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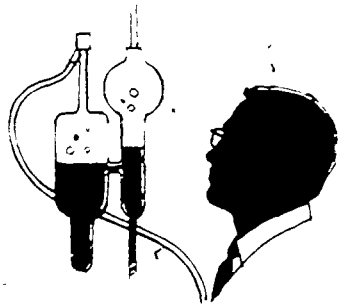
ABSTRACT

This book is intended as a final report on those activities and institutions supported through the National Science Foundation's College Science Improvement Programs (COSIP A & B), and as a reference to current developments in undergraduate science education. In the first major subdivision of this work are included project abstracts for the two program elements, COSIP A (individual instructional projects in 4-year colleges) and COSIP B (interinstitutional projects in 4-year colleges), presented in alphabetical order. A second section consists of a comprehensive index utilizing 1,916 descriptive statements which permits ready reference to undergraduate activities at colleges and universities throughout the United States. (Editor/CP)

An Index to Undergraduate Science



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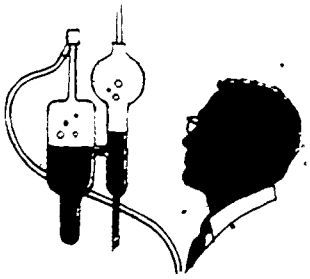

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FOREWORD

This book is intended to serve two functions It is presented as a final report on those activities and institutions supported through the National Science Foundation's College Science Improvement Programs (COSIP A & B), and as a reference to current developments in undergraduate science education.

The book has two major subdivisions. The first includes the project abstracts for the two program elements, COSIP A (individual institutional projects in 4-year colleges) and COSIP B (interinstitutional projects in 4-year colleges), presented in alphabetical order by institution. The second, and perhaps more generally interesting major section, is a comprehensive index which permits ready reference to undergraduate science activities at these colleges including, but not limited to, those activities supported under COSIP The index contains 10,305 separate key word permutations derived from 1,916 descriptive statements. Directions for using the index are given on p. 103

The project abstracts and indexing statements were prepared independently by the directors of individual projects, but discussed and refined at a meeting of all directors held in Washington, D C., March 20-22, 1974. The index itself was developed by Chemical Abstracts Service, Columbus, Ohio, from the statements submitted by the project directors

The College Science Improvement Programs was conceived in the post-sputnik era as one of a number of Federal Government responses of concern for the Nation's scientific strength and welfare. Its primary purposes were to enhance the science capabilities of predominantly undergraduate colleges and universities and to increase the capacity of these institutions for continuing self-renewal.

It was the Foundation's intention through COSIP to provide aggressive institutions with a competitive incentive for orderly long-range development of their science programs. The intrinsic scientific and educational soundness of specific activities proposed was therefore not the sole criterion for award. High priority was given institutions that exhibited plans for coordinated development from careful consideration of the existing situation and future potential.

Within such an unusually broad framework of programmatic objectives few proscriptions were placed on the precise nature which COSIP support might take. As a consequence, a highly diverse set of project activities resulted. Projects frequently focused on curriculum strengthening by upgrading laboratories with new instructional scientific equipment, together with updating old, or introducing new, course offerings. Existing faculty received retraining and new faculty were employed where curriculum expansion was deemed necessary Increased involvement of students in independent research and/or field activities (with an emphasis on "relevance") was quite common.

A typical grant involved the direct cost expenditure of $225,000 in NSF funds and $100,000 in local funds over a 3-year period A total of 160 individual institutions received broadly based developmental awards worth nearly $31 million under COSIP A. In addition, 23 grants for $2.2 million were awarded for consortium activities under COSIP B. During the program's lifetime, which extended from 1967 to 1973, it reached 25 percent of its target population, the predominately undergraduate colleges and universities.

Ruth Ann Verell and Robert F Watson, *Editors*

ACKNOWLEDGEMENTS

The efforts of many people underlie the activities and accomplishments which this report is only able to touch. Certainly, the project directors whose names are shown with the abstracts deserve primary credit, not only for the material presented herein, but also for their years of personal effort from proposal preparation to project termination. Too many other college faculty and administrators to name were also important contributors to the achievements of individual projects.

A number of Foundation staff served the program during its history, but Donald Schwartz and Homer Wilkens, initially, and Jim Kellett later were primarily responsible for COSIP's style and direction.

The participation of Chemical Abstracts Service in the development of abstracting and indexing materials, and the cooperation of the American Association for the Advancement of Science is also acknowledged

CONTENTS

I

INSTITUTIONS SUPPORTED UNDER COLLEGE SCIENCE IMPROVEMENT PROGRAMS — SECTION A

Individual Institutional Projects in 4-Year Colleges (COSIP A)

1. Albion College
2. Allegheny College
3. Amherst College
4. Antioch College
5. Augustana College
6. Augustana College
7. Austin College
8. Ball State University
9. Beaver College
10. Bellarmine College
11. Beloit College
12. Bemidji State College
13. Bennett College
14. Berea College
15. Bluffton College
16. Bucknell University
17. California State College-Bakersfield
18. Canisius College
19. Capital University
20. Carleton College
21. Central State University-Ohio
22. Central State University-Oklahoma
23. Central College
24. Central Washington State College
25. Centre College of Kentucky
26. Christian Brothers College
27. The Cleveland State University
28. Coe College
29. The Colorado College
30. Concordia College
31. Cornell College
32. Davis and Elkins College
33. Denison University
34. De Paul University
35. De Pauw University
36. Dickinson College
37. Drake University
38. Drew University
39. Drew University
40. Drexel University
41. Earlham College
42. East Carolina University
43. Eastern Kentucky University
44. Eastern Michigan University
45. Eastern Washington State College
46. East Texas State University
47. Elmira College
48. Emory and Henry College
49. Evergreen State College
50. Fairleigh Dickinson University
51. Findlay College
52. Fisk University
53. Florida Atlantic University
54. Florida Institute of Technology
55. Franklin and Marshall College
56. Franklin and Marshall College
57. Furman University
58. Gettysburg College
59. Grand Valley State Colleges
60. Grinnell College
61. Gustavus Adolphus College
62. Hamline University
63. Hampden-Sydney College
64. Hampton Institute
65. University of Hartford
66. Harvey Mudd College
67. Heidelberg College
68. Hollins College
69. Hood College
70. Hope College
71. Humboldt State University
72. Illinois Wesleyan University
73. Juniata College
74. Kenyon College
75. King College
76. Knox College
77. Lawrence University
78. Lincoln University
79. Louisiana Tech University
80. Luther College
81. Macalester College
82. MacMurray College
83. Manchester College
84. Manchester College
85. Marquette University
86. Maryville College
87. Mary Washington College
88. Miami University
89. Middlebury College
90. Millsaps College
91. Minot State College
92. The Monmouth College
93. Morehouse College
94. Morgan State College
95. Mount Holyoke College
96. Nebraska Wesleyan University
97. North Carolina Central University
98. The University of N.C.-Greensboro
99. University of North Dakota
100. Northeast Louisiana University
101. Northern Arizona University
102. University of Northern Iowa
103. North Georgia College
104. Oberlin College
105. Oberlin College
106. Occidental College

107. Ohio Northern University
108. Ohio Wesleyan University
109. Old Dominion University
110. Portland State University
111. Providence College
112. University of Redlands
113. Reed College
114. Ripon College
115. Rollins College
116. Roosevelt University
117. Rose-Hulman Institute of Technology
118. Rosemont College
119. St. Andrews Presbyterian College
120. Saint Joseph's College
121. St. Lawrence University
122. Saint Mary's College
123. Saint Olaf College
124. Saint Peter's College
125. Savannah State College
126. Simpson College
127. S.D. School of Mines & Technology
128. South Dakota, University of
129. Southeastern Mass. University
130. Southwestern at Memphis
131. Southwest Texas State University
132. Spring Hill College
133. Stephen F. Austin State University
134. Stetson University
135. Susquehanna University
136. Swarthmore College
137. Sweet Briar College
138. Tennessee Technological University
139. Tougaloo College
140. Trinity College
141. Trinity University
142. University of Tulsa
143. Tuskegee Institute
144. Upsala College
145. Valley City State College
146. Vermont, University of
147. Virginia Military Institute
148. Virginia State College
149. Wabash College
150. Washington College
151. Washington and Lee University
152. Weber State College
153. Wheaton College
154. Widener College
155. Wilkes College
156. Willamette University
157. William and Mary, College of
158. Williams College
159. Winona State College
160. University of Wisconsin-LaCrosse
161. University of Wisconsin-Milwaukee
162. Wittenberg University
163. Wofford College
164. Wooster, The College of
165. Worcester Polytechnic Institute
166. Worcester Polytechnic Institute

II

INSTITUTIONS PARTICIPATING IN PROJECTS UNDER COLLEGE SCIENCE IMPROVEMENT PROGRAMS—SECTION B

Interinstitutional Projects in 4-Year Colleges (COSIP B)

167. Amherst College
Mount Holyoke College
Smith College
Williams College

168. Associated Colleges of the Midwest (ACM)
Beloit College
Carleton College
Coe College
Colorado College
Cornell College
Grinnell College
Knox College
Lawrence University
Macalester College
Monmouth College
Ripon College
St. Olaf College

169. Same as 168

170. Same as 168

171. The Atlanta University Center Corporation
Clark College
Morehouse College
Morris Brown College
Spelman College

Atlanta University-Advisory

172. Austin College
Bishop College
Dallas Baptist College
Texas Weslevan College

173. Great Lakes Colleges Association
Albion College
Antioch College
Denison University
DePauw University
Earlham College
Hope College
Kalamazoo College
Kenyon College
Oberlin College
Ohio Wesleyan University
Wabash College
Wooster, College of

174. Consortium for the Advancement of Physics Education (CAPE)
Bethany College
Fort Hays Kansas State College
Kansas State College at Pittsburg
Kansas Wesleyan University
Southwest Missouri State College
William Jewell College

Kansas State University-Advisory

175. Amherst College
Hampshire College
Mount Holyoke College
Smith College
University of Massachusetts

176 Arkansas College
Bethel College
Henderson State College
Lambuth College
Lane College
Memphis State University
Ouachita Baptist University
Rust College
State College of Arkansas
Union University
University of Tennessee-Martin

177. Middle-Atlantic Educational and Research Center (MERC)
Franklin and Marshall College
Juniata College
Lebanon Valley College
Messiah College
Wilson College

178. Franklin Pierce College
Keene State College
Mount Saint Mary College
New England College
Notre Dame College
Plymouth State College
Rivier College
Saint Anselm's College
Suffolk University

University of New Hampshire—Advisory

179. Vantuna Consortium
- California State College-Fullerton
- Occidental College
- Pomona College
- San Fernando Valley State College
- University of California—Santa Barbara

180. Pacific Northwest Association for College Physics
- Sixty Institutions of Higher Learning in the States of:
  - Alaska
  - Idaho
  - Montana
  - Oregon
  - Washington

