Annual Report for NSF DUE-CCLI/A&I Grant #0126788
"Seeing the Big Picture: Linking the Sciences and Humanities"
Wofford College
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Program Summary and Goals:

This institutional initiative for curriculum improvement is establishing freshman learning communities (LC) for non-science majors. Two general education courses, laboratory science for non-science majors (Science-104) and humanities seminar (Humanities-101), are linked by a common theme to create integrated learning experiences. The program objectives are to 1) dispel the discipline-specific compartmentalization of knowledge and help students integrate information across disciplines, 2) acknowledge and further develop the creativity and teaching skills of gifted upperclassmen by including them as teaching partners, 3) inspire the freshmen to be active learners and the instructors to provide a more interactive learning environment, 4) emphasize the importance of the General Education program, 5) help first-year students focus their academic priorities, and 6) integrate student and faculty use of technology throughout the program. An overarching goal of this initiative is to encourage students to embrace science as a necessary part of their development as liberally educated citizens capable of integrating all types of knowledge to help solve the complex and challenging problems facing our society.

Curricular activities:

1. In its first year this program has produced eight, new, semester-long courses linked in theme-based pairs to form four learning communities (LCs). The courses in each LC fulfill two General Education requirements: a laboratory science course for non-science majors (4 credit hours) and a discussion-based, writing intensive humanities seminar (3 credit hours). Each LC was developed and implemented by a "teaching team" of two faculty members (one from science and one from humanities) and two undergraduate student "preceptors." The titles of the LCs are: "The Nature and Culture of Water" (faculty members in biology and English), "Cosmology and Ultimate Questions" (physics and philosophy), "Scientific and Literary Perspectives on Madness: Reality's Dark Dream" (psychology and English), and "The Mammal in the Mirror" (biology and philosophy).

2. Each of four science and four non-science faculty members and eight undergraduate preceptors have worked a minimum of 240 person-hours (including summer preparatory work and classroom contact hours) on the project. Each four-person teaching team collaborated for 8 weeks in the summer of 2002 and taught their LC with all members of the teaching team present at every class and laboratory meeting during the semester in which the courses were offered in the 2002-2003 academic year.

3. Beginning in the summer of 2003, six additional semester-long courses will be developed to form three more LCs. The tentative titles for these are "The Impact of Breakthroughs in Science and Medicine" (faculty members in biology and philosophy)," "Thinking Like a Mountain: Conserving our Natural Heritage" (biology and sociology), and " Did You See That? The Senses, the Mind and Our Perception of Reality" (psychology and history). Therefore, an additional six faculty members and six preceptors will each add over 240 person-hours to the project.

4. The Wofford College administrative support for this program has far exceeded expectations (see also "Findings" sections), and the President and Dean have provided funding beyond that proposed in the grant match for:
a. A one-course reduction for all faculty members involved in the project during the semester the LC is offered. This has been a major contributing factor to the success of the program since each faculty member is present at all meetings of both courses.
b. Two weeks of financial support during summer 2003 for faculty involved in the first four learning communities to "debrief" with their teaching team, consider changes to the LC for its future offering, and share (in formal workshops and informal discussions) their experiences with other Wofford faculty members involved or interested in the program.
c. Summer development (8 weeks) of a seventh learning community (the NSF grant provided funding for 6 LCs), at the same dollar level as set in the grant, for two faculty members and two preceptors.

5. Each LC has made extensive use of educational technology and developed and maintained a web page, which can be accessed via the LC home page at http://webs.wofford.edu/goldeyes/sciencehumanities/ learningcommunities.html. First year students enrolled in the learning communities also developed and maintained their own web pages to which they posted biweekly journal entries, pictures, etc.

6. As part of the requirements for successful completion of the LC, every enrolled freshmen used new knowledge derived from their coursework to develop and implement an outreach project for elementary students from the Spartanburg community (see "Outreach" section).

Activities related to program dissemination:

A number of professional presentations at national academic and non-academic conferences have been made to date.

1. Two invited presentations at the 2002 SENCER Summer Institute (SSI) took the form of 75-minute interactive workshops. The first was titled "Students as Partners in Change: An NSF-funded initiative at Wofford College," and was led entirely by four student preceptors. The other workshop, titled "Confluence of Sciences and Humanities: Interdisciplinary Learning," was led by two faculty members. Evaluations of the workshops rated both presentations very highly, but it was the presentation by the students that became the "talk" of SSI 2002.

2. A presentation at the Arkansas Southern Regional Learning Communities Conference (24-26 October 2002) titled "Water: A Confluence of the Sciences and the Humanities" was presented by the complete "Nature and Culture of Water" teaching team (faculty and preceptors).

