

Trinity University and the Associated Colleges of the South
Fifth and Final Report to
The W.M. Keck Foundation of Los Angeles
The Reform of Introductory Science Courses for Non-Science Majors Program
June 30, 2007

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Report to the W.M. Keck Foundation of Los Angeles
Reform of Introductory Science Courses for Non-Science Majors Program
June, 2007

Trinity University and the Associated Colleges of the South present the fifth and final report on the program activities made possible by a grant awarded on June 12, 2003, by the W. M. Keck Foundation of Los Angeles. This report covers the six-month period ending June 2007.

We thank the Foundation for their support and for granting the requested one year grant extension to June 2007. All funds have been expended.

1. Progress Since Last Interim Report Dated January 2007

a. Program Committee membership

Program Committee membership remained stable in the 2006-2007 academic year. The committee membership roster for 2006-2007 is attached in Appendix A.

b. Science Education Reform Initiative Planning Meeting

Following up on the larger Science Reform in K-16 Education Meeting of October 2006, a smaller group emerged from ACS science and education departments to focus on the next initiative. They met April 27 & 28, 2007 at Furman University to look at another area where science reform is crucial. They discussed the crisis and need for reform in K-16 science education. They were seeking the direction that ACS science and education departments working together can take to be more effective in strengthening their undergraduate science programs, produce more science teachers and support K-12 science in their local schools.

Nine faculty members, representing seven ACS institutions, discussed and ranked the needs of their individual campuses in this area. They shared examples of how to strengthen undergraduate departments through freshmen seminars, composite science certifications and professional development for both science and education faculty. They brainstormed ideas, researched funders and matched grants to needs. Breaking into groups, topics were decided on and currently 3 white papers are being developed on separate topics. They are looking at freshman seminars in science education, conducting lesson study reviews as a part of faculty development and conducting research across the K-16 curriculum. Once the white papers are completed in the fall, they will be shared with all ACS science and education departments and a proposal will be developed for funding. The meeting agenda and planning committee members are in Appendix B.

c. Program Committee Activity

Members of the Program Committee for the Reform of Introductory Sciences met via phone in 2007 to discuss the final report and provide materials for the outside evaluation and for dissemination of projects. Dr. Jeanette Norden, the outside reviewer for this project from Vanderbilt University, discussed how she will be assessing the overall Science Reform Grant activities and reminded the committee about the importance that evaluation and dissemination play in the grant process. It was agreed again that one of the things to be acknowledged up front is that the very nature of the grant funding cycle means the long-term investment results cannot be determined by the 2007 final grant report. Grant recipients are being encouraged to continue reporting results to ACS even after their final report is completed. A document was created and distributed to all grant recipients to update ACS on continued project activity. It is located in Appendix A.

Program Committee members and course mini-grant recipients continue to be encouraged to share what they are doing as part of this grant. During the discussion of the course evaluation and dissemination at the fall 2006 meeting, each committee member was asked to return to campus and encourage the grant recipients to send course syllabi and laboratory modules for posting on the ACS website. The syllabi and laboratory modules are now posted at http://www.colleges.org/sciencereform/grant_recipients.html for all to use.

The Subcommittees of the Program are responsible for writing reports assessing if we did what we said we would do, and if not, why not. These reports come from the Mini-grant (Leo Pezzementi and Tim Ward), Course Design and Assessment Workshops (Preston Miles and John Snyder), and Mentoring Workshop Subcommittees (Linda McNally). These reports refer to the goals in the grant proposal for each of the components and can be found in the assessment section of this report.

The Members of the Program Committee were responsible for collecting the following information from their institutions: (It can be found online with each grant recipient's information. Additionally it was sent to the outside evaluator to help inform her report.)

- Raw course evaluation data, including institutional quantitative and qualitative course evaluations, and instructor-designed evaluations, which could include supplemental questions, pre and post tests, focus groups, etc., depending on the course.
- Numbers of students taking the course should also be reported.
- The methods used for on-campus, regional (meetings), and national (meetings, journal publications, books) dissemination will also be addressed.

- Whether additional funding has been requested, or is planned, and if not why not.
- Level of support and encouragement from the Dean/Provost, according to grant recipient and institutional representative.

d. SAM VI Evaluations of Science Attitudes

Dr. Leo Pezzementi, the Program Committee Chair from Birmingham-Southern College, worked with The Drury University group and received the results of the Science and Math Values Inventory (SAM VI) that several ACS institutions used to evaluate and inform them on ways to improve pre and post course attitudes toward science. It has been a useful tool to aid in the evaluation of the science for non-science major courses. Five ACS institutions used the Science Value Inventory as part of their assessment of courses. They are:

Birmingham Southern College, Megan Gibbons
 Millsaps College, Tim Ward & Stan Galicki
 Morehouse College, Larry Blumer
 Southwestern University, Kerry Bruns
 Trinity University, Denise Pope

It is important to note that for institutions conducting pre/post testing, the results include only those students who provided complete information on both the pre- and post-tests. Students often omitted their ID information, which was the key used to perform the pre/post matching. This reduced sample size by 25% or more in several cases. The results for the six courses with pre/post data show a variety of results. In some cases, instruction appears to have had minor or no effects on how they value science; in a few cases, there are modest increases, and in some, a modest decrease. At institutions where value (as indicated by the total score) did not change, some aspects of value did shift in meaningful ways: for example, students' interest value was significantly higher, although the total score was largely unchanged.

It is of interest to see how ACS students compared to the Drury norm group, given that ACS institutions are generally characterized as selective, private liberal arts colleges. These differences also show some range as well. In the case of Birmingham Southern, there was some suggestion that this small class contained a mixture of science and non-science majors, which may explain the higher initial value these students attached to science.

In the case of Morehouse, the SVI was administered to a large class of non-science majors, as well as a small class of biology majors. Each class received only one administration, so no pre/post analysis is provided. For this data set, two sets of students are compared against each other, which shows (not surprisingly) that student in the majors sections show significantly higher value for science than those in the non-majors section. Comparison of the non-majors group from Morehouse against our norm group (an overwhelmingly white cohort at a regional state university) show no significant differences, a first indication of how students at an HBCU value science. In addition,

there is two-page word file describing the background of the SVI, and another word file that provides a guide for interpreting the excel spreadsheets. SAM VI was only used by five institutions. The five institutions also employed their own evaluative process in addition to SAM VI. The remaining ACS schools utilized their own evaluative process to access course value instead of SAM VI. The SAM VI evaluation summaries and a guide for their interpretation can be found online at <http://www.colleges.org/sciencereform/SVI/ScienceValueInventoryResults.pdf#2007>.