181. Malheur Environmental Field Station Consortium
- Blue Mountain Cmty College
- Central Oregon Cmty College
- Clackamas Cmty College
- Eastern Oregon College
- George Fox College
- Lewis and Clark College
- Linfield College
- Linn-Benton Cmty College
- Mount Hood Cmty College
- Oregon College of Education
- Oregon Technical Institute
- Pacific University
- Portland State University
- Southern Oregon College
- Warner Pacific College
- Willamette University

University of Oregon-Oregon State University—Advisory

182. Meredith College
Saint Augustine's College

183. Nazareth College of Rochester
St. John Fisher College

184. Saint Vincent College
Seton Hill College

185. Emmanuel College
Simmons College

186. Southern College University Union
- Birmingham-Southern College
- Centenary College of Louisiana
- Centre College of Kentucky
- Emory and Henry College
- Fisk University
- Hendrix College
- Millsaps College
- Southwestern at Memphis
- The University of the South

Vanderbilt University—Advisory

187. Tech Aqua Development Consortium
- Belmont College
- David Lipscomb College
- Fisk University
- George Peabody College
- Middle Tennessee State University
- Tennessee State A & I University
- Tennessee Technological University
- Trevecca Nazarene College
- University of the South
- Vanderbilt University
- Western Kentucky University

188. Bethel College
- Carson-Newman College
- David Lipscomb College
- East Tennessee State College
- Hiwassee College
- Knoxville College
- Middle Tennessee State University
- Tennessee State A & I University
- Tennessee Wesleyan College
- University of Chattanooga
- University of Tennessee-Martin

University of Tennessee—Advisory

189. Knoxville College

University of Tennessee—Advisory

III

COSIP A PROJECT ABSTRACTS

ALBION COLLEGE, Albion, Mich. 49224. Russell Aiuto, Asst. Prof. of
1 Biology. 517-629-5511. Ext. 299.

Grant GY-5361 was a one year pilot program to evaluate five program categories in undergraduate science education in biology and physics. These five programs were: (1) alumni communications, (2) departmental evaluation; (3) visiting scientists; (4) pre-college; (5) faculty and curriculum development. The entire program was an attempt to integrate sources of information dealing with pre-college, undergraduate, and post-graduate science education at a single institution. In all five instances, these programs have been continued in various forms beyond the grant year (1969-1970). Three areas were particularly successful. Particular progress was made in curriculum development by the institution of greater opportunities in science for non-science students. Because of the impact of the visiting scientist program, a greater number of prestigious scientists are brought to the campus each year through the use of institutional funds than heretofore. The colleague relationship developed with selected high school science teachers has been maintained. The limitations imposed by the methods selected for departmental evaluations (two "outside" evaluators) did not result in much significant change with respect to departmental activities. The alumni communication program was the least successful, since its major goal was to utilize the expertise of science alumni and most of the year was spent accumulating lists. This has been more successfully accomplished through the facilities of the college alumni office than through the individual departments. It was felt that the principal contributions of the program were an increased appreciation of student and faculty research, and a more responsible curricular philosophy for non-science students.

ALLEGHENY COLLEGE, Meadville, Pennsylvania 16335. Dr. Richard L. Bivens,
2 Associate Professor of Chemistry, (814) 724-5363.

The purpose of the project was to accelerate the development of the curricula of the six participating departments, to expand the undergraduate research program, to provide opportunities for faculty professional development and to stimulate the development of a sense of professional dedication in majors. A number of courses and laboratories were completely revised or redesigned, resulting in increased efficiency of learning and teaching. The biology department has completely revised its curriculum, while mathematics, chemistry, physics and psychology have changed several courses each. Several departments are now teaching courses by the Keller Method and other experimental teaching methods. The geology department has developed a program with several graduate schools to accelerate student progress toward advanced degrees. The number of students participating in undergraduate research projects has increased dramatically, largely as a consequence of equipment purchases and expanded laboratory facilities. Faculty research and professional growth were greatly enhanced by released time, leaves of absence for study at other institutions and with interaction with visiting scientists. The visiting scientist program in the mathematics and psychology departments has been so successful in terms of stimulating both faculty and students and in providing a regular source of outside evaluation of the departments that every effort will be made to continue the program. Another successful program for several departments has been the increased attendance by faculty and students at regional and national professional meetings. Students return from these excited about their field and eager to try some research projects of their own. In some cases students have made their own paper presentations at these meetings. All of the benefits of CoSIP have been realized at a time when an unexpected increase of student enrollments in science courses of more than 30% occurred. The science division is now in a position to attract more outside sources of financial support as a result of CoSIP. The major benefit of the project was the increased activity and morale of faculty and students which should manifest itself for many years.

AMHERST COLLEGE, Amherst, Massachusetts 01002
3 Prosser Gifford, Dean of the Faculty, 413-542-2333

The COSIP grant to Amherst College focused on a development plan for three departments: Biology, Chemistry and Physics. The components of the plan included visiting professors, faculty released time, purchase of new scientific equipment and renovation of laboratory facilities. The visiting professors encouraged new approaches to research problems and helped to create and experiment with new courses or course modifications. The departments also provided released time equivalent to one full semester to each faculty member during the grant period to help revitalize and reorganize departmental andinterdisciplinary offerings. Biology laboratory space was renovated to improve facilities for experimentation in studies in the cycling of plant poisons through the food chain. Equipment for a chemistry course directed to establishing the physical bases of chemistry and employing many of the modern techniques of the professional research scientist was purchased. Equipment also was obtained for two new courses in Physics, one dealing with tools and techniques of modern physics and the other with electrical measurements and electronics. The IBM 1130 computer system used by the science departments was expanded and through COSIP funds a central processor and printer, remote terminal stations and plotter unit attachment were added to the College system. The monies in each of the above categories have served to strengthen substantially the teaching of science at Amherst College. We have brought several new areas of science into the curriculum, we have built solidly upon our tradition of interdisciplinary teaching in the sciences, and we have provided the capability for sophisticated student honors work in several major scientific disciplines. The goals for which we sought COSIP support have been in large part reached, and more important, the gains achieved through the use of COSIP monies will become a continuing and integral part of our science curriculum.

ANTIOCH COLLEGE - YELLOW SPRINGS
4 Yellow Springs, Ohio 45387
T. C. Holyoke, Professor of Mathematics (513) 767 - 7331, ext. 436

There were sixteen distinct Project activities, not directly related to one another, ranging over a wide variety of disciplines and involving a variety of immediate purposes and methodologies. Eight of these activities crossed disciplinary boundaries significantly, six dealt primarily with social science, eight dealt primarily with natural science, and three made substantial use of outside consultants. One was devoted primarily to faculty research, eight to combined faculty-student research, and four to student research under faculty supervision. Most of the research made use of equipment which could not have been purchased without the help of the Project grant. Five activities involved the specific development of new courses. The Project was undertaken in conjunction with a reorganization of the natural science division designed to promote interdisciplinary activities and social awareness related to scientific and technological endeavors, build up the natural science faculty, seek new approaches to and new styles of conducting science education, and attract students to scientific study. Not all of these goals were attained to the fullest possible extent, and recent special difficulties have had an adverse effect; but it seems clear that the Project helped Antioch move toward its goals and to weather the difficulties. There is close interdisciplinary cooperation among natural science faculty and some such cooperation among social science faculty and between the two areas. Interdisciplinary courses have arisen and continue. Attention to matters of social awareness has found and maintains a place in the science curriculum. Greater student involvement in research has added a valuable dimension to scientific education that, although diminished since Project termination, nevertheless continues to have a place in the program. And the usual enrichment of courses due to faculty involvement in research has taken place here as expected.

AUGUSTANA COLLEGE. Sioux Falls, South Dakota 57102 Sven G. Froiland, Chairman,
5 Division of Natural Sciences, 605-336-4712

A new phase in science education at Augustana College was initiated with the COSIP grant through faculty summer research opportunities, faculty improvement through supplementary grants for sabbatical leaves, development of multidisciplinary courses, addition of a Computer Center Director, a greenhouse-live animal room technician, and an electronic equipment workshop technician. Junior faculty members of eight departments in Natural and Social Sciences were awarded summer grants for active research programs over a three-year period. Senior faculty were provided opportunities for updating with semester or full year sabbatical leaves at major universities. The departments of psychology, sociology and economics developed a multidisciplinary course. An earth science program was introduced. Several staff members were added including a full time Computer Center Director, plus two technicians to relieve faculty of routine responsibilities such as equipment preparation. The overall effect on all eligible departments has proven to be most beneficial, reflected in attitudes of faculty, administrators and students toward research as an instructional tool. Release from routine non-teaching or research tasks allowed the faculty to devote more time to teaching-research. With the impetus provided by this grant, a second phase in the college's science program was implemented and paved the way for securing a second COSIP grant which made possible the continuation of emphasis on faculty development and faculty-student team research programs. Although it is difficult to document or quantify the increased interest of faculty and students in research and scholarly activity, there has been a significant improvement in attitude toward and participation in scholarly activities throughout the campus community in science and non-science disciplines alike.

AUGUSTANA COLLEGE. Sioux Falls, South Dakota 57102 Sven G. Froiland, Chairman,
6 Division of Natural Sciences, 605-336-4712

The continuing development of Augustana College's science program was substantially aided by providing support for academic year and summer faculty and student research programs and interaction, support for hiring a statistician-methodologist, development of a Senior Honors Program in Mathematics, initiating computer-based instruction in all science departments, enhancing multi-disciplinary audio-visual-tutorial instruction, and a visiting scientist program. The grant markedly affected the concept of teaching-research as the best approach to science education through involvement of individuals and teams of both faculty and students in active research in eight Social and Natural Science departments. The statistician-methodologist has substantially aided instruction and individuals and departments in establishing research activities plus computer applications. The Mathematics Honors Program has significantly increased interest in and improved the quality of mathematics instruction and research. Remote terminals have been added to each science department to facilitate computer based instruction in all disciplines. Several audio-visual tutorial programs have been implemented, mostly multidisciplinary. Visiting scientists were engaged for semester assignments. The grant was administered by an elected committee representing each participating department, changed annually to involve faculty in implementation and to increase interest in the programs. It has increased student interest in research and revitalized faculty by active participation and involvement in communicating results of projects to peer groups. The grant has affected all eligible departments, enabling them to maintain a continually evolving program of teaching-research and insuring updated instruction.

7 AUSTIN COLLEGE. Sherman, Texas 75090. Frank C. Edwards, Dean of Educational Research and Development and Professor of Chemistry. ph. 214/892-9101.