3. A presentation at the 75th Annual Water Environment Federation Conference and Exposition (September 28-Oct. 2, 2002 in Chicago, IL) represented a unique opportunity to extend the reach of this program to a non-academic audience. This presentation was particularly well-received by its diverse international audience of elected officials and municipal water system managers charged with educating the public about our water resources. The presentation and resulting publication, " Innovative Public Education Programs for College Students - Combining the Sciences and Humanities to Achieve a Deeper Understanding of Water Issues," was prepared and presented by Goldey (PI/PD), Lane (SP) and Graham Rich, the General Manager of the

Spartanburg Water System and Spartanburg Sanitary Sewer District (SWS/SSSD). The SWS/SSSD has been an active and loyal partner in the development of the LC initiative in that it provided funding for the pilot LC, "The Nature and Culture of Water," in the year prior to NSF funding. SWS/SSSD continues is active collaboration and supplemental funding for this LC. The SWS/SSSD has a mandate to teach the public about water issues, and their collaboration with Wofford marks a novel initiative to target college level students.

4. In recognition that this NSF-funded initiative is a model of partnering with students in fostering campus change, PI Goldey was invited to bring a student to Washington, DC to participate in the 2002 Sumner Symposium of the Program for Health and Higher Education: A National Conversation on the Power of College Students to Accomplish Goals for Campus and Community Health (sponsored by AAC&U). Similarly, Goldey was invited to bring another student (preceptor Snider) to Washington, DC this winter to participate in the planning session for the 2003 Sumner Symposium.

5. Upon invitation by Wofford's president, formal presentations by faculty members and preceptors have also been made to Wofford's Board of Trustees and the President's Advisory Council. These presentations are further described in the "Findings" section.

Activities related to program evaluation:

1. Wofford College was recently identified as scoring well in the National Survey of Student Engagement (NSSE). As a result, an external team from "Project Deep" (sponsored by the NSSE program) visited the campus to evaluate a variety of programs, including the NSF-funded LC program. They interviewed a number of LC faculty members, preceptors and freshman students, and their report should be released sometime in the first half of 2003.

2. The PI/PD sought and received financial support from the college to attend, along with Wofford's chief assessment officer (and Dean of the Library), the 2002 Summer Institute on First-Year Assessment: Understanding and Strengthening the First Year of College, sponsored by the Policy Center on the First Year of College. Although a number of ideas were discussed as a result of this conference, we determined that there are no widely used assessment tools available that would allow Wofford to evaluate its LC program relative to other similar programs (although such tools are being developed; pers. comm. Joseph Pica, Educational Benchmarking, Inc).

3. Upon our invitation last summer, Dr. Trace Jordan, a member of the SENCER faculty and an associate professor at NYU, agreed to become the external evaluator of our program. Dr. Jordan has extensive experience in developing courses for non-science majors, and has been a leader in implementing the NSF-sponsored SENCER initiative. A team from Wofford participated in the SENCER Summer Institute in 2001, and Dr. Jordan was our "home-room" teacher for the duration of the institute, and we valued his leadership, advice, and constructive criticism. One of SENCER's goals is supporting the development of new curricular models that embody the SENCER mission, and in this spirit Dr. Jordan agreed to assess our LC project. He came to Wofford for 3 days in early June, 2002 to meet the LC faculty and preceptors and facilitate discussions about the goals and objectives of the initiative. Then a subset of these faculty and preceptors met with him in August during the 2002 SENCER Summer Institute, and he will return to Wofford during the summer of 2003 to evaluate our progress. We also hope that he will

be able to visit campus in the fall of 2003 to see the LCs "in action" and talk with freshmen students.

4. Wofford has a six-person team (including the PI) participating in The Third Annual Institute on Learning Communities at Evergreen State College this summer. This program requires a follow-up visit to Wofford by two experts to evaluate our progress in the LC initiative. This will provide additional external assessment of our NSF-funded program.

5. Detailed pre-semester and end-of-semester evaluation forms were developed and utilized by all LCs. These forms are available to download from the LC home page.

General activities/responsibilities for all preceptors:

1. The faculty members on each teaching team selected and invited two students to become preceptors. There were no specified criteria that preceptors had to meet to be selected. Preceptors committed to the following:
a. Working eight 40-hour weeks in the summer (earning $14/hour).
b. Scheduling their courses so that they could be present at all class and laboratory meetings of both courses in the LC. The Wofford faculty approved a new 3-hour course, "Independent study in teaching Learning Communities," for the preceptors to take to acknowledge their tremendous investment of time, creativity and energy, as well as the amount they would learn through the program. To successfully complete this course, preceptors attended and helped facilitate both courses in their LC, met with their LC faculty outside the classroom at least once per week to "debrief" and plan the following week, and completed an end of the semester project, typically a 10-page reflective paper on their role in, and perceptions of, the LC. In addition, the preceptors received "work-study" pay as laboratory assistants for the 1 credit hour of science laboratory within each LC. This nominal pay is the same as that received by undergraduate assistants in laboratory courses for science majors.