- e. Final reports from the five **second Course Mini-Grant recipients** announced in May 2005 can be found at http://www.colleges.org/sciencereform/grant_recipients.html and the recipients list is in Appendix D.
- f. The deadline for the **third round of Course Mini-Grants** was October 14, 2005. Five proposals were received from faculty for introductory courses in Biology, Geoscience, Chemistry, and for an interdisciplinary core course. One was awarded. Four PIs were asked to revise their proposals, addressing concerns around pedagogy, budget, assessment, and evaluation, and resubmit them by the end of January 2006. All were awarded mini-grants. Southwestern University used the science component of the Science and Math Values Inventory developed by Drury University in their new course. The list of those funded is in Appendix E and their proposals, interim, final reports, labs and syllabi can be found online at http://www.colleges.org/sciencereform/grant_recipients.html
- g. The **fourth round of Course Mini-Grants** was awarded in March of 2006. Nine proposals were awarded in Earth Science, Biotechnology, Geoscience, Biology, Chemistry, and Environmental Science. The recipients list is included in Appendix F and the proposals, interim, final reports, labs and syllabi can be found online at http://www.colleges.org/sciencereform/grant_recipients.html
- h. The **fifth and final round of Course Mini-Grants** proposals were submitted on December 1, 2006. Six proposals were submitted and awards notification and funds were sent in January 2007. These six projects will have their final reports submitted in June of 2008. The projects are in the fields of Biology, Chemistry, Neuroscience, Geology and Forensic Chemistry. The recipients list is in Appendix G and proposals can be found online at http://www.colleges.org/sciencereform/grant_recipients.html The interim reports are due in September 2007 and the final reports are due in June 2008. They will be posted on this site at those times.

2. **Problems Encountered Or Unanticipated Developments in Project/Program Since Last Interim Report**

- a. We feel it is important to reiterate that final reports from mini-grant recipients often mean a final reporting of their activities for the grant period, not a comprehensive report

on the overall project, especially if new or revised courses/modules are taught after the mini-grant period ends. New or redesigned courses/modules may not be implemented and or evaluated until one or two years after the mini-grants end due to curricular cycles, and the process for publishing in peer reviewed journals often takes 18-24 months.

b. Dr. Jeanette Norden, Vanderbilt University, our outside evaluator with this project has been delayed in completing the evaluation. She has been ill and the evaluation expected to be a part of this report is delayed and will be sent to the Keck Foundation by the beginning of August 2007. We appreciate the foundation's understanding in this matter.

3. Further Progress Anticipated Within The Next 6 Months

- Dissemination will continue to occur via the ACS website and at disciplinary state and regional meetings.
- Paula Lessem (W&LU), course mini-grant recipient presented her course ideas at the June 2007 Association of Biology Laboratory Education meeting at the University of Kentucky.
- Paula Hanson (BSC), presented her course materials and "hypertextbook" at the Experimental Biology Meeting in May 2007.
- Cindy Hauser (Davidson), is presenting a poster at the South East Regional Chemical Society Meeting in the fall of 2007 and conducting a workshop at the American Chemical Society's national meeting in Boston in the fall of 2007.
- Rosanna Cappellato (Rhodes), will give a workshop on her findings at the Ecological Association of America's Meeting in August 2007 in San Jose.
- Weston Dripps (Furman), is submitting a paper to the Journal of Geoscience Education in the summer of 2007.
- Suresh Muthukrishnan (Furman), is presenting a paper at the Association of American Geographers in 2007.

4. Other Support Solicited/Received Since Last Interim Report

None solicited/received from ACS as a whole but individual projects and institutions within ACS have solicited funds.

- Gary Radice (Richmond) submitted a proposal to the National Science Foundation and was not funded. He plans to revise and resubmit this summer of 2007.

5. In Hindsight, Would You Have Structured This Grant Differently, And If So, How?

As stated previously, in hindsight, we certainly would have set two dates during each academic year for submission of course mini-grant proposals. This would have kept the process in front of our audience and hopefully encouraged more submissions. Our submissions increased once we added more dates.

6. Related Activities

- Articles about the science reform initiative were published in the Winter and Spring 2007 editions of the *Palladian*. Copies of these editions are included in Appendix H.
- Paula Lessem (Richmond), submitted a paper for presentation at the National Association of Biology Teachers Meeting in November of 2007.
- Warfield Teague (Hendrix), presented his research at the National American Chemical Society Meeting in Chicago in March 2007.
- Cindy Hauser (Davidson), is preparing a manuscript for submission to the Journal of Chemical Education.

7. Relevant Honors and Awards Since Last Report

At this time we are not aware of any honors and/or awards that have been received since 2006 by anyone involved in the program.

OVERALL ASSESSMENT

8. Goals from original proposal achieved

The subcommittee chairs wrote reports for each of their areas to address whether we met our goals. The reports that follow come from the Mini-Grants (Leo Pezzementi and Tim Ward), Course Design and Assessment Workshops (Preston Miles and John Snyder), and Mentoring Workshop Subcommittees (Linda McNally, Kerry Bruns, Thom Moore, and Ellis Bell).

Mini-grants: A total of 31 grants totaling \$273,593 were awarded to 37 faculty at 12 of the institutions of the Associated Colleges of the South (2nd -5th Round of Mini-grants are listed in Appendix E-H. Round 1 is listed at http://www.colleges.org/sciencereform/grant_recipients.html)

In general a very collegial review process was followed. Applicants were aware of the goals and requirements for the mini-grant proposals as they were listed on the ACS website at <http://www.colleges.org/sciencereform/minigrants.html>. A committee of four or five faculty from various scientific disciplines at assorted ACS institutions reviewed the proposals by using a standardized review form, which stressed the goals of the program (See Appendix C). After each referee reviewed the proposals, the Chair of the committee provided a summary report and a conference call was held to discuss each proposal. In many cases, applicants were requested to revise their proposals and provide additional information, and some were asked to resubmit. All applicants, successful and unsuccessful, were provided written feedback on their proposals. The original proposal to the W.M. Keck Foundation of Los Angeles stated that “the purpose of these grants is to encourage the design, evaluation, redesign, and implementation of introductory science courses for non-majors that will address the critical problem of science literacy and fluency among non-science majors, primarily in the disciplines of biology, chemistry,

geology, and physics.” Given the great variety and number of disciplinary and interdisciplinary courses that have been developed we think that the Mini-grant program grant allocation process has met its primary goal.