The National Science Foundation (with the National Endowment for the Humanities) is helping to fund the Austin College Total Institutional Project to restructure the entire institution to make it more responsive to individual student needs and to infuse self-renewal efforts on a sustained basis. The Project aids implementation of the new educational program called IDEAS (Individual Development: Encounter with the Arts and Sciences) by supporting the restructuring of educational programs in the entire curriculum. Science is given a new fundamental role, partly through three new interdisciplinary core programs: (1) Communication/Inquiry--a course where entering students work in small groups with shared faculty and student leadership, using a contemporary problem topic as a vehicle to develop skills of intellectual inquiry with a value orientation plus oral and written skills; (2) Heritage of Western Man--a three-course sequence studying the past in relation to the present and future of Western man, team-taught by faculty from the sciences and humanities; and (3) Policy Research--attacks by interdisciplinary groups of upper-level students on social issues to develop alternative policy solutions, using the students' knowledge in the sciences and humanities. Individual Development, a personalized advisory system gives each student the primary responsibility for his own education through a mentor relationship and support services. In revamping the traditional undergraduate college education, new educational technologies are also used including interactive computer usage and televised instruction through a consortium of colleges and universities.. One of the more controversial techniques is the use of psychological tools including a computerized personality profile for facilitating understanding of self, others, and groups and in lubricating the processes involved in attitudinal change. Many new strategies are involved, unified around the concepts of individualization, the changing nature of the educational task, and meeting the needs of the future.

8 BALL STATE UNIVERSITY, Muncie, Indiana, 47306. Dr. Robert L. Carmin, Dean, College of Sciences and Humanities, 317-285-1042.

The Departments of Geography and Geology, Chemistry, and Physics proposed to enrich their undergraduate science instructional programs, accelerate the development of expanded undergraduate research programs, and enlarge off-campus study capabilities. The basic goals were accomplished and enhanced through the assignment of liberal research and supervision time to faculty, undergraduate student research projects, publications, creative activities, and participation at scientific meetings; in general, a substitution of latitudinarian student research habits for something sound, deep, and well defined. The programs utilized visiting lecturers; improved the quality and quantity of lecture demonstrations; provided for more efficient and mobile summer field studies; offered short 5 to 10 day credit courses, taught by experts; supplemented field experiences; provided field vehicles and procured excess property equipment. COSIP singularly strengthened undergraduate research and resulted, for example, in Chemistry being able to report a total of 29 research papers and publications, two research projects in chemical education which produced 36 cassette tape recordings and written outlines of chemical concepts, and four 8 mm. sound movies showing stereochemical concepts. Physics, along with 9 publications and 26 student projects, has developed a catalogue of lecture demonstration assemblies plus particularization for 13 new demonstrations. The availability of governmental excess property has been an exemplary source for creativity, ingenuity, and amelioration, especially for Physics. Geography and Geology, by purchasing and altering two new vans, has enhanced its field studies which were also successfully translated into concentrated summer study by students during two weeks of participation and supplemental field experiences beyond regular course requirements. The short concentrated course offerings were probably the most successful part of the program for Geography and Geology. COSIP has been a synergetic force in the academic life of this university.

9 BEAVER COLLEGE, Glenside, Pa. 19038
Raymond Rose, Ph.D., Assistant Professor of Biology, 215-884-3500

Major permanent benefits resulting from Project funds include significant curricular changes, particularly of an interdisciplinary nature; and the increased involvement of students and faculty in research and teaching projects. An interdisciplinary, two-semester laboratory science course for non-science majors, involving the departments of Biology and Chemistry-Physics, was initiated through Project funds and is being continued through College support. A self-paced, student-taught course in statistics open to all students, but used primarily by Psychology and science majors, was supported by COSIP and is also continuing through College support. Faculty and student research was stimulated through use of funds for support of summer research and for new equipment. Research projects were conducted in Psychology, Biology, and Chemistry; in addition, projects in Sociology and Political Science were also supported. Teaching aids for Anthropology were also purchased with Project funds. The tradition of summer research by students established under COSIP helped stimulate other summer programs. Among these were a student-initiated SOS program in the summer of 1973 on rat control and a follow-up proposal for SOS for 1974. This research activity included Psychology and Biology students. The laboratory exercises developed under COSIP were in part responsible for the laboratory portion of an NSF sponsored summer institute for high school psychology held in 1972 and 1973. Equipment which was purchased partly or entirely with Project funds greatly aided interdisciplinary course interaction. Equipment in Biology and Chemistry up-dated the Biochemistry course as well as led to the offering of a Molecular Biology Seminar. A major addition to the science facilities was the installation of closed-circuit television cables. This COSIP-funded project has the capability of being used by the Psychology, Biology, and Chemistry-Physics Departments.

10 BELLARMINE COLLEGE, Louisville, Kentucky 40205. Dr. John M. Daly, Chairman, Department of Chemistry. (502) 452-8536

The COSIP Grant was multi-departmental with the end in view that it would bring about interdisciplinary programs. This has not resulted. The initial impetus was for biology, chemistry, mathematics, physics, and psychology to upgrade their own programs and then attempt to work at interdisciplinary developments. The original monies as requested by the departments were for the following, Biology, summer research stipends; Chemistry, major equipment and audio visual materials; Mathematics, calculating equipment and renovation of office and laboratory space; Physics, mainly low temperature research equipment; Psychology, stipends for visiting faculty and student assistants. In physics due to enrollment decline the results of the grant were minimal. In mathematics, addition of the calculators and remodeling of office and laboratory space have definitely improved the program. The psychology department made use of grant funds for visiting professors in areas of Psychology where the faculty had no experience. Reaction was highly favorable. Use of senior psychology students as group discussion leaders for freshman courses showed variant success. The biology department effort was mainly centered on faculty student research during the summer months. The tangible result was a dramatic increase in publications. It did substantiate the belief that if properly supported undergraduate college faculty can do significant publishable research if properly funded. The chemistry department used a good majority of its COSIP funds for a Varian NMR, development of flameless organic chemistry laboratory glassware and a closed circuit TV system. All of the above were successful in upgrading the instructional effort of the department tremendously.

11 BELOIT COLLEGE, Beloit, Wisconsin, 53511. Dr. John E. Lutz, Professor of Biology, (608) 365-3391, Extension 388.

Three aspects of this COSIP project all relate to increased use of technological aids in the college educational program: a computer facility with remote access, a video facility, and an audio-tutorial laboratory. Over 70 per cent of the $180,000 grant ($132,000) was used to purchase equipment and supporting materials. The grant included support for faculty time and incorporated modest funds for consultants, travel, and conferences ($21,000) and provided support for student assistants who helped develop software ($27,000). Eleven departments participated in varying degrees: Anthropology, Biology, Chemistry, Economics, Geography, Geology, Government, Mathematics, Physics, Psychology, and Sociology. The major thrust of the three-year project (1968-71) permitted development of remote access to an IBM 1802 computer (24K, 16 bit words) and included purchase of three IBM 2310 Disk Drives (3 million bytes), an IBM 2401 Tape Drive, and four Model 33 Teletype terminals with acoustical couplers. With three additional rented terminals, all seven operate in a time-shared mode. Over 120 programs were developed locally and, along with many from other sources, are now used regularly for instruction and research in the biology, chemistry, economics, geology, government, mathematics, physics, and psychology departments. Heavy and increasing terminal use may shortly force acquisition of upgraded equipment. The broadcast-compatible video-tape unit required purchase of three recorder-players, a production switching unit console, three cameras, adequate monitors, and associated equipment. This permits production of taped programs, instructional segments, and closed-circuit TV use and has been used extensively by various campus departments including Chemistry, Geography, Geology, Government, Physics, Psychology, and Sociology. The audio-tutorial facility with 30 carrels was used for the laboratory portion of the general biology course. It proved very successful until the individual responsible for its development had to pursue other duties. Currently unused pending curricular changes, the facility requires extensive commitment by the involved faculty.

12 BEMIDJI STATE COLLEGE, Bemidji, Minnesota 56601, Thomas L. Boates, Professor of Chemistry, 218-755-2921.

The conversion of instructional programs in computer science, experimental psychology and the natural sciences from a relatively poorly equipped "make do" condition to one permitting sophisicated laboratory work and advanced classroom activity has been the primary achievement of the COSIP program at Bemidji State College. The use of hitherto unavailable microbiological microscopes of advanced design, of modern spectroscopic and chromatographic instruments for chemical analysis, of nuclear radiation counting devices, of small animal laboratory equipment, of tissue preparation apparatus, of electronic calculators, of student learning modules in physics and of geological field sampling equipment has improved the quality of instruction throughout all programs. Not only did this increased instrumentation result in improved laboratory experimentation but also improved the interest by students in the theoretical and mathematical concepts necessary to interpret the experimental results. This led to the introduction of advanced and lower level courses in chemical and biological instrumentation, in experimental psychology, in statistics, in computer programming and in electronics. This new climate has initiated new approaches to laboratory design; biology has become more open ended, chemistry and physics have moved toward an individualized project orientation, and freshman laboratory courses in both biology and chemistry incorporating specially designed experiments, have been separated from lecture courses. Today, the laboratory programs at BSC provide opportunities for students to gain experience in a wide variety of techniques spanning traditional academic programs at all levels. These new approaches have permitted academic areas to use more effectively the surrounding natural environment of lakes and forest. Both staff and students have participated in environmental impact studies, in montoring effects of wild rice cultivation and snowmobiling activities, and other smaller scale similar projects. Recently studies have begun in the area of industrial chemical synthesis. Two percent of the budget was used by the mathematics department to develop single concept film loop study guides, a program which has now expanded beyond the initial seed project. Twenty percent of the funds were used to upgrade library holdings to support increased experimental activities.

13 BENNETT COLLEGE, Greensboro, North Carolina 27420
J. Henry Sayles, Chairman, Division of Sciences
(919) 275 9791, Extension 65

The major activities and efforts in this project consisted of: (1) increasing the scholarly competence of the science faculty, (2) promoting curriculum development, (3) revitalizing scientific research, (4) equipment acquisitions, (5) renovation of greenhouse facility, (6) experimenting with new teaching technology and (7) using new approaches to motivate students to raise their academic sights. These activities produced significant improvements at Bennett College including: (1) increasing the percentage of science faculty holding terminal degrees from 18% to 53%, (2) developing a new curriculum in medical technology and recasting the subject matter in all science and mathematics courses, (3) increasing the number of faculty members involved in scientific research from one to six and increasing the number of funded research projects from zero to five, (4) increasing the holdings of scientific equipment by $56,000.00, (5) restoring the greenhouse to a useful teaching facility, (6) expanding the use of audio-tutorial, science modules and computer assisted instruction, (7) increasing the number of scientists invited to the campus from three each year to eight per year and (8) increasing the number of scientists attending scientific meetings each year by 75%. The major objective of this project was to accelerate the development of three science departments and to enhance their ability to produce beneficial effects on science professors, students, subject matter, science curricula, individual courses as well as on teaching technology. An analysis of the accomplishments and improvements derived by participating in this project precipitates the conclusion that this major objective was achieved.