Findings

This project has fostered dramatic, positive institutional change at Wofford College. Evidence of the success of the program comes from all sectors of the Wofford community, including the freshmen enrolled in the program, undergraduate preceptors, faculty members and administrators. All of Wofford's top administrators and staff have shown a remarkable level of support and enthusiasm for the LC initiative, and in this way the program provides a national model of what is possible when faculty members, students, administrators and staff work in partnership toward a common goal of curriculum innovation. This overview of "Findings" will describe the successes and current challenges of this initiative from the perspective of each group.

Student Findings

Perspectives of first year students enrolled in each LC:
Comparisons of pre- and post-semester evaluations, both within and among the LCs, and the students' weekly journal entries indicate that they perceived the LCs as very successful (excerpts

of written comments and summary of the evaluations are being compiled for the LC website). Most common among the students' written comments were indications of:
1. The closeness they felt to the professors, preceptors, and each other, (for example, most students studied together for major exams and commented on new and lasting friendships).
2. A general appreciation of the use of new (for the faculty members) and diverse teaching methods that fostered active learning. However, some students continued to prefer the more passive lecture format, and most of the participating faculty members found that a regular mix of methods was most effective for first-year students.
3. A newfound appreciation for the efforts of teachers and professors, especially following their own educational outreach project with grade school children. They also found the outreach itself to be extremely challenging and rewarding and strongly recommended its continued inclusion in the program.
4. A heightened sense of self-reflection and responsibility to succeed academically.
5. Initial skepticism followed by embrace of the pedagogy of linking sciences and humanities, and their strong recommendation to broaden the initiative.
6. An increased civic awareness and heightened responsibility to resolve local and global problems.
7. An increased willingness to consider new ideas that challenged their beliefs and/or fell outside of their "comfort zone."
8. As non-science majors, a new appreciation for how science is an integral part of their education, how their eyes and minds have been opened to scientific issues in the world (even the cosmos) around them, and how they can use science throughout their lives to help solve problems. A couple of students in each LC even indicated an interest in becoming science majors after the LC experience.

Based on end-of-term evaluations, ALL of the students in the integrated Science/Humanities learning communities are advocates of the program. The following excerpts from a sample of these evaluations (all from different students) underscore how the program has impacted student development:

"I feel this [LC] has been wonderful at creating new ways of viewing things. This is truly what college should be about. This LC has given us knowledge of new topics and subjects while preparing us to be successful in the real world."

"This [LC] has enabled me to establish many correlations between the sciences and humanities that will equip me with the knowledge to bring unity to senseless divisions within our society."

"Because I didn't enjoy science in high school, I really liked linking a weakness to something I enjoy. It's a great [LC]."

"I am now a more critical thinker and am better able to enjoy and interpret things."

"[The LC] has made the transition to college easier because this group is very supportive. The linking of the two courses together made it more enjoyable. I think I learned more because of all the ties that could be made between the courses."

"I have really enjoyed this LC...The connection between the two classes was very clear and interesting..."

"I am an aspiring English major, and I shunned the sciences. Now I am more interested in the sciences, and although I am not likely to major in a science, I am more willing to broaden my horizons and take a science as an elective."

"This [LC] has had an extremely positive impact on me. In a Utopian society all education would be like this. I learned about real world issues and then experienced them first hand. I loved this [LC]. I tell everyone about it."

"This [LC] has let me see that I am good at science...This is really priceless because I can only imagine the effect that my new love for and interest in Biology will have on my academic life."

Perspectives of students not enrolled in the LC program:
The popularity of the LC program has led to one bittersweet indication of its success. Those students not enrolled in a LC (science majors being some of the most vocal) are jealous of the students who are. The grant proposal was written to focus on non-science majors for numerous reasons, but one was practical. There was flexibility in the type and depth of science content covered in our non-major's science courses, thus allowing each science faculty member the autonomy to work creatively with their Humanities colleague to come up with something completely new. In contrast courses within a science major tend to be more rigid, even entrenched, in specific content and tradition, making innovation more difficult.

One objective of linking the sciences and humanities in the freshman year is to show students (and faculty) the value of our General Education program as key to the future success of our graduates as productive citizens, rather than as a series of courses that must simply be endured and forgotten. Science professors in the LCs feel strongly that such an integrated experience would benefit our science majors as much as it has benefited the non-majors. Just as non-science majors tend to view science as an unnecessary burden to obtaining their degree, freshmen science majors tend to regard their humanities courses as a similar "waste of time."

As an outgrowth of this NSF initiative, the Biology department has begun investigating ways to create additional learning communities that link biology and non-science disciplines. Almost half of incoming students (130) enroll in the first freshman biology course, and the high number of students represents an obstacle to creating LCs like the ones in this project. Therefore biology professors are developing integrated learning experiences (e.g., a Bioethics course taught by professors in biology and philosophy; linked courses in tropical biology and Latin American culture, etc.) for upper-level students. Three members of the Biology department will be part of a six-person team accepted to participate in The Third Annual Institute on Learning Communities at Evergreen State College this summer to further develop their ideas.