Course Design and Assessment Workshops: The grant application included a plan for regularly scheduled “Science Information Exchange Workshops.” A stated goal for these workshops was to “...bring together ACS science faculty...[to] exchange information with their colleagues from across the consortium on their existing or proposed classes, to encourage each other to test new ideas, to assist one another in reshaping and redefining courses, to consider a wide variety of pedagogical and evaluative approaches, and to provide critical cross-fertilization that is the fruit of a collaborative approach.

Typical attendees to these workshops were to be faculty (a) who had received grants from the program and who had carried out their proposed work, (b) who had recently received grants from the program and who were progressing toward their stated goals, (c) who were interested in writing applications for next-round grants, and (d) who were members of the Program Committee.

A total of four such workshops were offered, hosted by ACS schools. The initial workshop, at Rollins College, was held in January 2004. Thereafter, workshops were held in the Fall of each year of the grant: 2004 (Millsaps College), 2005 (Furman University), and 2006 (Birmingham Southern College).

Attendance ranged from 25 to 47, averaging 36 participants. All 16 ACS schools were represented by faculty members in at least one of the workshops, with a majority of schools sending at least one representative to *each* of the four workshops.

In addition to ACS school faculty, invited speakers or resource persons came from Vanderbilt University, University of Alabama at Birmingham, University of Maryland, Drury University, Clemson University, and non-college organizations.

A typical workshop would include progress reports or final reports by grantees (orally and/or by posters), keynote talks by invited experts, breakout sessions to discuss points of interest, and informal gatherings to compare notes on teaching techniques, science facilities, etc. After each 1½ day workshop, the members of the Program Committee and an ACS coordinator would meet an additional half day to discuss the just-completed workshop and make plans for the grant’s future activities.

Most of the stated objectives of the program were addressed during the four workshops. Among these were:

(a) “Expanding the orientation and mentoring of new science faculty to include special seminars to address such topics as the educational needs of non-science majors, new courses, and pedagogical approaches that are appropriate for this audience and these courses.” In both formal talks and informal gatherings during each workshop, new science faculty were mentored as described above. Although no workshop was devoted exclusively to this, every workshop gave many opportunities for such mentoring.

(b) “Sharing, across the consortium, the models that already have been created and tested by member institutions.” This was certainly a major thrust of each workshop. Although it was emphasized that such sharing needs to go beyond the participants attending any single workshop, the sharing of information began at the workshops.

(c) “Partnering with colleagues at Drury University to pilot the first comprehensive Science and Math Values Inventory (SaM-VI). The Drury faculty members gave presentations at the Rollins College workshop. In addition, each subsequent workshop included discussion of the SaM-VI inventory tool, and how it was being incorporated as an assessment device for many of the newly built courses emerging from this grant.

(d) “Evaluating the individual projects as well as the program as a whole and distilling best practices and lessons learned in specific courses and on the initiative as a whole.” Although formal evaluation was not part of the workshops, it certainly happened on an informal basis. During a typical workshop, each presentation of an accomplished or contemplated course would be followed by a vigorous discussion of the course in a question-and-answer format.

(e) “Disseminating the results of this initiative within and outside the consortium, via electronic means, professional journals, presentations at professional meetings and workshops that include non-ACS institutions.” As mentioned in (b), above, the beginning of this disseminating occurred at the workshops as all participants went back to their home institutions with ideas to share among their departments. Several of the posters presented at the workshops were also taken to state and regional meetings throughout the Southeast (e.g., to state-level academies of science). All oral presentations (usually accompanied by PowerPoint slides) from each of the four workshops have been posted on the ACS website and are accessible worldwide. Workshop agendas can be found in Appendix C.

Mentoring Workshop: The mentoring objective in the original grant proposal was to provide funding to each ACS institution during each grant year to foster mentoring opportunities for junior faculty in the first 3-5 years of their teaching careers. A total of \$9,000 per grant year (total of \$27,000) was allocated for mentoring among the 16 ACS institutions. Since mentoring can occur in a variety of formats, the original proposal did not specify the particular format for which the funds would be used but gave examples of potential mentoring activities.

Initial discussions of the Mentoring Subcommittee and Program Committee acknowledged the potential difficulties/limitations for junior faculty wishing to participate in such a program and the potential benefits this program could provide senior faculty. The Program Committee decided to focus, but not limit, funding to junior faculty at the post-mid-tenure review stage. The Committee also discussed potential mentoring activities and proposed setting up opportunities for natural science departments to have a "seasoned" faculty member from another ACS institution visit and act as a facilitator/discussion leader with their faculty (potential facilitators would be nominated by the Academic Dean of each ACS institution). While this would be one possible form

of mentoring, the Committee felt it was important to allow other mentoring activities to be considered for funding.

The result of these discussions was the development of a "Mentoring Mini-Grant" program in which each ACS institution could apply to receive limited funding of up to \$500 per grant year for mentoring activities. The Mentoring Subcommittee developed proposal guidelines and a list of potential mentoring activities. The "facilitator visitation" program was included as a primary form of mentoring. In early 2004, the goals of the mentoring program, proposal guidelines, and ideas for possible mentoring activities were posted on the ACS Science Reform website and an email announcing the Mentoring Mini-Grant Program was sent out to ACS natural science faculty. No proposals were submitted through early summer of 2004. Since there was concern that this may have been due to timing of the announcements, a second email was sent to ACS natural science faculty in August 2004 in hopes that a reminder at the start of the academic year would encourage participation. Still, no proposals were submitted.

After discussions at the second Program Committee meeting regarding potential reasons for the lack of proposals, the Mentoring Subcommittee revised the wording of the guidelines to provide clarification that the program was available to any faculty teaching introductory courses for non-science majors. Additionally, the Program Committee decided that if the lack of proposals continued, mentoring funds would alternatively be used to provide a mentoring workshop during the third year of the grant.