14 BEREA COLLEGE Berea, Kentucky 40403. Gerrit Levey, Chairman of the Chemistry Department. 606-986-8014.

Independent study and research, curriculum studies, teaching method studies, acquisition of a limited amount of equipment, and renovation of space for the Chemistry and Biology Departments were parts of the program funded by the COSIP grant during the 1967-1970 period. The research efforts by the students and faculty of the Chemistry and Physics Departments gained considerable momentum during the three years of support by NSF. Continued efforts during the academic years made it possible for students to keep in contact with the research effort so the summer program was very popular. The Chemistry Department has been successful in obtaining support from various sources for continuing the research effort. At least four students and one staff person have done chemistry research at Berea College during the summers following termination of the COSIP grant in August of 1970. The Physics Department continued their projects for a time also but to a lesser degree now that the number of majors has dropped due to the job market for physicists. The COSIP grant initiated research efforts, now continuing, which would not have been possible otherwise. A College-wide curriculum revision went into effect at Berea College in September of 1970. Some of the groundwork for the changes in the science departments was laid with support from the COSIP grant. The Biology and Physics Departments introduced a number of new courses. The Chemistry Department introduced a requirement of an experimental independent study for all chemistry majors and is at the present time extensively revising its offerings with less emphasis on the lecture approach and more on individual learning. The space renovated for chemistry research is being used both for summer research and for independent study projects during the academic year. The laboratory renovated for the teaching of biochemistry and physiology is in regular use. It also serves as a student project area plus a storage and viewing area for some of the audio-visual supplies acquired while studying the audio-tutorial approach to teaching biology.

15 BLUFFTON COLLEGE. Bluffton, Ohio 45817. LaVerne Schirch, Professor of Chemistry. 419-358-2178

The COSIP grant was used to establish an academic computer center. Funds were used to purchase an NCR Century 100 computer and for support in training the science faculty in the use of the facility. The computer is used by three different groups of students. First, essentially all students in Mathematics, Chemistry, and Physics take a course in programming. The majority of the courses in these science fields use the computer to some extent and the programs which are being used have mostly been written by the students. Second, students in departments such as Biology, History, Economics, Business, and Education use the computer in at least one of their courses. Also, a computer science course is a part of our liberal arts program. Third, area high school school students use the computer either in summer workshops or during the school year. The use of the computer is under the control of the faculty and even though there is administrative use of the facility the academic program always has first priority. This has permitted extensive use by students on an individual basis. Our experience has been that the facility is used most by faculty members with previous computer experience. We have been unable for the most part to incorporate the use of the computer into those departments where the faculty have had no previous experience with this educational tool.

16 BUCKNELL UNIVERSITY, Lewisburg, Pa., 17837, Lester Kieft, Professor of Chemistry, 717-524-1345.

The Bucknell program involved curriculum improvement, student and faculty research, faculty development, library automated information retrieval system, statistics-computer consortium course for education, psychology, management and sociology majors. The library on-line circulation system produces a due-date for each volume charged out, notification for overdue book, prepares a fine notice, and records all processing of book charge/discharge operations. Students can make a fast accurate search by author title, Library of Congress Number, and subject. The summer research for students and faculty provided an opportunity to do uninterrupted research for an eight week period. The direct involvement of students in research is a valuable portion of undergraduate education and often motivates the student to do graduate work. Each liberal arts student must plan with his faculty advisor a program representing his personal academic agenda. This plan of study must meet the distribution requirements. Freshmen advisor seminars vary in content, mode of study, and method of instruction. All seminars introduce the student to an academic discipline, consider the relation of this discipline to at least one other discipline, and provide a student-faculty relationship which can better develop academic advising. The Economics Department completely revised its introductory courses, focusing on the essential elements of the discipline required for undergraduates. The Psychology Department constructed a special outdoor field cage for the housing of Japanese macaques. The field cage created a biological and psychological structure which encouraged naturalistic behavior with two macaques being born during the first summer. Both student and faculty research have involved aggressive patterns and reproductive behavior of this rare species. The engineering departments involved students in research on the design and construction of laboratory equipment. The Mechanical Engineering Department originated a teaching intern program which introduced selected students to the teaching profession. Problems for each section of the statistics-computer course differed and were prepared in consultation with the departments concerned. This course fills a definite need and is of real value to several departments.

CALIFORNIA STATE COLLEGE, BAKERSFIELD. Bakersfield, California
17 93309. John R. Coash, Dean, School of Natural Sciences and Mathematics. (805) 833-2221.

Modularized student-centered instructional materials were developed and tested on a School-wide basis by the Departments of Biology, Chemistry, Earth Sciences, Mathematics, and Physics. Certain courses in these areas were completely modularized and conducted with self-pacing by individual students. Supplemental and remedial modules were utilized in other courses. A variety of materials, including textbooks, reference books, study guides, audio tapes, video tapes, film loops, film strips and slides, were used in module preparation. Some commercially prepared modules were also utilized. In several cases parallel courses were conducted with different modes of instruction and presentation. Preliminary evaluations have indicated that content masteries in modular courses are comparable to those attained by students in conventional courses. Subjective faculty judgment indicates improvement in independent learning capability of students as compared to traditional courses. The involvement of student tutors in assisting class students has resulted in considerable mutual benefits. The general orientation of science curriculum at this institution toward student inquiry has been maintained in modular courses primarily through investigative work in the laboratory. Student reactions have been reasonably favorable. Significant costs have been involved in the initiation of this program, but there are indications of cost-saving potentials in certain areas.

CANISIUS COLLEGE, BUFFALO, NEW YORK 14208. Frank J. Dinan, Chairman, Department of
18 Chemistry, (716) 883-7000 Ext. 262

The COSIP grant awarded to Canisius College has been used to develop and fully implement a self-sustaining biochemistry program. The program is largely based on a cooperative venture between the College's departments of Biology and Chemistry. COSIP funds allowed the initial hiring of one faculty member, a biochemist, who is now a tenured member of the College's faculty. Under this grant, two excess classrooms were combined and converted into a biochemistry laboratory. This facility serves as the primary teaching unit in the program and allows each junior biochemistry major to have their own individual work area. Students pursuing individual research programs are also allotted individual units. Space adjacent to the laboratory area was converted into a walk-in cold room which not only allows the large scale storage of thermally unstable materials, but also makes it possible to conduct entire experiments under reduced temperature conditions. The purchase of a variety of centrifugation, spectrometric and chromatographic equipment has made it possible to introduce biochemistry majors to most of the techniques used in contemporary biochemical research. Promising high school students from area schools have done research in cooperation with upperclass biochemistry majors under a program sponsored by the COSIP grant. This program has proven to be of great mutual benefit to both the college and high school students. Thirty biochemistry major students have graduated since the program's inception and seventy students are presently enrolled as biochemistry majors at this College.

19 CAPITAL UNIVERSITY, COLUMBUS, OHIO 43209, Carl F. Sievert, Professor of Chemistry (614) 236-6100

The COSIP project at Capital was designed to provide increased opportunities for faculty research and study, introduction of computer facilities, purchase of scientific and educational equipment, renovation of instructional laboratories and augmentation of library journal holdings. The computer facilities provided for the establishment of computer programming courses in mathematics, physics, geology and chemistry, and opportunity for expanded research in the natural and social sciences. The faculty leave program greatly expanded faculty competence in computer utilization in mathematics and physics, led to the inauguration of an earth science education curriculum and to a complete revision of the laboratory programs in analytical chemistry, broadened faculty backgrounds in several areas of mathematics, and enabled one faculty member to earn the Ph.D. degree in embryology. Equipment purchased with the aid of the COSIP grant contributed to the improvement of laboratory programs in biology, chemistry, geology and physics. New calculators improved student learning efficiency, especially in mathematics, and made possible new emphases in the statistics courses. Laboratory renovation in biology, chemistry and geology, supplemented by the equipment purchases, provided the impetus for a revised organic chemistry laboratory program, a complete revision of the geology curriculum, revitalization of the physiology, morphology and cell physiology laboratories and establishment of courses in meteorology and oceanography. Acquisition of excess property through the GSA provided equipment for the electronics and other laboratories. New journal subscriptions and acquisition of back issues of foreign journals provided a basis for improved undergraduate research capabilities. Perhaps the most significant achievement was the molding of the entire science and mathematics faculty into a cohesive working unit.

20 CARLETON COLLEGE. Northfield, Minnesota 55057. Robert A. Reitz Director of Science Activities, 507-645-4431 Ext. 242.

The major components of our program were in the areas of curriculum innovation, new teaching methods, and professional development of the faculty and included the departments of Biology, Chemistry, Geology, Government and International Relations, Mathematics, Physics and Astronomy, and Psychology. Under curriculum innovation were summer support and academic-year released time for faculty to develop or revise courses and laboratories for both the major and for the non-major. Some of these were an off-campus Marine Biology program, an interfacing of computers with laboratory equipment course, Field Studies in the Geology of the Bearpaw Mountains of Wyoming, Contemporary Black Political Strategies, several seminars on the applications of mathematics to the social sciences, Contemporary Research in Physics, and a Practicum Laboratory for Developmental Psychology. Experimentation with New Teaching Methods included: 1) the purchase of audio-visual-tutorial equipment and the development of materials for a remedial program for students with weak backgrounds in high school chemistry, and for the enrichment and supplementing of introductory and advanced geology courses; 2) the integration of a new campus time-sharing computer system into our classes and laboratories; 3) computer generated films for mathematics and physics; 4) computer control of experiments in operant behavior and physiological and sensory psychology. Professional development of the faculty included summer support for research, advanced seminars for the mathematics faculty, and a program of colloquia by Visiting Scholars in the various disciplines. Finally the laboratory programs in both biology and chemistry have been significantly strengthened by the purchase of some major pieces of equipment.

21 CENTRAL STATE UNIVERSITY, Wilberforce, Ohio 45384. Shelbert Smith, Professor of Chemistry, (513) 376-6424.

The purpose of the COSIP project at Central State University was to upgrade the curricular programs in Biology, Chemistry, Mathematics, and Physics in order to provide for the improved undergraduate scientific training of the student, and to enhance the science capability of the University To fulfill these goals, the departments sought and obtained COSIP funds to support the development of audio tutorial instruction for Biology courses for non-science majors, the purchase of needed scientific periodicals to sustain a viable science program, the granting of faculty release time for advanced study, the purchase of specific undergraduate scientific equipment to sustain the curriculum development, the renovation and equipping of the greenhouse in order to utilize more effectively this resource as an instructional tool, and the expansion of the undergraduate research program. These activities were coupled with the restructuring of the curriculum in the four departments, the development of computer assisted instruction in Mathematics, and the purchase of additional modern laboratory equipment and teaching aids in the departments These latter activities were supported by funds of the University. The accomplishment of these goals has provided the stimulus for the development and expansion of the audio tutorial concept to other areas and courses with locally prepared materials, an increase and broadened undergraduate research program involving greater faculty participation, with which the faculty members have been able to enhance their teaching effort. The purchase of modern laboratory equipment has provided the students an opportunity for training in and exposure to modern and varied laboratory instrumentation. More importantly, the program has been a stimulus to the development of greater professionalism and enthusiasm for scientific teaching-learning experience among both students and faculty.