Perspectives of the undergraduate preceptors:
Perhaps the group most transformed by the project has been the preceptors who work in partnership with the Science and Humanities faculty members to develop and implement each LC. In addition their contributions to the success of the program are invaluable. Their remarkable creativity and energy made for a delightful summer experience for all participating faculty members. Their confidence grew quickly, likely facilitated by the way the summer development workshops were designed, with students sitting as equal partners at tables with faculty and senior administrators (see "Training and Development" section).

Although the PI/PD had envisioned that the four people on each teaching team would work "side-by-side" throughout most of the 8 weeks (as the team for the "Nature and Culture of Water" team had done), not surprisingly each team developed their own strategy. In one LC, the preceptors spent time on their own developing expertise in a particular content area and then preparing presentations, discussions and activities that they later facilitated during the semester. In another the preceptors became the technology aficionados, developing course web pages and leading freshman students in developing their own. In all cases, however, teams met at least once a day throughout those preparatory eight weeks to share progress and ideas.

It is clear that first-year students looked up to the preceptors, even though in some cases preceptors were just one year ahead. The preceptors all spoke of an unexpected sense of responsibility to act as a role model (in and out of the classroom) to "their" freshmen and confessed that occasionally this new role was challenging for them, especially in social settings. They felt as committed to the success of the LC as the faculty, and their lack of prior teaching experience made them particularly frustrated when the freshmen failed to put in their best effort. That frustration was great motivation for the freshmen, as in at least one LC, the preceptors gave a number of spontaneous "pop quizzes" when they felt the freshmen were unprepared for class. Despite this, the students and preceptors developed close ties and friendships with each other.

The preceptors served as a liaison between faculty and students, and often were able to help professors understand the "students' perspective" and come up with different ways to explain difficult material for the students' benefit. From the faculty perspective, not only did preceptors help facilitate the transfer of knowledge, they also modeled being an active learner in the classroom. Similarly, the faculty member in humanities modeled being a learner in the science classroom and vice versa. The teaching teams agree that this had a tremendous impact on the freshmen, as long as the teaching team acted as facilitators and were careful not to dominate discussions.

Contrary to some of the "nay sayers" who believed that preceptors would try to make the LC content too easy, the opposite was true, and they encouraged faculty to push the students' assignment load, etc. They also came up with creative ways to present material and were particularly helpful in coming up with laboratory projects, field and out-of-classroom experiences, and outreach project ideas. While all of the faculty members agree that they could do the LC without the preceptors, they feel it would be a tremendous loss to the program. Therefore we are thrilled that the Dean has allotted funds to support new preceptors to work with faculty members that have taught their LC in the 2002/2003 academic year (not included in the NSF grant). Typically, these "year two" preceptors are selected from among the LC students, therefore they are familiar with the courses and will join their former professors for two weeks this summer to adapt/change the existing course offerings and be present as peer teachers next year. This year's preceptors for the "Nature and Culture of Water" LC were sophomores who had taken the LC last year, demonstrating that sophomores are just as capable of successfully performing in this role as upperclassmen.

The preceptors developed excellent communication and critical thinking skills through this experience. Beginning with the first summer's workshops (see "Faculty Development") and continuing throughout the semester, they were "on stage" whether in front of the LC students or giving formal presentations about the program to the Board of Trustees, President's Advisory

Council, faculty from throughout the country at SSI-2002, or at the Southern LC Conference (see "Activities"). We have found that the preceptors are the programs strongest spokespeople, and that it was well worth the institutional funds that were spent for them to travel to these meetings. Few students will ever have the insight into the "behind the scenes" life of an academic institution, nor develop the level of closeness and respect that they have for the professors on their teaching team. All of them have indicated their sincere appreciation for being selected for the program, how much they have learned from it, and how much it has meant to them.

Faculty/Administration findings

Faculty members participating in the LC program met periodically throughout the semester to share their successes and frustrations. Statements from those participating include:
"If only I could spend this much time (8 summer weeks) preparing all of my courses, they'd all be this good."
"I love working with [my colleague in the other discipline]. My non-LC classes feel lifeless in comparison, because [he/she] isn't there."
"I'm exhausted but strangely energized because I'm having more fun teaching than I have in years."
"It's amazing to see how differently [my colleague from the other discipline] approaches things; such as how [he/she] interacts with students and how [he/she] approaches an issue for discussion or analysis. I've learned so much from working with [him/her], and I know I'll never teach the same way again, even when I'm on my own."