With no proposals received, the alternative plan was implemented in 2005. The "Mentoring and Information Sharing Workshop" was held September 17, 2005 at Furman University. This workshop brought together the recipients of 2004 and 2005 mini-grants, the Science Reform Program Committee and an additional person from each campus that was interested in submitting a Science Reform Mini-Grant proposal. Twenty-five faculty from fourteen ACS institutions attended. The workshop was extremely successful as a mentoring venue – with formal and informal discussions and idea sharing occurring throughout.

Despite the success of the mentoring workshop, the question of why no mentoring proposals were submitted still remains. The lack of participation in this program was surprising and no single factor seems to be the cause. Discussions between the Mentoring Subcommittee and Program Committee raised several issues that may offer some explanation. (1) The initial wording in the guidelines may have caused confusion and limited our audience. The focus on junior faculty in the post-mid-tenure review stage may have led others to believe only these individuals could apply. (2) The limit on funds at \$500 per year per institution may have reduced interest and potential activities. Travel is expensive and may not have been covered by the allotted funds – this may have restricted the type of collaboration that could occur. In addition, faculty may have hesitated to submit some requests for fear they would "use up" funding for others at their institution. Furthermore, funds could not be used as stipends for participants or facilitators. (3) Time limitations and other demands may also be a factor. As rewarding as participating in

mentoring activities can be, it is also time consuming. Faculty members have many other obligations both on and off campus.

This program required submission of a proposal well in advance of the intended activity and mentoring activities would require time away from other demands. It is possible that other obligations simply "outweighed" the desire to participate in this program. In conclusion, many factors in addition to those mentioned above may have led to a lack of proposal submission. Clearly the ACS website postings, announcement emails, wording revisions and word-of-mouth advertising by Program Committee members were not able to overcome these obstacles. However, the use of the mentoring funds to sponsor a workshop that focused on the original objective proved to be a successful alternative. The Mentoring and Information Sharing Workshop provided an opportunity for ACS faculty to mentor each other as they shared and discussed ideas and proposals.

9. Overall Impact of the Grant

Overall, the impact has been extremely positive. The courses given have been innovative and extensive and have made science easier to understand with less fear. They have been quite popular with the students also. Enrollment has been good for most courses and many have been repeated. In some institutions they have become models for course creation. Because we have disseminated course information on the ACS website each school can share research, concepts and results. At our course workshops each year, people were excited by all the course ideas that have been generated and critiqued and questioned each other to make the courses more impactful and take ideas back to their home campus. Consortium members overall have benefited widely. An example from one of the final reports from Millsaps College from the course "How Things Work" clearly shows course success:

For *How Things Work* the course evaluations compared to the college average for each semester taught are as follows:

Pre-grant data:

Spring 2001-2002 course 4.5 compared to college 5.7 (std. dev. 1.2)

Spring 2002-2003 course 3.5 compared to college 5.7 (std. dev. 1.3)

Spring 2003-2004 course 4.6 compared to college 5.7 (std. dev. 1.2)

Spring 2004-2005 course was not taught so we could re-design the sequence.

Post-grant data:

Spring 2005-2006 course 5.3 compared to college 5.7 (std. dev. 1.2) Enrollment: 24 students

Spring 2006-2007 is in progress. Enrollment: 28 students (The enrollment for these courses is limited to 24 students due to lab safety concerns and lab space. However, we have accommodated a few more students as waiting lists are beginning to form due to popularity of course.)

We are very pleased with the increasing course evaluations by students (5.3 for *How Things Work* and 5.7 for *Human and Natural Disasters* are the highest ratings ever in the

history of Superscience!). In fact, we are finally within the standard deviations of the college course averages!!!! Our philosophy seems to be getting across to the students, even if they are uncomfortable with science in general. In the words of one *How Things Work* student, “It is one of the best ideas for a course and one of the best courses here at Millsaps.”

Information gathered at The University of Richmond (UR) for the *Emerging Infectious Disease* course is equally impressive: Raw Evaluation Data: Fall term 2006 enrolled 66 students in two lecture sections.

1. Pre-test assessment: 66 students * took the survey. The average score was 10.6 correct out of 50 questions (21.2%) The pre-assessment test for the spring term 2007 resulted in an average score of 13.8 correct out of 50 questions (27.6%).
2. Post-test assessment (administered with the final exam): 67 students took the survey. The average score 26.8 correct out of 38 questions (70.5%).

* One student did not take the pre-test. His score was not included in the final.

UR Evaluation Forms: Sample student comments-

1. I thought the course itself was very interesting and the pace was just right. For non-science majors who just need to fulfill a Gen. Ed. Requirement, it is a great class.
2. I thought the subject matter was very interesting and relevant. It is an unimimidating way to fulfill the Gen. Ed. Requirement that incorporates science (biology) and the more liberal arts-related aspect of the study of emerging infectious diseases.
3. As a nonscience person, I really appreciated that this course was offered as an option for fulfilling a general education requirement. I enjoyed the material and I can honestly say that I have a greater appreciation for science after taking this course.
4. The course was a detailed course covering the various infectious diseases which effect the world in various different ways... It connected science to various perspectives on life and culture.
5. This course was a good way to fill the science education requirement. It was interesting and effectively joined biology and real life in order to maintain student interest.

Impact at Birmingham Southern College: Cancer: Biology and Beyond

Dr. Gibbons' course meets these goals quite well. It is a team-taught interdisciplinary course that examines the science of ecology and environmental management and the political, economic, and ethical issues in environmental sustainability (ES 150). The goals for and expectations of students are clearly presented, and described, in the course syllabus (which is included, along with other course and laboratory materials), and match those of the Mini-grant program. Her grant was one of the smallest awarded; yet, she has done a large amount of implementation. Her grant was for “Using the Learning Cycle to Teach Ecological Concepts in Introduction to Environmental Studies.”

Dr. Gibbons has included a large amount of information in her report, including considerable assessment data and analyses, and I refer you to item one in her report to

access the details. She had been teaching this course prior to receiving the grant, and it was already very successful and very popular. The quantitative and qualitative college assessments show the success of the course, and improvement in virtually all areas after the introduction of the learning cycles, particularly in the area of student perceptions of her ability to facilitate comprehension. She also designed her own course assessments and analyzed them to determine the effects of the year of the students, whether they were majors or non-majors, and the amount of effort put into the course on their perceptions of (1) course design, (2) connectivity, and (3) overall satisfaction. There were positive correlations for the year of a student, being a biology major, and the amount of effort put into the course on all three variables, although they were not always significant. Dr. Gibbons also used the SAM-VI. The Drury group concluded “An overview of the analysis for your institution reveals that there was a slight increase in the perceived value of science after completing your course, with the most significant change in students’ perceptions of the conflict between science and their religious commitments.” The change is in the direction of a decrease in conflict.

