in the project, most of which were suggested by SyRIS peer mentors and collaborative team members either on the field-test instructor survey or on the SyRIS project evaluation.

1. Establish a common format for the modules soon in order to facilitate their final development and dissemination for use in the district. The format should include incorporation of instructor notes or an instructor guide into the module.

2. Provide each college team with an example of a good science module from this year that uses the desired format.
3. Provide training or technical assistance that will enable each team to complete their 2000-2001 module and develop their 2001-2002 module using the common format. An alternative for completing the 2000-2001 modules, which may be less acceptable in several ways, is to convene a small development team to finalize all eight modules.
4. Conduct early planning for the eight 2001-2002 modules to provide coverage of important science content areas and to minimize redundancy of content across areas.
5. Conduct early planning to identify several faculty development workshops, possibly including one or more workshops on the new modules that will diversify and expand development opportunities for MCCCCD science faculty.
6. Consider the possibility of holding fewer group meetings with all peer mentors and team members and instead hold more meetings with individual college teams on their own modules and module assessment.

The goals of the SyRIS project, especially the development and distribution of the 16 interdisciplinary science modules, present a formidable challenge. The recommendations presented above are intended as suggestions that could help the project management team in their efforts to successfully meet that challenge.