Because all members of the teaching team (two faculty members and two preceptors) were required to be present at all meetings of each course (including the weekly laboratory session), a one course reduction to each faculty member's teaching load was probably the most critical piece ensuring the success of the program. With one exception, all received this reduction in teaching load from the Dean. Even with the course reduction, faculty members in the Humanities were struck by the added "strain" on their time of the 3-hour laboratory period every week, although they were unanimous about the extraordinary value of their participation in it. They have suggested that an additional reduction in duties somewhere else (such as a reduced advising load during the LC semester) would be greatly appreciated. The one faculty member who did not take a course reduction was the physics professor in the "Cosmology" LC team. Due to his department's small faculty size and high number of required courses for majors, he retained his regular teaching overload and added the LC to it. Although the "Cosmology" LC was deemed very successful by all involved, it is the only LC that will not be offered again next Fall due to the stress endured by this professor, and his understandable concern that the students in his other courses suffered as a result of his limited time. This is, perhaps, the most frustrating obstacle to the sustainability of the project, in part because this professor remains one of the program's strongest advocates. Whereas a short-term solution to this particular problem remains in doubt, President Dunlap is using the success of these LCs as fodder supporting his new fiscal campaign to build Wofford's academic program. A large part of the earnings from this campaign are to be used to continue to increase the size of the faculty; therefore a long-term solution to this problem is foreseeable.

Support for the program has been garnered through the numerous opportunities that we've had to publicize it. Our program has twice been the central feature in our alumni magazine, "Wofford Today," and the LCs have been featured in a number of articles in the local newspaper and in

brief local/regional television broadcasts. Preceptors and faculty members have also presented at a number of national conferences (see "Activities" section), as well as to the Wofford College Board of Trustees (at their biennial retreat) and to the President's Advisory Board. This latter group is composed of a body of national and regional "difference makers," selected by the president, which meets annually to brainstorm a particular topic. As further indication of the impact of the NSF initiative, this year's topic was "Science and the Humanities." Thus, prominent leaders, decision makers, and thinkers at Wofford College have been given unique insight into this initiative, and their response has been enthusiastic. We believe that the students' voices at these presentations have been the most convincing in this regard, and it underscores how important it is for our "off-campus" leadership to hear directly from students (and how rarely they do). We are well aware that the support of the Board of Trustees, in particular, will be critical to the sustainability of the program after the NSF funding period ends.

Training and Development:

On-campus summer workshops were held during the last week of May and the first week of June, 2002 to prepare faculty members and their undergraduate preceptors for their roles in developing and implementing the new NSF-funded learning communities. Remarkably, with additional support and financial incentives from the president and the dean, the first week of workshops was opened to include the broader Wofford community (members of the faculty and administration). Seating was arranged in 'round table' format with student preceptors, faculty members and administrators present at each table. A web page provides a pictorial overview of these two weeks of workshops (http://webs.wofford.edu/goldeyes/WoffordWorkshops02/Workshopoverview.html).

Guest experts facilitated this first week of workshops:
1. Dr. Karen K. Oates of George Mason University provided an overview of learning communities as a pedagogical method to deepen student learning. After a break-out session in which interdisciplinary teams of attendees designed their own 'hypothetical,' interdisciplinary learning communities, Dr. Oates discussed experiential and service learning practices that can further enhance the learning experience for students and faculty members.
2. Dr. Peter Facione, Provost at Loyola University - Chicago, facilitated our second day of workshops. A well-known and respected expert on critical thinking, Dr. Facione encouraged us to identify and utilize critical thinking skills in our lives as well as demonstrating how we can help our students progress toward higher-order critical thinking levels during college.
3. The third day of workshops were facilitated 'in house' by our Senior Vice President for Information Technology, Dr. David Whisnant, who led a workshop on web page design and on the educational uses of public folders. Wofford has just installed a new multimillion-dollar information system at Wofford, and this workshop provided timely training on the new system. Dr. Nancy Mandlove and Dr. Dennis Wiseman, faculty members in the Foreign Languages department, facilitated a concurrent workshop on how they utilize student-developed multimedia projects to deepen student engagement and learning.
4. Dr. Lorin Anderson facilitated the final workshop of the first week. A 'Carolina Distinguished Professor' within the Department of Educational Leadership and Policies at University of South Carolina, Dr. Anderson helped us analyze the efficacy of our current classroom assessment procedures using actual examination materials and student final projects volunteered by faculty members for discussion and analysis.

Only the faculty members and undergraduate preceptors involved in teaching the new learning communities participated in the second week of workshops.

The objectives of this second week were to:

1. Foster understanding of the different modes of thinking and inquiry across the Sciences and the Humanities.
We began with discussions of C.P. Snow's 'Two Cultures' and how our academic 'upbringing' has differed among the workshop participants. Dr. Trace Jordan of New York University (who is also serving as external reviewer of our NSF-funded program) and Ian Marshall of Penn State University - Altoona facilitated these discussions. Dr. Jordan, an environmental chemist, has extensive experience developing interdisciplinary programs (within science, math and technology) for non-science majors, whereas Dr. Marshall, an English professor interested in environmental writing and interdisciplinary studies, drew upon his experiences of teaching with a biologist.