You can also find quantitative data on enrollment, course offerings, etc. in her report.

Overall, the grant has had a positive impact on the already popular and successful introductory environmental studies course at BSC. The numbers of students impacted may not be great yet, but that may change in the future, as the college is adopting an environmental studies major; however, it is anticipated that the course will serve a mixture of majors and minors.

Individual course evaluation data is listed on our website in the final reports and/or separately by each grant recipients name at <http://www.colleges.org/sciencereform/minigrants.html>.

10. Lessons Learned

As stated previously, in hindsight, we certainly would have set two dates during each academic year for submission of course mini-grant proposals. This would have kept the process in front of our audience and hopefully encouraged more submissions. Our submissions increased once we added more dates. As discussed earlier above, we did not realize that grants for mentoring would not be desired. When we discovered this, we changed the grant format to a mentoring workshop that was quite successful. It is our belief we should have made on campus and regional dissemination a requirement for accepting mini-grant funds. We strongly suggested it. Some recipients complied right away, but many had to be encouraged repeatedly to hold a meeting or workshop on campus for colleagues. It was easier for some to present at regional or national meetings where they would get more off-campus colleague recognition. Some though, even after encouragement did not present outside of our ACS meetings.

11. Future Plans for the Program

Many ACS institutions have committed to continuing the courses and they are a part of the regular curriculum each year or are cycled in and out among the introductory courses offered. The deans have been generous in regards to funds necessary to keep the courses going and for some courses that means a continuation of new equipment purchases to stay up to date. Some grant recipients have mentioned writing grants to continue the development of their course or the creation of future courses. They feel encouraged by the success of their endeavors. In seeing the value of their new course, The University of Richmond has decided to offer the Emerging Infectious Disease course as a part of their Summer Fellows program and as well as offering it during the academic year. Some institutions have seen the benefit of supporting faculty as they develop courses which can mean adjusting work load or by having a course taught by multiple instructors thereby increasing the impact.

The newly formed ACS Science Education Committee as discussed in section 1b above is working on the next step in the Science Reform Initiative within the consortium. Linking our undergraduate science and education faculty strengthens them and their departments around science education. By adding a research component to our proposal that includes faculty, undergraduates, high school teachers and students, it should serve to motivate and inspire undergraduates to seek majors in science education and ultimately help us better serve the K-12 science needs in our local schools. The undergraduate student will assist education and science faculty in creating and implementing the research project to work with the high schools. High school students will get earlier exposure to research skills thereby hopefully creating excitement about a career in science. Their teachers will gain new information to take back to the classroom and increase their confidence and knowledge. We are very hopeful that the proposal that results from our current white papers will be as successful for ACS as this one has been with the Keck Foundation.

12. Final Thoughts on the Review Process

From the outset of our discussions with the foundation, we found the staff to be interested, thoughtful, responsive and very helpful. They raised key questions and provided very useful guidance and advice. They tested our interest and commitment to the program. Throughout our relationship, they were meticulous and thoughtful, while also being flexible and understanding. In sum, we could not have had a more stimulating and helpful partner in this initiative.

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Appendix A

2006-07 Program Committee Membership

ACS Reform of Introductory Science Courses for Non-Science Majors
Program Committee
2006-2007

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March 15, 2007

Project Update Document

Data Collection at ACS Institutions for Keck Foundation Science for Non-Science Majors Grant Recipients

The following information is needed:

1. Raw evaluation data for the courses, including institutional quantitative and qualitative course evaluations, and instructor-designed evaluations, which could include supplemental questions, pre- and post-tests, focus groups, etc., depending on the course.
2. How many times and when the courses have been offered; numbers of students taking the courses.
3. The dissemination efforts used on-campus, regionally (meetings), and nationally (meetings, journal publications, books).
4. Whether a grantee has requested or received additional funding for the project, or is planning a proposal, and if not why.
5. Level of support and encouragement from the Dean/Provost throughout the project, according to grant recipient and institutional representative.
6. Syllabi, laboratory and field protocols, and other relevant course materials, including assessments and evaluations, as **PDF** documents to be uploaded onto the ACS website.

Many grant recipients have already submitted final reports. **Thus, data obtained after the submission of those reports should also be included to provide updated information.**

Appendix B

Science Education Meeting

Furman University
April 27 and 28, 2007

AGENDA

Science Reform and Teacher Education Planning Meeting

Furman University
27-28 April 2007

The project that is being considered is to involve strengthening undergraduate science and education departments and pre-service teachers and local schools or districts. We will be discussing ideas that will become a white paper and then a grant proposal for how to be more effective in science education. Come with ideas, possible funders, and energy!

Friday, 27 April 2007

- | | |
|--------------|--|
| 6:30 P.M. | Meet in Hyatt hotel lobby to go to dinner together |
| 7:00-8:30 pm | Dinner – local restaurant – ACS will reimburse you after the meeting |
| 9:00 pm | Return to Hotel- evening on your own |

Saturday, 28 April 2007

Reform of K-16 Science Education

- | | |
|-------------------------|---|
| 8:00 A.M.
to Furman | Check out and meet in Hyatt hotel lobby for transportation |
| 8:30-9:00
University | Continental Breakfast – Hipp Hall-Room 205, Furman |
| 9:00-9:15 | Welcome, introductions, overview, housekeeping –Michael Svec, host & Marcia White, ACS-Hipp Hall, Room205 |
| 9:15-9:45 | Available funders, grants and guidelines-Mike S. |
| 9:45-10:00 | Break |
| 10:00-10:15 | Examples of how to strengthen undergrad depts.-Mike Kamen
(Freshmen seminars, composite science certification, prof dev with science & ed faculty) Other examples-all participants |
| 10:15-10:30 | List needs of our institutions in this area and rank them-Mike S. |

10:30-12:00 P.M.	Break into 2 groups with grants to match grants and needs-all
12:00-1:00	Lunch-working lunch (Discussion on How People Learn for upcoming Teagle grant-Marcia)
1:00-2:00	Decide on topics (1or 2) for white paper & assemble writers (task force)-Mike Svec & Mike Kamen
2:00-adjourn	Next Steps for us to take back to our campuses and as a group-Marcia
2:00-2:15	Transportation to Hotel