22 CENTRAL STATE UNIVERSITY, Edmond, Oklahoma 73034
Dr. Norman H. Russell, Dean, School of Mathematics and Science, 405 341-3980

The NSF College Science Improvement Program grant awarded to Central State University three years ago has benefited the instructional program profoundly in many ways. Audio-tutorial laboratories have been instituted for both the non-major courses in General Physical Science and General Biology. Faculty research, involving student assistance, is many times as great as at the beginning of the grant period. The equipment purchased is in constant use by faculty and students. The student tutorial program has helped in improving student performance and success. With small expenditures it is estimated that surplus equipment which would cost perhaps two million dollars new, has been obtained and is being used in a variety of teaching and research efforts. Building modifications by our university are enabling us to use these materials better. Undergraduate curricula have been modernized by faculty committees, and new B.S. options have been added. Proposals for several graduate programs have been submitted. Due to the CoSIP assistance, many of our faculty have been able to attend meetings and workshops where their knowledge of current research and teaching techniques and materials has been improved. When the grant is complete, we expect its salutory effects to be felt for many more years in the future.

CENTRAL COLLEGE (CENTRAL UNIVERSITY OF IOWA), Pella, Iowa 50219
23 Donald M. Huffman, Chairman, Division of Natural Science (515) 628-4151 Ext. 322

Our proposal as initially funded included the following goals: "(1) supervise senior-freshman research including cross-disciplinary approaches, (2) develop a formal structure for the evaluation and modification of curriculum based on feedback from students and graduates, (3) add computer science and encourage computer use, (4) provide overall strengthening of departments by planned leaves of absence and staff additions, (5) strengthen the Physics Department." In retrospect it is fair to say that we met our objectives adequately in each area, with unusually encouraging results realized from goals (3) and (4) above. Furthermore, the overall objective of increasing the number of science majors/graduates was realized. Initially (1967) we had 59 graduates and at termination of our project (1971) we had 111 graduates in the sciences (in this case including Biology, Chemistry, Mathematics, Physics, Geography, Psychology, Economics, Political Science, and Sociology), an increase of 88% while our total college enrollment increased only about 30% over the same period. Science (as defined herein) budgets increased 41% during this period (from $341,432 to $487,694), thus we realized a net reduction in cost/major graduated as either a direct or indirect result of the COSIP grant. Science faculty increased from 30.5 F.T.E. to 32 F.T.E., so that the number of majors/faculty member was markedly increased as a result of the grant. The most outstanding progress has been the continued growth and development of our computer science program to a point where it enrolls at least 75% of all students in the college, and virtually all science students in a direct hands-on experience.

CENTRAL WASHINGTON STATE COLLEGE
24 Ellensburg, Washington 98926
Bernard L. Martin, Dean, School of Natural Sciences and Mathematics (509) 963-1331

Major activities consisted of the establishment of a mobile field station for use by the Biological Sciences, Anthropology, and Geography Departments; equipment purchases for three major areas of chemistry education; curriculum improvement programs in mathematics, physics, and psychology; and faculty research participation in the Department of Physics. A curriculum, which might be entitled "Natural History of the Pacific Northwest," has been developed centered around field studies of the natural history of the eastern Washington prairies and scablands and the Cascade Mountain regions. Mobile field stations were established using funds for laboratory trucks, compressors, water trailers, tents, folding tables, and carryalls. The Department of Chemistry purchased equipment for general chemistry, quantitative analysis, biochemistry, and physical chemistry, considerably increasing the quality of the instructional program and the number of students served. This has enabled the College to expand its general education offerings to include laboratory experiences for non-science students. The Department of Mathematics utilized funds to enable faculty members and graduate students to develop mathematics programs for elementary teachers, an off-shoot of which has been an expansion to provide mathematics instruction for the non-mathematics major. A statistical laboratory has also been established utilizing electronic calculators. The Department of Physics purchased introductory laboratory equipment and equipped a shop. Students were employed to assist in testing and utilization of these various items of equipment and in the development of the physics curriculum. The Psychology Department developed a higher level of quality in their various courses and purchased or fabricated additional equipment related to the various laboratory situations, providing a great deal of flexibility for research on animals and humans. Conditioning equipment for both animals and humans has been provided and incorporated into the recently completed psychology building. In conclusion, NSF funds under CoSIP have been put to extremely good use and have provided the impetus for additional acquisitions of equipment and other activities. The real impact of the NSF CoSIP grant to Central will be felt for many years to come.

CENTRE COLLEGE OF KENTUCKY, Danville, Kentucky 40422. Harold N. Hanson, Dean of
25 Instruction, (606) 236-5211

In September 1967, Centre College began the implementation of a new curriculum whose goals were to demonstrate a more unified approach for faculty and students; to promote the independent pursuit of knowledge; to make the courses and programs relevant to life in the last third of the 20th century; and to emphasize the way in which values infuse all knowledge and learning. This project aided in the implementation of this program in the natural sciences and mathematics. Specifically, the grant supported: staff replacements to allow the faculty to spend a full year in off-campus study; direct support for research projects of these faculty members; additional staff (subsequently supported by the college) during implementation period; consultant fees; instructional equipment; student participant research; and other direct costs. Implementation of this new program has resulted in the introduction of new, interdisciplinary major programs in the sciences, increased student enrollments in the sciences, increased number of science majors, improvement in undergraduate research participation and capabilities, and rejuvination of faculty interest and involvement in innovative activities.

CHRISTIAN BROTHERS COLLEGE, Memphis, TN 38104, Brother Louis Althaus, Academic
26 Dean, 901-278-0100, Ext. 202.

The purpose of this program has been to improve the undergraduate engineering curriculums at Christian Brothers College. The funds were expended in the three year period from August 1970 to August 1973. The three primary objectives of the COSIP grant were to: 1) Stimulate continued academic growth of the faculty, 2) Strengthen certain laboratories, 3) Extend the engineering periodical holdings of the library. Under this grant $53,635 purchased a medium scale Analog Computer. $6864 was expended to strengthen the library's periodical holdings in engineering. $28,191 was used by the engineering departments for laboratory equipment. These acquisitions greatly improved the instructional capability of the engineering faculty. Experiments and instrumentation have been modernized and upgraded in a number of laboratories with these funds. In order to redesign experiments and develop the laboratory curriculum, $25,600 was expended in laboratory development and implementation. Besides laboratory improvement, $45,254 has been expended for faculty development in faculty research and in short courses and seminars. Nine faculty members engaged in summer research during these three years. Faculty members attended 34 short courses which updated and broadened their engineering background in a number of instructional areas. Research begun with COSIP support will be continued. The instructional short courses, laboratory equipment and development, and summer research have had a marked impact on engineering education at CBC. Some of the techniques have been exported to other programs here. Students have benefited both from improved instruction and from involvement in research projects. To the extent that college funds are available, the techniques for faculty improvement that were developed within the COSIP program will be expanded in the next years. This grant came on the heels of the ECPD accreditation evaluation in the Spring of 1970. The funds in this grant were timed perfectly to help answer the recommendations of the ECPD team for departmental improvements. In this third COSIP year 1972-73 the Project Director has been able to use the knowledge gained in the planning and implementing of this COSIP program to develop the overall academic programs of Christian Brothers College as Academic Dean.

27 THE CLEVELAND STATE UNIVERSITY, Cleveland, Ohio, 44115, Dr. Bernard Hamermesh, Professor of Physics, Chairman, Department of Physics, (216) 687-2426.

During the grant period when the university experienced unusual growth the grant enabled us to develop curriculum, introduce technological improvements in instruction, and devote faculty time to research on new learning structures and to individual research in conjunction with students. Curriculum development and technological improvements spanned all departments with new laboratories and laboratory manuals in biology, physics, chemistry and geology. In particular, geology has instituted audio-visual laboratories, while the physics department has prepared a number of videotapes for mediated instruction in the laboratories which are now being analyzed in cooperation with a member of the College of Education. Three departments have improved laboratory instruction through student use of calculators and computers: chemistry utilizes calculators on a checkout basis, biology a small minicomputer for more advanced ststistical analysis, and physics a larger computer directly connected to experimental equipment in the introductory laboratories. The physics department has experimented with different learning structures in the engineering physics sequence. Group learning techniques were developed and have been referred to in the literature. These techniques have been extended to courses for non-scientists where they appear to have considerable impact on student attitudes towards physics. Student observers have been used in physics for the purpose of improving faculty performance in the classroom and to discern barriers to effective communication between teacher and student. This technique has been reported in a recent paper. Biology and geology have also developed courses of special appeal to non-scientists. Course construction is of special concern here requiring faculty time obtained with this grant particularly for geology where construction of the audio-visual tutorial labs was necessary. Finally, individual faculty research with students has been possible in both geology and physics through summer grants and travel funds for field trips.

28 COE COLLEGE, Cedar Rapids, Iowa 52402 Leo L. Nussbaum, President, Project Director; Carson W. Veach, Provost and Dean of the College (319) 364-1511

Situational and applied research related to the immediate metropolitan area and college curricular needs made possible by reductions in faculty course loads and selective use of students engaged in independent study. Four social science departments (Economics, Political Science, Psychology, and Sociology) identified three objectives: Curriculum enrichment; faculty growth and development; student involvement in learning through research. Each participating faculty member developed and obtained administrative approval of his own approach to one or more of three objectives. He was then granted an appropriate amount of time -- usually a reduced teaching load -- to complete his teaching-directed research or research-directed teaching. This approach uniquely met institutional needs by having the regular faculty on campus to meet on-going needs as well as being able to work with students doing independent study. Curricular results: new courses developed; new methodology including programmed instruction, production of a film; statistics laboratory in the computer center; one interdisciplinary course developed, course instruction exchanged with a neighboring college. Faculty members designed and completed research projects, prepared bibliographies, worked closely with students on independent studies ranging from papers on a day care center to the reasons behind major lay-offs by a large local manufacturer. No significant physical changes were a part of the COSIP funded project. Attitudes were changed as: faculty completed research on released time rather than during sabbaticals, research and teaching were closely related, students worked on applied research projects; faculty changed course content, developed new courses, changed teaching methodology; faculty and students worked intensively on community based projects and problems. COSIP projects brought to the four social science departments laboratory experiences equivalent to those of the natural sciences. COSIP projects identified ways in which the College can become a "central place" for situational and applied faculty research related to the community.

THE COLORADO COLLEGE. Colorado Springs, Colorado 80903. William C. Champion,
29 Professor of Chemistry. 303-473-2233 Ext. 301

The COSIP Proposal from Colorado College sought to improve science education and to enhance and maintain faculty competence by providing academic year released time in augmentation of the sabbatical leave program for faculty to engage in study of interdisciplinary subjects and of specialized topics, to conduct research or to pursue activities related to curriculum development; by increasing the level of support for expenses incurred by faculty attendance at conferences, professional society meetings and for research consultation, by supplementing the existing college program of providing stipends for summer faculty research and/or study; by providing stipends for students to participate in faculty research efforts; by providing a series of visiting scientists to acquaint faculty and students with areas and problems of current research at leading graduate institutions. Courses in advanced biochemistry, the history of mathematics, Human Heredity (a course for non-science majors), and a general studies course, Science, Religion and Society, were developed as a result of released time under this COSIP Grant. Four sound-on-slide programs were developed to introduce students to certain chemical apparatus and instruments utilized in the introductory chemistry laboratory. The effort and the information available to the science departments through the analysis of our needs was instrumental in augmenting the change from a semester system to a nine block one course at a time academic year plan. Continued curriculum development and course changes claimed a significant portion of faculty time from 1968 to the present and further adaptations will certainly be necessary within this academic format. Academic year leaves for study resulted in a dramatic increase in computer use within existing courses and in increased computer course offerings. The faculty commitment to research was significantly increased by development of research programs in biochemistry, parasitology, X-ray crystallography, paleogeology, history of mathematics, flora of the Pikes Peak Region, Vision, and Catalysis.