2. Develop mutual trust and respect between faculty members and student preceptors on each teaching team.
We broke into our teaching teams to begin work on the Science/Humanities learning communities. Each team developed a concept map for their learning community and presented the map to the entire group for discussion and suggestions. We encouraged the student preceptors to be equal partners in this process to begin to establish the type of rapport that would be sustained throughout the summer and the semester in which the learning community was offered.

3. Become familiar with various teaching methods (jigsaw, think-pair-share, debate, discussion, etc.) not previously tried by many participating faculty members.
Since the project included an expectation to create an environment of active learning, each teaching team considered how they might incorporate the use of such methods into their LC.

4. Develop pre-semester, mid-semester and post-semester evaluation forms to be used by all students enrolled in the learning communities.
Only the pre-semester and post-semester forms were required to be used by each learning community, and they are available to the general public on the website as PDF files.

5. Consider the ultimate sustainability of the program (even though we'd just begun the funding cycle).
We've been aware, from the start, that this project is labor intensive -- both in terms of man-hours for preparation and for implementation. Therefore, we invited Wofford's Development Officers and other funding experts to discuss our program and to begin to consider how we might find funding to further support the development of the program (if it is deemed successful) once the NSF funding cycle is ended.

Further training and development occurred throughout the remaining six weeks of summer work as faculty members and preceptors planned and prepared for their LC.

Outreach activities:

Each LC incorporated an outreach activity into their curriculum, and the success of these programs for public school elementary children exceeded expectations. Each activity was developed and implemented by the freshmen enrolled in the LC, with the following objectives:

1. Develop teamwork skills by working in groups of 3-4 to design, prepare and implement activities for the children.

2. Become "experts" in specific content areas before teaching children.

3. Allow all freshmen to experience the role of teaching and the responsibilities that come along with it.

4. Be reminded of the eagerness for learning that they once had as children.

5. Provide an opportunity for freshmen to become more aware of the needs of people in their surrounding community and witness, first hand, the positive difference their involvement can make.

The following includes a description of the outreach activities carried out by the three LCs offered in the Fall, 2002 (pictures of these activities are available from links on the LC website).

The "Nature and Culture of Water" LC hosted a day-long educational field day called "Meet the Creek" with all of the 5th graders from Chapman Elementary School. Sixty children participated in 2002 and eighty in 2001 (the pilot year for this LC). Like the other public schools in Spartanburg, SC, Chapman is ethnically diverse, with 52% African-American, 40% Caucasian, 6% Hispanic and 2% Asian-Pacific or Native-American students.

Preparation for "Meet the Creek" is incorporated into the content and design of the LC, as in first month of the semester the LC makes extensive use of a local stream as a teaching landscape (the same stream that they will use during the outreach). From a science perspective, the freshmen studied the ecology of the ecosystem, sampled macroinvertebrates as indicators of the water quality, and developed their understanding of how science relates to civic issues such as treatment of urban sewage and the maintenance of a safe drinking water supply. From the "humanities" perspective, they were encouraged to write about (in poetry and personal reflection) the natural beauty of the stream, consider what responsibility they have in protecting and restoring it, and learn about the historical and social roles that the water system has played in the development of the Spartanburg community.

The elementary teachers also met with the freshmen in advance to teach the freshmen about the science and language arts "standards." The freshmen then formed four teams to design highly interactive learning stations along the stream. On "Meet the Creek" day, the children moved from station to station in a "round-robin" setup. The first station was

a macroinvertebrate station, in which children used sampling equipment to collect, sort, and identify various insect larvae, crustaceans, mollusks and annelids. The second station was a "scavenger hunt" in which children collected many different types of leaves from trees along the stream and used a key that the freshmen developed to correctly match the leaves to the common name of the trees from which they had come. The third station combined art and science in that the freshmen led the children in a discussion of native vs. introduced species, and then, using leaves from a native (e.g., Sycamore) and an non-native (e.g., Mimosa) trees, they helped the children use paint and rollers to stencil the leaf patterns onto a new white t-shirt (that the children to subsequently take home). In the final station children were encouraged to draw their inspiration from the natural world around them to write poetry. This outreach project was co-sponsored by the Spartanburg Water System and Spartanburg Sanitary Sewer District, which covered the cost of t-shirts, paints, etc.

For the "Cosmology and Ultimate Questions" LC, the class broke into three teams of 4-5 students to develop their outreach projects for 4th graders. The fourth grade was selected because astronomy topics are part of the science standards for this age group. To aid the teams in their initial planning, a member of Wofford's Education Department presented a workshop on outlining lesson plans, gave an overview of science standards and classroom management techniques, and, along with the LC teaching team, helped the students brainstorm ideas. The teams were given autonomy in picking a topic from the standards list and a budget of $200 dollars to implement their project. Throughout the semester, each team worked together to design a short presentation and interactive activity to be carried out in the elementary classroom near the end of the term.