This workshop is supported by the W.M. Keck Foundation of Los Angeles

Associated Colleges of the South
Science Education Initiative Planning Committee

- | | | |
|--------------------------------|--|--|
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Appendix C

Program Committee
Sub-Committee Addendum

Workshop Agendas-2004-2006

Mini Grant Review Form

Course Design & Assessment Workshop
 The ACS Reform of Introductory Science Courses for Non-Science Majors Program
 Rollins College
 January 9-10, 2004

Saturday Jan 10

Sessions in the Faculty Club

7:45-8:15 a.m.	Continental Breakfast
8:15-8:45	Welcome, Introductions, & Orientation Ed Roy
8:45-9:45	<i>Assessment of an Integrated Science & Math Curriculum</i> Bruce Callen, Physics, Drury University, Springfield, MO Discussion, Q&A
9:50-11:20 (10:30-10:40 Break)	Moderated by Ed Roy 1. <i>The Use of Studio-Format Classes in an Introductory Biology Course</i> Beth Leuck, Centenary College 2. <i>Summary of Models for Non-Majors Science Courses</i> Preston Miles, Centre College Discussion, Q&A
11:20-12:05	<i>A First Year Experience: Teaching "How Things Work," For Non-Science Freshman At Sewanee</i> Ben Szapiro, University of the South Discussion, Q&A
12:05-12:50	Lunch
12:50-2:00	Tour of science classrooms/labs and meetings by disciplines
2:10-3:40 (Break 2:50-3:00)	Moderated by Ed Roy 1. <i>Exploring Earth, A Revised GeoScience Course</i> Glenn Kroeger, Trinity University Discussion, Q&A 2. <i>Super Science</i> , Tim Ward and Stan Galicki, Millsaps College Discussion, Q&A
3:40-4:45	Dialogue and Wrap-up Ed Roy and Bruce Callen
4:45-5:00	Evaluation
5:00	Adjourn
6:30 p.m.	Meet in hotel lobby for dinner at Chapters, Park Avenue, Winter Park

Sunday Jan 11

Departure

This consortial program is supported by the W.M. Keck Foundation of Los Angeles
Science Education Reform Workshop

The ACS Reform of Introductory Science Courses for Non-Science Majors Program

Millsaps College
November 12-13, 2004

Our second consortia-wide workshop will advance efforts to design, implement, assess and share new models for science courses for non-majors. Specifically, participants in this workshop will have opportunity

...

1. To explore the meaning of science literacy and how it informs course design.
2. To explore how course design informs course assessment.
3. To provide opportunity for information sharing on Science Reform efforts already underway on ACS campuses.
4. To provide a forum for mini-grant recipients to share what they are doing.
5. To foster communication among ACS science faculty.

Friday, November 12

6:15 p.m. Meet in Cabot Lodge Lobby to go to dinner
6:30pm Dinner Millsaps
Go through Cafeteria line and take trays to Leggett Center
7:30 pm "The Importance of Reform" Preston Miles

Saturday, November 13

7:30-8:00 Continental Breakfast Cabot Lodge
8:00-8:30 Introductions and Welcome, Preston Miles Leggett Center
8:30-2:30 Science Literacy - Course Design - Course Assessment
Facilitators: Jeanette Norden and Linda Nilson
The format will be a mix of facilitator input, group discussion, and interactive activities.
The intent is to show/model the interconnectedness of these topics [how they can inform each other] rather than presenting them as three separate topics/issues.

Morning/Afternoon Breaks and Lunch are provided

2:30-4:00 Poster Session and Science Facilities Tour, Olin Hall
4:00-4:30 Closing Session, Wrap-Up, Evaluation Preston Miles
Leggett Center
5:15 Meet in Cabot Lodge lobby for transportation to dinner
5:45-7:45 Dinner at The Parker House, 104 SE Madison Drive, Old Town
This workshop is supported by the W.M. Keck Foundation of Los Angeles

Science Education Reform Workshop

The Reform of Introductory Science Courses for Non-science Majors Program of the Associated Colleges South

Furman University
16-17 September 2005

This third consortial workshop will provide an opportunity for grant recipients to share the design, implementation, and assessment of their new science courses for non-majors, and how they have disseminated their findings. The workshop will also aid the efforts of additional faculty to design, implement, and assess their courses.

Friday, 16 September 2005

6:15 P.M.	Meet in Hotel Lobby to go to dinner
6:30 – 7:30	Dinner – Trustees’ Dining Room [in Charles E. Daniel Dining Hall, # 18 on campus map]
7:30 – 8:15	Welcome – Leo Pezzementi (BSC), Silas Pearman (Furman)

Saturday, 17 September 2005

7:30 a.m.	Meet in Hotel Lobby for transportation to Furman
8:00 – 8:30 A.M.	Continental Breakfast – Trustees’ Dining Room
8:30 – 8:45	Introductions and Welcome – Leo Pezzementi, John Snyder
8:45 – 9:15	The Need for Reform, Assessment, and Dissemination – Leo Pezzementi
9:15 – 11:30	Presentation and Discussion of Grants Awarded in 2004
9:15 – 9:45	<i>Redesign and Reimplementation of Environmental Biology</i> , Kelly Agnew,
Hendrix College	
9:45 – 10:15	<i>Redesign of Exploring Earth; an inquiry-based studio format geoscience course</i> , Glenn Kroeger, Trinity University
10:15 – 10:30	Break
10:30 – 11:00	<i>Codifying Materials for the Presentation of Scientific Investigations into 17th Century Dutch Art</i> , Erich Uffelman, Washington and Lee University
11:00 – 11:30	<i>HIV/AIDS: Development of a Thematic Non-majors biology course</i> , David Wessner, Davidson College
11:30 – 12:30 P.M.	Lunch
12:30 – 1:50	Presentation and Discussion of Grants Awarded in 2005
12:30 – 1:00	<i>Re-energizing Superscience (2004) and Implementation of Re-energized Superscience Courses (2005)</i> , Kristy Stensaas and Bob Nevins, Millsaps College
1:00 – 1:15	<i>Evaluation of ecosystem services as the objective of field and laboratory activities to be added to an introductory course in Environmental Sciences</i> , Rosanna Cappellato, Rhodes College
1:15 – 1:30	<i>A Textbook Prototype for Non-science Majors Cancer Biology Courses</i> , Pamela Hanson, Birmingham-Southern College
1:30 – 1:45	<i>Integrative Biology at Trinity University</i> , Denise Pope and Kevin Livingstone, Trinity University
1:45 – 2:00	<i>Key Figures in Modern Physics</i> , J. David Turner, Furman University
2:00 – 4:00	Consultation, Planning, and Presentation Session
2:00 – 3:00	Faculty planning to submit a grant proposal will pair with grantees and members of the Program Committee to discuss their proposals and prepare 5-minute

presentations on their proposed courses. See name tag color code [below] for groups.