CONCORDIA COLLEGE. Moorhead, Minnesota 56560 Robert Homann,
30 Associate Dean. 218-299-3002.

The Concordia project had four major goals: 1.) revision and updating of the entire college curriculum in natural and social science 2.) expansion of opportunities for faculty and student research 3.) improvements in the computer center and 4.) development of electronic calculator capabilities in the social sciences. A total of 180 man-weeks of curriculum development was accomplished by eight science departments resulting in completely revised major and minor programs in biology, pre-medicine, medical technology, pre-nursing, chemistry, physics, mathematics, psychology, sociology, economics and political science. Several other new developments emerged as a result of the COSIP grant. These included: a new program in science for elementary school teachers, more courses for the non-science major, greater emphasis on internship and field study opportunities in the social sciences, more flexibility in course offerings, a new program in environmental studies and the widespread adoption of audiovisual techniques in the science curriculum. A computer science minor program, an applied physics major sequence, and a competency-based program for secondary science teachers are currently under development as a result of ideas generated during the grant period. A Faculty Research Awards Committee acted as an internal regranting agency for faculty research projects. About 211 man-weeks of research were supported for 21 science faculty and 196 man-weeks of student research for 24 science majors. The physics department upgraded its research capabilities through the purchase of a multi-channel analyzer and accessories for the linear accelerator. Additional keypunches and new time-sharing terminal equipment were installed in the computer center. The terminals already receive heavy student usage and more will be needed shortly. Finally, the social science division improved instruction in statistics and research methods through the purchase of twelve electronic calculators.

CORNELL COLLEGE, Mt. Vernon, Iowa, 52314. Addison Ault, Professor of Chemistry,
31 (319)-895-8811.

The grant made it possible to 1) revise several basic courses and selected upper level courses, 2) support faculty-student participation in summertime research projects, and 3) provide limited released time for faculty study and research. Revisions of introductory courses were made in the areas of Biology, Chemistry, Mathematics, Physics, Economics, Psychology, and Sociology. Revisions of advanced courses were effected in the areas of Chemistry, Mathematics, Physics, Economics, Political Science, Psychology, and Sociology. Faculty-student research projects were carried out in the departments of Chemistry, Geology, Physics, Political Science, Psychology, and Sociology. Released time for study and research was provided to faculty members in the departments of Economics and of Political Science.

DAVIS AND ELKINS COLLEGE, Elkins, West Virginia 26241 Ralph R. Booth, Chairman,
32 Department of Chemistry, (304) 636-1900

The COSIP grant to Davis and Elkins College provided for a visiting scientist program; additions to the library holdings; instructional and research equipment; and a faculty leave program for the Division of Natural Science and Mathematics. The benefits that are most significant to date are those derived from the visiting scientist program - an increase in student and faculty enthusiasm and the discovery that good outside speakers can be obtained with minimal expenditures - and the instructional and research equipment. The physiograph and inverted phase microscope have become the "work horses" of the Biology Department on a year-round basis and add a new dimension to independent study. The neutron howitzer, oscilloscope and desk calculators have proven to be effective instruments for our courses in physics and mathematics with the pre-engineering program (Engineering Technology program leading to an A. S. degree) deriving the greatest benefit. The most effective instrumentation for the Chemistry Department has been the UV spectrophotometer; the atomic absorption spectropnotometer, the Electroscan, and the adiabatic oxygen bomb calorimeter. These have resulted in a significant upgrading of our organic and physical laboratories. Harder to identify specifically, but certainly significant in our overall program with increased emphasis on independent study, is the contribution made to our library holdings in the area of scientific journals.

DENISON UNIVERSITY. Granville, Ohio 43023. Louis F. Brakeman, Provost.
33 614-587-0810

As an extension and expansion of a program begun by Research Corporation, Denison's scientific opportunities and capabilities were strengthened and developed by extending the possibilities for faculty research and study during the summer and academic year, by assisting individual departments in fulfilling specific equipment and enrichment needs. COSIP has been instrumental in helping to maintain a professional environment conducive to the attraction, retention and productivity of an able and vigorous science faculty and has resulted in a more vital professionalism and higher morale. Research is now an accepted element of faculty responsibility. Faculty productivity has increased. Science faculty activity in university governance has increased. Student research interest, and utilization of independent study opportunities has increased. Science enrollment and number of science majors has increased despite stable college enrollment. Average number of credits and students taught by science faculty has increased. Trend toward flexibility of course requirements has developed. Summer research opportunities which permitted intensive, full-time one-on-one research education have been of fundamental direct and indirect significance. This program has been continued. Interdisciplinary thinking has increased but implementation has actually been hampered by some effects of COSIP which increased class enrollment, independent study, professional identification, and research activity leading to more departmental commitments and obligations among faculty.

DE PAUL UNIVERSITY
34 Chicago, Illinois 60614
Edwin J. Schillinger, Professor of Physics (312)549-6900

The project's purposes were: curricular innovation and reform and the development of new faculty attitudes toward courses for the non-science student (Mathematics and Physics), and laboratory renovation (Chemistry). Physics faculty members have developed 12 courses for the non-scientist, four of these being in the University's "General Education" College. Three general education courses in mathematics have been introduced. These 7 have been well received and will attract 630 students in 15 sections in 73-74. The 8 courses offered as physics have tripled in size (to 26 students) over the past 3 years, but 3 have yet to reach full potential. All 15 of these courses are accessible to all students. They are concerned with phenomena, methodology, history and philosophy of physics and mathematics and the interface between these disciplines and society. Mathematics has introduced 7 courses in computer science for advanced students. These attract an average of more than 30 students and more than half of the majors in mathematics now specialize in the computer option. A freshman computer course is offered in conjunction with a computer option in calculus and attracts over 130 students per year. In both Departments faculty attitudes have changed sharply toward the student with little or no desire to take science or mathematics; faculty-student interaction is now vastly improved. Faculty members are also more concerned with the direct applications of their disciplines to work and society, and many regular courses reflect this. In short, the project has led to significant re-thinking of the faculty role in education. The Department of Chemistry renovated a large laboratory for undergraduates with excellent results. Tutoring programs in mathematics and physics were successful and continue. An Honors Program and Senior Seminar in Mathematics have been phased out in favor of expanding Independent Study Programs which now attract over 30 students per term. Most of the curricular developments have included written materials which are available for others wishing to innovate. All new courses are integral parts of existing curricula and will have continuing impact upon the University and the concerned departments.

DEPAUW UNIVERSITY, Greencastle, Indiana 46135
35 Dr. Paul B. Kissinger, Professor of Physics (317) 653-9721 x 445

The four specific goals of the COSIP project were to: 1) Strengthen the undergraduate course offerings by improving the laboratory experiences; 2) Offer the opportunity for every science major to become involved with a faculty member in a significant research project; 3) Increase the interdisciplinary aspects of science education; 4) Incorporate the use of computers into all courses and undergraduate research. The following areas were stressed to accomplish these goals; (a) Student-Faculty Research Projects. This category received major overall emphasis. These projects generated student enthusiasm for research, helped retool the faculty and significantly increased the utilization of the science facilities during the summer months. At least 5 papers will be published as a direct result of student research carried out under COSIP. (b) Visiting Lecturers and Interdisciplinary Seminars. A variety of outside speakers, chosen for their breadth of knowledge as well as for specific technical expertise, provided the university with added insights regarding the role of science and technology in the modern world. (c) Improved Computer Utilization. New computer courses for liberal arts students were put into the curriculum and in-service faculty training seminars were conducted. The COSIP program also allowed released time for five faculty to conduct off-campus research, provided for construction & remodeling of research facilities and furnished funds to purchase research grade equipment for student-faculty projects. Other immediate benefits included the introduction of interdisciplinary courses, the furthering of campus wide interest in science affairs, increased participation by scientists in public occasions, and renewed dedication to maintain strong science departments within the DePauw liberal arts context. The ongoing expenses for maintenance and repair of the equipment and costs for continuation of certain programs will be provided by the University; but, additional outside support will be required to continue science activities at the high level provided by the COSIP grant.

DICKINSON COLLEGE, Carlisle, Pennsylvania, 17013. Dr. Howard C. Long, Professor
36 of Physics and Astronomy, 717-243-5121, Extension 241.

Dickinson College completed a three-year College Science Improvement Grant in 1971 which increased released time available for faculty research and scholarly activity and which brought added and necessary scientific equipment to the Departments of Geology. The Departments of Biology, Chemistry, Geology, Mathematics, Physics-Astronomy, and Psychology were supported in the phase of the grant dealing with released time for research and other scholarly activity. Through an infusion of young faculty fresh from graduate study and other faculty returning from sabbatical leaves independent studies were increased. Faculty members and students participated in two NSF programs - Student Originated Studies (SOS) and Undergraduate Research Participation (URP). A two hundred percent increase in year long research projects has resulted over the three year period of the grant while semester projects have continued at the same level. Obviously there has been a sharing of enthusiasm for research with students and faculty on the COSIP program and that with an increase in departmental research projects has come participation by students in basic research. The College has fulfilled its commitment to continue the research fund through the budgeting of $30,000 annually for Faculty Research and Development. These funds are available to all faculty but science faculty have received significant support.

DRAKE UNIVERSITY, Des Moines, Iowa 50311. Leland P. Johnson, Dean College of
37 Liberal Arts, 515-271-2134.

The departments of Mathematics and Physics were enriched by increasing competency of the faculty, adding to the staff, adding library resources and equipment to the degree that program was expanded, undergraduate research was enhanced and innovative approaches to teaching accrued. The Mathematics Department added a specialist in computer science and a computer science major has been developed with minors appropriate to disciplines of the natural and social sciences. An exhaustive study and subsequent significant revisions were made in the undergraduate curriculum of the department. Library holdings, departmental facilities, and instructional equipment including mini-computers of differing complexity were added which bulwarked curricular development. In the Department of Physics, Dr. Downing had the opportunity to complete the Ph.D. degree and a theoretician and plasma physicists were added. The library holdings in Physics were enriched by the addition of selected current journals, back issues, reference works, and text books. Audio visual materials were added and used by undergraduate students as supplements to courses and for remedial study. Equipment was built which allowed the development of undergraduate research in plasma physics and stimulated faculty research. The Physics Department revised it's major curriculum and added non-major courses in the areas of the environment, communications, and contemporary physics. The impetus provided by COSIP has been instrumental in increasing the enrollments, both majors and non-majors, in the departments of mathematics and physics, and has had a positive impact on other sciences as well as the social sciences.