Each team focused on one of the following topics for their activity: "The Nine Planets," "Phases of the Moon," and "Stars and Constellations." The first group designed an interactive game to help the children learn the order and characteristics of the nine planets, and then had an activities session in which the children used paints to create one of the planets on a Styrofoam ball. In Phases of the Moon, children learned the names, shapes and causes of the lunar phases. Their presentation included an interactive demonstration where the undergraduates used a big flashlight and children as props to demonstrate the phases. Then the children made mini posters illustrating the lunar phases. The "Stars and Constellations" group shared some of the mythologies associated with the major constellations and what these constellations looked like. They designed several dot-to-dot drawing activities (using florescent pens on black cardboard) and included a creative session that allowed each child to design their own constellation and develop a mythology for it.

The "Literary Perspectives on Madness and Creativity: Reality's Dark Dream" LC designed an outreach project where they encouraged elementary children to consider how perspective and self awareness is influenced by our point of view. The freshmen designed stations for children to discuss what they saw in optical illusions, how colors are used in famous paintings, and a session in which the kids were given the opportunity to see how their perspectives were influenced when working with others compared to when they worked alone. The freshmen led the children in lively discussions about a very important life topic, that every individual has a different way of looking at things, and that there is often no one right way to do so.

Outreach to other sectors of the public:

As noted in the "Activities" section, faculty members in the "Water" LC partnered with the general manager of our county's water utilities agency to present the results of their collaboration at a non-academic conference, the 75th Annual Water Environment Federation Conference and Exposition, September 28-Oct. 2, 2002 in Chicago, IL. The presentation, " Innovative Public Education Programs for College Students - Combining the Sciences and Humanities to Achieve a Deeper Understanding of Water Issues," was a unique opportunity to extend the role of higher education into the public sector. The audience represented a diverse group of elected officials and municipal water system managers from around the world charged with educating the public about our water resources, and their response to the presentation was enthusiastic. Follow up correspondence with attendees has included inquiries into how to establish ties with local colleges and universities to get similar initiatives started in their own communities (e.g., a manager from a Denver water utilities agency has contacted faculty at Denver University to establish a similar partnership, and a group from Canada was particularly interested in our "Meet the Creek" outreach design). The publication that resulted from this collaboration will provide a valuable resource for developing similar programs in other parts of the world.

Contributions within science disciplines:

As previously stated, these LCs are designed for non-science majors, and the faculty members from the various science disciplines are free to develop the science content of each LC based on their own interests and expertise. Therefore the pedagogical method employed in each LC is the most unifying theme of the initiative; that of integrating science and humanities courses to achieve a better understanding of how science fits into the students' liberal education. An overarching goal of this initiative is to help students see how science literacy is necessary to becoming productive, compassionate and civically engaged citizens willing to integrate all aspects of their knowledge and training to seek solutions to complex problems in their communities and beyond. We believe that we have made significant contributions in this regard as three science disciplines have participated in this program, and each has introduced students to the knowledge, theory and research within their disciplinary field (as described below).

Biology:

During the first summer of the project, biologists developed two learning communities in collaboration with their teaching teams. Only the contributions of the "The Nature and Culture of Water" LC are reported here because the second biology-based LC, "The Mammal in the Mirror" is being taught in the spring semester of 2003. A third biology-based LC will be developed during summer 2003.

The "Water" LC students are introduced to aquatic ecology, watershed geology, aquatic toxicology, and the effects of urbanization on natural areas. Students received fist hand experience of different aquatic habitats within the state of South Carolina, including urban streams, a "Wild and Scenic" mountain river, a riparian wetland, oligotrophic and eutrophic

impoundments, and a coastal estuary. Supplementing the expertise of the teaching team were regional experts from other campuses (University of South Carolina, USC-Spartanburg, Davidson University, Furman University, and Clemson University) and institutions (an environmental consulting firm, our county water utilities agency, and a coastal marine research laboratory) that met with our students to share their expertise - almost always in the field rather than in the classroom. Students experienced first hand the types of research conducted in each type of aquatic system, studied the serious problems posed by human disruption of natural systems, and debated solutions/interventions for these problems. They also saw how scientists and non-scientists can work together to identify and solve these problems. One anecdote (among many) from the semester underscores the potential long-term impact of such work with students. Three of this year's freshmen are the sons of major developers along the coast of SC, and all plan to pursue the careers of their fathers. In traveling from one of our research destinations this semester, these young men, without prompting, described how horrible it is that most developers are ignorant of the negative impact they are having on our natural areas in South Carolina, and how the students' minds had been opened to the importance of such knowledge in minimizing the negative impact of their own future work. Needless to say, it was a great teaching moment.