3:00 – 3:15

Break

3:15 – 4:15

Presentations of preliminary plans for proposals

4:15 – 5:15

Closing Session – Jeannette Norden

5:15 – 5:30

Evaluation

6:00 – 6:15

Meet in lobby of Hotel to go to dinner

6:30 – 8:30

Dinner at the SassafRAS Restaurant [within walking distance of the Hyatt]

This workshop is supported by the W.M. Keck Foundation of Los Angeles

Science Reform and Teacher Education Workshop

Birmingham-Southern College
28 October 2006

This fourth and final workshop will provide an opportunity for recent grant recipients to share their new science courses for non-majors. The workshop will also aid the efforts of additional faculty to design, implement, and assess their courses, through the discussion of the importance of reform, pedagogy, assessment, dissemination, and the meaning of science literacy.

Saturday, 28 October 2006

The Reform of Introductory Science Courses for Non-science Majors in the ACS

8:00 A.M.	Meet in hotel lobby for transportation to BSC
8:30 – 9:00	Continental Breakfast – Great Hall, Norton Center
9:00 – 9:15	Introductions, Welcome, and Overview – Leo Pezzementi, Great Hall, Norton Center
9:15 – 9:45	The Need for Reform of Science Courses for Non-science Majors – Glenn Kroeger (Trinity University)-Great Hall
9:45 – 10:45	The Importance of Pedagogy - Spencer Benson-Great Hall
10:45 – 11:00	Break
11:00 – 12:00	What is Science Literacy? – Facilitators, Spencer Benson, Jeanette Norden (Vanderbilt U.), Preston Miles-Great Hall
12:00 – 12:20	Mellon Faculty Development Grant Proposal – Marcia White-Great Hall
12:30 – 1:30 P.M.	Lunch, Executive Dining Room
1:30 – 2:15	The Importance of Assessment - Scott Snyder, Great Hall
2:15 – 2:45	The Importance of Dissemination - Jeanette Norden, Great Hall
3:00 – 5:00	Poster Session of courses funded in 2005-Third Floor Atrium Tours of E.B. Stephens Science Center; refreshments
5:00 – 5:30	Closing Session and Evaluation – Leo Pezzementi, Stephens Science Center, Room 138
5:30 – 6:00	Recent Trends in the Design of Science Facilities – Gary McNay (Perkins and Will) Stephens Science Center-Room 138
6:15 – 7:00	Reception-Executive Dining Room
7:00 – 9:00	Dinner - Executive Dining Room, <i>Sponsored by Perkins and Will</i>

This workshop is supported by the W.M. Keck Foundation of Los Angeles

Science Reform and Teacher Education Workshop

Birmingham-Southern College
26-28 October 2006

This fourth and final workshop will provide an opportunity for recent grant recipients to share their new science courses for non-majors. The workshop will also aide the efforts of additional faculty to design, implement, and assess their courses, through the discussion of the importance of reform, pedagogy, assessment, dissemination, and the meaning of science literacy.

The next phase of the project that is being considered is to involve pre-service teachers and local schools or districts. In order to do this, we want to have a conversation between science and education faculty to determine how to be more effective in science education. This discussion will serve as a basis for an upcoming grant proposal.

Thursday, 26 October 2006

- | | |
|-------------|--|
| 6:30 P.M. | Meet in hotel lobby to go to dinner |
| 7:00 – 8:00 | Dinner - Executive Dining Room, 3 rd floor Norton Campus Center |
| 8:00 – 8:30 | Welcome - Leo Pezzementi, Kathy Murray (Provost) |

Friday, 27 October 2006

Reform of K-16 Science Education

- | | |
|-------------------|---|
| 8:00 A.M. | Meet in hotel lobby for transportation to BSC |
| 8:30 – 9:00 | Continental Breakfast – Great Hall, Norton Center |
| 9:00 – 9:15 | Introductions, welcome, and overview - Leo Pezzementi, Great Hall, 3 rd floor Norton Campus Center |
| 9:15 – 9:45 | The Need for Reform of K-12 Education – Preston Miles (Centre College) Great Hall |
| 9:45 – 10:00 | Break |
| 10:00 – 11:30 | Models of K-16 connections at ACS institutions-Great Hall |
| 11:30 – 11:50 | Mellon Faculty Development Grant Proposal – Marcia White-Great Hall |
| 12:00 – 1:30 P.M. | Lunch, Executive Dining Room |
| 1:30 – 2:00 | The Greater Birmingham Mathematics Partnership (GBMP) – Ann Dominick, (GBMP, Hoover City Schools), Great Hall |

Appendix C1

2:00 – 2:45	The Assessment of K-16 Programs – Scott Snyder (Center for Educational Accountability, UAB) Great Hall
2:45 – 3:45	National models of K-16 connections and funding opportunities – Spencer Benson (Center for Teaching Excellence, U. Md.)-Great Hall
3:45 – 4:00	Break
4:00 – 4:15	The Need for Leadership – Leo Pezzementi-Great Hall
4:15 – 5:15	Wear Do We Go from Here? – Facilitator, Spencer Benson-Great Hall
5:15 – 5:30	Evaluation-Great Hall
5:45 – 6:30	Reception-Executive Dining Room
6:30 – 8:30	Dinner-Executive Dining Room

ACS-Keck Science for Non-Science Majors Mini-grant Proposal Review Form

Proposal Title:

PI:

Institution:

Category of Proposal:

Budget Request:

Whether the proposal addresses a new course, module, or other learning/teaching activity, the resulting experience should increase students' ability to:

understand and appreciate the scientific world-view, including its limitations, and how it differs from other perspectives;

understand the increase of inter-relationships among the different disciplines of science;

understand the connection between scientific concepts and technological developments, their impact on society, and the cultural and historical context in which they emerge;

and use their understanding to evaluate rationally scientific controversies in the world.