DREW UNIVERSITY, Madison, NJ 07940. James M. Miller, Professor of Chemistry,
38 201-377-3000

This first COSIP grant to Drew supported the natural sciences (botany, chemistry, physics, zoology) and mathematics. Emphasis was on curriculum development and the chemistry and zoology curricula were completely revised. The new chemistry curriculum is non-traditional in organization. In total, 34 semesters were revised including courses in astronomy, computer science, electronics, genetics and human affairs, and marine biology. Publications which resulted include four chemistry laboratory manuals and a statistics text. Only a few interdisciplinary courses were introduced contrary to original plans. Media (films and TV) were used extensively. Fourteen movies and tape/slide programs were prepared. TV tapes of lectures, demonstrations, and laboratory experiments were made, evaluated, and revised. Research projects for six faculty in chemistry, and zoology were supported and independent research for zoology majors was introduced into the curriculum.

39 DREW UNIVERSITY, Madison, New Jersey 07940. H. Jerome Cranmer, Professor of Economics. 201-377-3000.

This second COSIP grant to Drew University supported departments in the social and behavioral sciences: Anthropology, Economics, Political Science, Psychology, and Sociology. Major emphasis was on curriculum revision and development. The grant provided released time and summer compensation enabling faculty in the five departments to examine their course offerings and the content and method of individual courses. Major accomplishments have been: (1) the development of a new course, Behavioral Science, which integrates the introductory offerings of Anthropology, Psychology, and Sociology; (2) preparation of a multimedia approach employing cassette tape modules for the introductory economics course; (3) integration of two courses in economics, economic statistics and intermediate analysis--micro and macro; (4) assembly, duplication, and incorporation within the course on Chinese Society of materials hitherto unavailable for undergraduate study. Acquisition of materials and equipment was another major aspect of this grant. Major equipment acquisitions included such diverse items as a chimpanzee skeleton, a polygraph analyzer, several electronic calculators, a number of cassette recording and playback units, studio video cameras, videotaping instructional materials, and classroom TV receivers for their reply as well as other gear for the newly-established audio-visual center on campus. Faculty research activities probed areas such as investigations into proto-language, European monetary affairs, pollution of the Hudson River, recent social developments in Communist China, and the computerization of tabulations of New Jersey municipal election data. Research opportunities for students were enhanced by the development of independent study programs in each of the departments.

40 DREXEL UNIVERSITY, Philadelphia, Pennsylvania 19104. Dr. Chris Rorres, Assistant Professor of Mathematics, (215) 895-2675.

The intent of the COSIP project at Drexel University is to upgrade and improve the undergraduate mathematics program and to make it more responsive to the needs of an applied and task-oriented society. This is being accomplished through the following five specific improvements: 1) Modernization of the curriculum through revision of existing courses (Linear Algebra, Differential Equations, and Probability and Statistics) to strengthen and make more relevant their content and to better demonstrate the importance of computers and computational methods, both as educational aids and as scientific tools. 2) Expansion of the curriculum through the development of four new courses in optimization and mathematical modeling of the social and life sciences. 3) Improvement of the quality of instruction through refresher and advanced training plus industrial experience for three veteran faculty members. 4) Improvement of the program for prospective science teachers through the creation of a Curriculum and Materials Resource Center. 5) Introduction of opportunities for undergraduate research in mathematics, computer science, and other areas of science. Most expenditures provide release time for faculty members to accomplish the objectives listed above. Equipment required for the project consists mainly of audio-visual devices for the proposed Curriculum and Materials Resource Center.

41 EARLHAM COLLEGE, RICHMOND, INDIANA 47374. Professor Laurence Strong
(317) 962-6561 Ext. 419

Through COSIP faculty research productivity was increased, student project work was developed, curricular innovations were more vigorously pursued, and a computer has facilitated new approaches and activities in teaching, research, and administration. Faculty research in Geology was concerned with bedrock studies in Connecticut and Pleistocene studies in the Whitewater drainage basin of Indiana while research in Psychology concerned animal behavior studies including the effects of drugs on behavior. Students were supported in independent study projects and this type of support has been continued through various sources since. Curricular innovations were developed in Biology, Geology, Physics, and Psychology that have continued and been developed further. This is especially true for Biology and Geology where the introductory courses have been transformed to encourage much more independent study by students. These new courses have included new laboratory experiments, increased emphasis on library work and the use of the primary literature, new examination procedures that include student grading of quizzes, instruction in discussion techniques and the use of student directed seminars. In Chemistry and Psychology computer simulated experiments in a game format have been developed for several topics. The addition of a digital computer (IBM 1130) has made possible the introduction of more emphasis on data analysis in many courses so that computer calculations and simulations continue to be developed.

EAST CAROLINA UNIVERSITY, GREENVILLE, NORTH CAROLINA 27834
42 Dr. J. William Byrd, Chairman, Department of Physics 919-758-6739.

The basic improvement program supported in part by COSIP included activities in the Departments of Biology, Chemistry and Physics. The essential features of the program were

(a) new or renovated quarters for the three departments,
(b) equipping a laboratory for electron spin resonance spectroscopy,
(c) equipping a laboratory for infrared spectroscopy,
(d) equipping an electron microscope laboratory, and
(e) establishing a research fund for supporting small projects involving faculty-undergraduate student teams.

All elements of the improvement program were realized and exceeded. The electron microscope obtained was the Hitachi HS-8. The infrared instrument was the Beckman IR-12. The electron spin resonance spectrometer was assembled from components using local faculty expertise and resulted in enough savings to include both an x-band and a k-band spectrometer. The research fund provided a total of 33 grants involving 41 students with the average support per grant being $1,950. The Departments of Physics and Biology are now housed in new buildings; and the Department of Chemistry is housed in thoroughly renovated quarters. The departments supported by the program have realized an increase in faculty productivity, an improvement in the quality of science graduates and a general improvement in the research environment for both students and faculty.

EASTERN KENTUCKY UNIVERSITY, Richmond, Kentucky 40475
43 Donald C. Haney, Chairman Department of Geology 606-622-3270.

Eastern Kentucky University received support from the National Science Foundation to assist in the improvement of several programs within the departments of Biology, Chemistry, Geology and Physics. While areas of common concern existed in several departments unique improvements were needed within specific departments. Areas of concern at Eastern Kentucky University included; (1) higher level of student participation in realistic scientific experimentation, (2) undergraduate research participation, (3) more adequate pre-professional scientific training of teachers, (4) improvement of curricula, (5) faculty improvement and, (6) a tutoring program for freshmen. Student participation in scientific experimentation has been encouraged through hands-on exercises and there is a great interest on the part of the student to partitipate on an individual basis. Individual requests are being made to include course content particulars in more of the basic departmental courses. Undergraduate research participation has become more of a reality through the availability of equipment. Several projects have been undertaken by students at different skill levels and the results have been gratifying. A definite attempt has been made to improve the quality of the teacher training program, but the results have not been overly encouraging. Young people just do not seem to be interested in careers in science education and the fault is not related to educational programs. Curricula studies have been made and suggestions for improvement are being implemented. Some courses are being completely restructured due to obvious weaknesses brought out by CoSIP studies. Faculty improvement was considered very crucial to overall improvement and faculty participation has been fair to good. It is impossible to convince some faculty that they could profit from short-courses and workshops. A tutoring program was instituted for the benefit of students in basic science courses. Results of this effort have been less rewarding than anticipated. Students who do not need tutoring have been the principal participants and those below average students who desparately need assistance tend to ignore the tutoring program. In general the project has been successful and the science departments at Eastern should be able to continue many of the programs initiated under the auspices of the College Science Improvement Program.

EASTERN MICHIGAN UNIVERSITY, Ypsilanti, Michigan 48197. Edward L. Compère, Jr.,
44 Professor, 313-487-2057.

The Eastern Michigan University COSIP project involves the Biology, Chemistry and Physics departments - largely intradepartmentally - These departments agreed on major foci for individual effort are: curriculum improvement, undergraduate research participation, and faculty development and improvement. Biology tested the feasibility of a four-year student-involved research program, with a summer pre-enrollment orientation session, as an integral part of the B.S. degree program; started a four-year B.S. degree program in microbiology; meshed into the existing and the new four-year research programs: summer URP projects for students and individually-supported faculty research projects; allowed faculty and students support for research off campus and for excursions providing professional development; and provided release-in-time for faculty scholarly work both on and off campus. Chemistry purchased, set up new equipment, and provided new necessary courses, for implementing an on-going vital metallurgical chemistry B.S. degree option; supported technical personnel to provide quality, multi-faceted uses of the computer for aiding students in learning chemistry - by means of computer software, developed or made serviceable to our system, from CAI programs to "computer oriented" general chemistry; carried out summer URP research with the better students; purchased a Laser-Raman spectrometer; provided release-in-time for scholarly work, and small stipends which doubled the normal time of sabbatical leaves; obtained an "expert" instrument repairman - whose services will continue after COSIP; and doubled secretarial service - some to continue after COSIP. Physics purchased and set-up optics equipment for an optics laboratory - now an integral part of the physics optics program; carried out URP summer research; provided faculty stipends for release-in-time to do scholarly work, provided funds for faculty summer research, and to attend meetings, conferences and institutes. Generally, the COSIP grant increased the scholarly and research work of the involved departments, resulting in increasing numbers of publications; provided helpful publicity for the departments; increased the base for obtaining GSA excess (more than $150,000.); and has greatly stimulated the student knowledge of and interest in research at Eastern Michigan University.

EASTERN WASHINGTON STATE COLLEGE. Cheney, Washington 99004
45 Vincent L. Stevens. Chemistry Department. (509) 359-2330

We have enriched the quality of science instruction at this college as a result of this COSIP grant. The departments of biology, chemistry, geography, geology, and physics have improved their undergraduate offerings as a result of equipment purchases and the advice of our consultants. The field studies program (largely a directed effort by the departments of biology, geology, and geography) now includes on-site laboratory investigations by undergraduate students. The bus, equipped with a public address system, permits one to teach sections en route to sites. Groups of 30 or more students can be handled in this way. The boat and the 4-wheel drive vehicle allow students to move into difficult areas and to study less accessible materials. The spectroscopy laboratory has now been extended to include nuclear magnetic resonance and x-ray flourescence. We can now include organic chemical structural studies and elemental analyses in our geology, organic chemistry, and physical chemistry laboratories. The physics department has completely revised its beginning sequence for majors in science. It is now entirely modular, individually taught, and self-paced by students. The equipment purchases in physics brought the laboratories up to date, the consulting assistance helped reorganize the curriculum. The auto-tutorial laboratory in biology has led to a substantial enrichment in instruction, especially in clarifying anatomical relationships. It has proven a potent supplement to the text and the lecture. The entire COSIP program has led to an improvement in quality rather than efficiency. We can now provide students with direct practical experience in the field; in spectroscopy; we now teach a physics course aimed at mastery of the elementary principles; and we have used audio-visual materials in specific problems in biology.

EAST TEXAS STATE UNIVERSITY. Commerce, Texas 75428, Arthur M. Pullen, Professor
46 and Head of Department of Biology, 214-468-2224.