Physics:

Students in the "Cosmology and Ultimate Questions" LC were introduced to a range of topics including sky observation, relativity, quantum theory, particle physics, dark matter, symmetry and string theory, multiple universes, and the SETI project. They also received hands-on experience with various types of state-of-the-art astronomical research equipment including radiotelescopes at the Pisgah Astronomical Research Institute. They conducted a number of "open-ended" laboratory experiments on topics including optical resolution, the Kepler orbit of Mars, and gravity. Students developed their own "expertise" in sky observation during an overnight trip to Asbury Hills Camp in Northwestern South Carolina. They then developed a campus "in-reach" project in which they planned a nighttime "Star Party" open to all of the Wofford community (the Roper Mountain Space Center agreed to bring excellent telescopes for the event). Unfortunately, this project was rained out on three different nights and was subsequently cancelled. Many of the freshmen had been looking forward to the event and wrote in their journals and course evaluations of their disappointment over not being able show the other Wofford students what they had learned.

Psychology:

Students in the "Madness" LC were introduced to the history and current conceptualizations of severe mental illness (specifically, depression and bipolar disorder, dissociative and somatoform disorders, and schizophrenia). Students studied the underlying neurobiological mechanisms theorized to cause these problems as well as the symptoms and treatments for these disorders. Students also studied the cultural and historical perspectives on mental disorders, including the cognitive and emotional biases that affect our judgments. The students then designed and conducted their own research experiments on how others perceive madness and how bias can be introduced into others' perceptions of the mentally ill. Students also toured an historic insane asylum (Central State Hospital in Milledgeville, Georgia) and visited a local art studio for the mentally ill ("Outside In" Artists' Studio). They also had the opportunity to talk with guest

speakers (one living with bipolar disorder and another treating mentally disabled Native Americans in western North Carolina).

Contributions to other disciplines:

This program is uniquely suited to have far-reaching contributions to other disciplines. By design, a number of faculty members from non-science disciplines have worked directly with a science colleague in the LC. All have commented on the wealth of information that they have learned about science, and the scientists reported that they learned just as much from their humanities' colleague. The depth of respect that these teaching partners have for each other is profound, and the students gave them the highest possible marks for the respect that they showed for each other in the classroom. Besides science faculty members from biology, physics and psychology, faculty members from across campus in English, philosophy, history, and sociology have or will participate directly in the project. In addition, virtually all of the departments participated in the 2002 Summer Workshops (see "Faculty Development"). Therefore the program has had an unexpectedly broad influence throughout the entire faculty.

Because the students enrolled in the LC are non-science majors, their subsequent disciplines will likely be affected by their participation in the program. Non-LC faculty members have often mentioned "I have one of your [current or former] LC students in my class." This point is worth noting because professors are normally unaware of the "rest" of a student's schedule, and these types of comments indicate that 1) LC students are standing out in some way, and/or 2) LC students are identifying themselves as belonging to a particular group based on their academic program, rather than on a social organization.

Contributions to Human Resources:

This program has provided a new way for Wofford's non-science majors to explore science and technology. Their written evaluations of the LC indicate that the LC approach is having a positive influence on how the students view science and its role in their education (see "Findings" section). The students have been transformed by the experience, and so have the science and non-science faculty members.

The outreach activities (see "Outreach" section) have also exposed grade school children throughout the community to science, often in ways that integrated science with other disciplines. The majority of these children are from underrepresented groups in science and technology, and the activities that the freshmen developed were fun, interactive, and educational. In addition, the readily identifiable "hero worship" by the children for their freshman "teachers" underscored the strong impact that the undergraduates made. Feedback from grade school teachers involved with one of the LCs indicated that the children continued to talk about the experience weeks later, and that the kids identified it as the "best thing they did all year" at the end of the year. Perhaps such a memorable experience will influence them to pursue future education and career options in STEM disciplines.

It is also likely that we have encouraged the undergraduate students to consider teaching as a profession. Anecdotal evidence of this appeared in student journals after the outreach days.

Many of the freshmen wrote that working with the young children had been a challenging and rewarding experience, that they had overcome their fears and proven that they could teach science to kids, and that they had newfound respect for grade school teachers. Currently among Wofford's 1100 students, about seven students per year declare Education majors (we only have a secondary education track), but many more Wofford graduates end up teaching in primary and secondary schools after graduation without certification (either at private schools or schools where the certification requirement is waved due to need). We don't yet know which of the LC students will become teachers, but we are hopeful that the LC experience will help shape their pedagogy.

The preceptors have indicated that the experience has made them consider teaching at the college level. In terms of professional training for future college professors, the PI is confident that these undergraduate preceptors have much deeper insight into teaching and learning than she had after completing her Ph.D., despite her own experience of teaching introductory courses during her graduate work. The preceptors' insight is profoundly evident in their final papers reflecting on the LC experience.