Does the project address the ACS goals?

Is the approach or design of the project appropriate to the goals and feasible?

Is the project innovative and a potential model for adaptation?

Are there adequate plans for evaluation and dissemination?

Does the project director have the appropriate background?

Will future offerings of the course be supported?

Is the proposal cost effective?

What is the impact of the proposal on the Institution?

Does the summary adequately address the following?

Issue, topic, problem, or process addressed by the proposal.

Goals and objectives of the course/module/laboratory or field activity.

Description of how the goals and objectives will be accomplished.

Anticipated outcomes and benefits to non-major science students.

Description of collaborative relationships, if any.

Does the Project Description describe adequately the following?

Goals and objectives.

Background and significance.

Detailed project plan for course/module/activity components and implementation.

Prior activities or research related to proposal.

Projected timetable.

Requested budget, with justification for each line item: reassigned time, equipment, supplies, travel, student research assistants, etc. Faculty stipends cannot exceed \$5,000.

Context of course in curriculum.

Impact on the Institution, including number of students per year.

Evidence of Institutional support.

Does the section on Evaluation, Dissemination, and Continued Support adequately describe the following?

A description of evaluation/assessment process.

Plans for dissemination of results. Include a plan to showcase the results of the project. For example, presentation of results at conferences and workshops; publications.

Summary Review:

Please write a summary review, addressing the questions

Does the project address the ACS goals?

Is the summary adequate?

Is the project description adequate?

Is the section on evaluation, dissemination, and continued support adequate?

Include overall general comments on the proposal.

Recommendation for funding:

___ Fund at requested amount of _____

___ Fund at a lower amount of _____ Explain briefly.

___ Do not fund. Explain briefly.

Appendix D
Second Round of Course Mini-Grants
Proposal, Interim & Final Reports
Spring 2005 Recipients

Second Round of Course Mini-Grants
Proposals, Interim & Final Reports
Spring 2005 Recipients

See Proposals, Interim & Final Reports, Syllabi, & Labs for the projects below at:
http://www.colleges.org/sciencereform/grant_recipients.html.

* Rosanna Cappellato, Rhodes College, "Evaluation of ecosystems services as the objectives of field and laboratory activities to be added to an introductory course in Environmental Sciences"

* Pamela Hanson, Birmingham-Southern College, "Textbook Prototype for Non-Science Majors Cancer Biology Courses"

* Denise Pope, Kevin Livingstone, Kelly Lyons, and James Shinkle, Trinity University "Integrative Biology at Trinity"

* Kristy Stensaas, Sarah Lea McGuire, Robert Nevins, Stan Galicki, Millsaps College, "Implementation of Re-energized Superscience Courses"

* David Turner, Furman University, "Key Figures in Modern Physics"

Appendix E
Third Round of Course Mini-Grants
Proposals, Interim and Final Reports
Fall 2005 Recipients

Third Round of Course Mini-Grants
Proposals, Interim, Final Reports
Fall 2005 Recipients

See Proposals, Interim, Final Reports, Syllabi and Labs online at:

http://www.colleges.org/sciencereform/grant_recipients.html.

- * Larry Blumer, Morehouse, “Science and Society: A New Interdisciplinary Core Course”

- * Bill Hamilton, Washington and Lee University, “The Impact of Highway Traffic on Atmospheric Chemistry and Biological Processes: A New Lab Science Course for Non-Science Majors”

- * Megan Gibbons, Birmingham-Southern College, “Integrating the Learning Cycle into Explorations in Biology for Non-Majors”

- * Kerry Bruns and Willis Weigand, Southwestern University, “Chemistry Connections Science Course For Non-Science Majors”

- * Suresh Muthukrishnan, Furman University, “Earth from Space: Spatial Science and Technology Focused Introductory Geosciences Course Development and Implementation”

Appendix F
Fourth Round of Course Mini-Grants
Proposals, Interim & Final Reports
Spring 2006 Recipients

Fourth Round of Course Mini-Grants
Proposals, Interim, Final Reports
Spring 2006 Recipients

See Proposals, Interim, Final Reports, Syllabi & Labs online at:

http://www.colleges.org/sciencereform/grant_recipients.html.

- * **Wes Dripps**, Furman University, “Earth Sciences and Silver Screen”
- * **Joseph Ginhardt**, University of Richmond, “Development of a Non-Majors Biotechnology Course”
- * **Lisa Greer**, Washington and Lee University, “Assessment of Concept Questioning and Electronic Student Response Technology in the Small School Introductory Geosciences Classroom”
- * **Cindy Hauser**, Davidson College, “Development and Implementation of Laboratory Modules to Accompany Introduction to Environmental Chemistry”
- * **Malcolm Hill**, University of Richmond, “Making the Land-Sea Connection in Inner-City Richmond Classrooms: Bringing Chesapeake to School and Bringing Students to the Bay
- * **Paula Lessem**, University of Richmond, “Emerging Infectious Diseases: Biology, Historical Significance and Public Policy”
- * **Gary Radice**, University of Richmond, “Teaching Biology According to How People Learn”
- * **Kristy Stensaas**, Millsaps College, “Incorporating Technology and Assessment Into Super Science”
- * **Warfield Teague**, Hendrix College, “The Green Laboratory for Chemistry of the Environment”

Appendix G
Fifth Round of Course Mini-Grants
Proposals
Fall 2006 Recipients

Fifth Round of Course Mini-Grants
Fall 2006 Recipients

See Proposals online at:

http://www.colleges.org/sciencereform/grant_recipients.html.

- * Paula Lessem and Maren Reiner, University of Richmond, “Biology in Popular Culture”
- * Linda McNally, Davidson College, “Re-Designing Human Biology For Non-Science Majors to Enhance Scientific and Quantitative Literacy”
- * Nancy Mills, Trinity University, “Creation of an Introductory Forensic Science Course for Non-Majors”
- * Luis Schettino, Trinity University, “Redesign of Neuroscience Courses As A Part of the Trinity Common Curriculum”
- * Nicholas Schister and Mike Winiski, “ Re-imagination of Interdisciplinary Non-Majors Science: The Physical and Living Universe Revealed”
- * Kristina Stensaas, Robert Nevins and Stan Galicki, Millsaps College, “Incorporating Technology and Assessment into Superscience”

Associated Colleges of the South
Palladian
Winter and Spring 2007