A four-year developmental program financed by $300,000 from COSIP and $219,000 from the University enabled the Biology Department to establish a new core curriculum and new courses at the advanced level, to remodel and re-equip laboratories to aid in establishing a high level of instruction, and to provide refresher training for 7 faculty members to improve technical and theoretical teaching. Remodeling was given priority in the first year to support the new equipment to be obtained. The new laboratories and equipment were used to augment the introduction of the 6-course core curriculum. Second and third year expenditures centered on equipment to improve advanced level teaching and to introduce sophisticated research methods and equipment into advanced undergraduate courses. Retraining of the faculty has enabled the introduction of new technical and teaching ideas into the classroom. Advanced courses, particularly those involving organisms and physiology, are taught at a much higher level. Field work has been increased and new equipment has made teaching more effective. Lower level and advanced level ecology courses have been introduced. A course in instrumentation, techniques and methods in biological research was added and these students are now familiar with concepts that are usually obtained at the graduate level. In addition to the direct COSIP program, two audio-tutorial courses for non-majors have been introduced. In faculty retraining in educational methods, the concept of audio-tutorial instruction was explored and model courses were written. In the fourth year of the grant the institution invested $40,000 in equipment for two laboratories and the courses are now well established. Also the concepts of the Keller Method have been adopted and are used in the core curriculum. Cell Biology is now well established as a self-paced, self-study course.

47 ELMIRA COLLEGE, Elmira, New York 14901 Gertrude Spremulli, Department of Chemistry, (607) 734-3911

The grant enabled Elmira College to improve its undergraduate science program through support of four major categories--acquisition of equipment, release of faculty for curriculum revision, use of upper-class students as laboratory assistants, and research assistantships for freshmen students. The equipment acquisitions (including that obtained as excess property) enabled the college to add three new courses (radioisotopes, comparative animal physiology, and instrumental analysis) as well as providing the opportunity to improve the laboratory offerings of numerous other courses and increasing the research opportunities of the faculty and students. Curriculum revisions resulted in a new approach in the geology-earth sciences area emphasizing a problem-oriented laboratory approach with considerable use of audiovisual aids. An interdisciplinary approach in the course for non-science concentrators was adopted which presents frontier developments in all areas of science at the same time emphasizing the social, economic, and political implications of these developments. As a result of faculty workshop sessions a new two-semester core course was developed as a prerequisite for any further work in the sciences. A new course combining a working knowledge of computers and statistics was also developed. The use of upper level students as laboratory assistants served two purposes. They experienced an important learning process and they helped the faculty improve the experimental aspect of science teaching. This project contributed to the decision of Elmira to institute a college-wide Senior Fellows program to encourage the participation of seniors in the education of underclass students in all disciplines. The use of freshman research assistantships fell short of achieving its original objectives in that none of the students admitted under the program accelerated their academic program as had been hoped. Furthermore, it is difficult to give the students enough scientific background in the area to make the experience as valuable as it should be.

EMORY & HENRY COLLEGE, Emory, Virginia, 24327.
48 Cecil M. Nelson, Professor of Physics, (703) 944-3121.

This COSIP grant supported a very comprehensive program which could be divided into four areas: faculty study, purchase of laboratory equipment, support of a tutorial program and library purchases. A number of science faculty were able to participate in research activities both on campus and at other universities. In most cases undergraduate students participated in these research projects and gained valuable experience. Some of these results have been published. Also, six faculty were able to take at least a year's leave of absence for graduate study. In this group two permanent faculty were able to complete their doctoral requirements with additional time and effort. They would not have been able to finish so quickly or even to have continued without the COSIP support. A major portion of the money allocated for equipment in all science departments went for modern research grade apparatus. The psychology department had virtually no apparatus for their lab courses previously. All the sciences have benefited in the lab and class from the purchase of a minicomputer which is used on a time-shared basis in the two science buildings. The College contributed some matching funds for the computer system and funds for the renovation of many science labs and rooms to improve the science program. A modest tutorial program was successful in several areas particularly if the professor and student tutors were adept in using this new approach. The College would not have been able to support the purchase of back issues of major science journals in all science fields.

EVERGREEN STATE COLLEGE, Olympia, Washington 98505; Frederick D. Tabbutt,
49 Member of the Faculty: (Chemistry) 206-866-6713.

The Evergreen State College (TESC) undertook a pilot project designed to produce self-paced-learning-units (SPLUS) that would provide much of the information, laboratory skills, and conceptual framework traditionally presented in courses to students on a non-course, individualized basis as these skills, concepts or facts are needed, and as students recognize the need for them because of their involvement in problem-solving activity, research, or in seminars. During the summer of 1973 and subsequently, faculty and students at the college have developed 32 SPLUS ranging from exponential notation and tissue culture techniques to travelling wave phenomena and in acid base equilibria. Some 200 additional SPLUS have been imported, evaluated and adapted for use by the college. Thus 232 units are now in use and more are being produced. Virtually all have been used and critically evaluated by students during the current academic year. Several of the SPLUS developed at TESC have already been exported for use elsewhere. Additionally, the college has developed an organization for production, standardization, cataloging and distribution of SPLUS. The project demonstrated that faculty from a variety of disciplines can come together, chart a structure for identifying needed SPLUS in a non-course interdisciplinary context, set format standards, critically evaluate each others work and actually produce materials that students find most useful in the learning process. SPLU formats have ranged from simple single frame learning programs, to complex, branching learning units involving video cassettes, computer assisted instruction and sophisticated laboratory instrumentation. Both wet and dry laboratory areas have been arranged at the college for self paced pre-laboratory instruction. While the pilot project was but a forerunner of a much more ambitious undertaking designed to make Evergreen a model for change toward individualized, problem-centered instruction, the SPLUS produced, the delivery system developed and student use to date all point toward the fruitfulness of the basic concept supported by the foundation grant.

FAIRLEIGH DICKINSON UNIVERSITY, Rutherford, New Jersey 07070
50 Dr. William Schick, Assistant Dean, College of Science and Engineering (201) 836-6300.

The COSIP grant had the following impact on the College: aided and promoted curricular development, design of new curricula, articulation of courses among departments, faculty and student research, doctoral study; and made possible the purchase of a digital computer and display for student use and for faculty research on simulation and human factors. During the term of the grant the following baccalaureate (B.S.) curricula were initiated: Biochemistry, Computer Science, Engineering Technology, Environmental Science, Management Science, Urban Systems and the following masters level curricula (M.S.): Computer Science, Bioengineering, Management Science, Materials Science, Systems Science. Experiments in the elementary and intermediate physics laboratories were rewritten. The content and articulation of the general, organic, inorganic, analytical, physical, geochemical, and biochemistry laboratories were studied, and plans for improvement were drafted. New courses were designed: Earth Physics, Engineering Projects (E.E. and M.E.), Computer Science, Geology, Biochemistry, Technology and Societal Problems (E.E.). The use of the digital computer was integrated into the College curricula. Experiments in teaching methods involving the use of television, proctorial sponsored instruction, and the digital computer as a motivating factor were carried out. All curricula of the College were revised, and all departments developed self-study and goals reports. Five faculty were aided in doctoral studies, and two of these have achieved the doctorate at this time. Considerable research was initiated, and approximately ten referred papers were published.

51 FINDLAY COLLEGE, Findlay, Ohio 45840. Mr. Stanley Wineland, Assistant Professor of Physics, (419) 422-8313.

The purpose of the project was to develop a single major in science in lieu of the more traditional majors in biology, chemistry, and physics. This was to be accomplished through the development of integrated courses and new curriculum designs. Under the project the Division of Natural Science has organized itself around two majors---Science and Mathematics--while maintaining the opportunity for students to specialize within one area of science at the completion of the core curriculum. The science major consists of twelve courses. The foundation of the major is supplied through two integrated courses in Physics and Chemistry which are taught concurrently with two courses in applied mathematics and a course in biological concepts. The remaining courses include Particles and Waves, Modern Physics, Solution Chemistry, Organic Chemistry, Botany, Zoology (several of which are to be taught with applications outside the specific discipline), and an elective course in mathematics. The development of these courses has provided the opportunity to examine and incorporate different teaching methodologies. In particular, an inquiry method has been implemented into the introductory sciences courses; an emphasis on concepts has been implemented into the introductory biology course; and the mathematics course has been approached from an applied point of view. The curriculum design has assisted the treatment of certain student handicaps, particularly in the area of mathematical competency and allowed them to be successful where otherwise they might have failed. As a result of this project, the disciplines have been integrated at the introductory level, but integration at the upper level is to be accomplished through example rather than content design.

52 FISK UNIVERSITY, Nashville, Tennessee 37203. George Hull, Jr., Chairman, Department of Biology, (615)329-9111.

The major activities under this project consisted of (1) undergraduate curriculum revisions in biology and physics (2) strengthening graduate studies in chemistry (3) establishing a laboratory for programmed instruction in mathematics. In biology, an undergraduate core curriculum of four new courses (cell biology, genetic biology, vertebrate biology, and environmental biology) was developed, replacing a number of outdated traditional courses. The main thrust of this venture involved the intergration of current biological materials into fewer courses. Evaluation studies indicate higher achievement of students taking the new courses than was true of those taking comparable traditional courses. The undergraduate program in physics was revised to include introductory courses with greater emphasis on competency in mathematical physics than was true in traditional courses. Initial follow-up studies indicate that students who have been involved in this program are able to pursue graduate work in physics with more success than those who took only traditional courses. In chemistry, a set of graduate core courses, coupled with wider options for research in different areas, was developed. Support for graduate assistants and graduate and faculty research led to significant curricular improvements on both the graduate and undergraduate levels. Several papers based on research conducted under the program were published. The Development and Enrichment Laboratory, developed and equipped in the Mathematics Department, is directed toward enhancing the intellectual maturity of students enrolled in mathematics courses at the University. Programmed instruction, designed to assist students in overcoming weaknesses in mathematics, is provided for both individuals and groups. Most of the students who used the laboratory because of weaknesses in mathematics courses have been able to overcome their deficiencies and pass their respective courses. The laboratory is also used occasionally by faculty and students of nearby institutions.

53 FLORIDA ATLANTIC UNIVERSITY, Boca Raton, Florida 33432. Kenneth M. Michels, Vice President, and Ray M. Iverson, Dean of Science. (305) 395-5100

The Biological Sciences Department introduced sixteen new environmentally-oriented courses. Three service courses were added to acquaint students of widely disparate backgrounds with the environmental problems confronting society. Thirteen new courses and eleven existing courses were developed or oriented toward environmental biology. Field exercises, graduate assistants and one new faculty member assisted in the implementation of the program. The very gratifying student interest attests to its success. The Chemistry Department purchased a Perkin-Elmer Model 621 Infrared Spectrophotometer and a Jeoloco Model C-60HL Nuclear Magnetic Resonance Spectrometer. These have introduced the broad applications of infrared spectrophotometry and NMR spectrometry in our undergraduate research projects. The lab programs and the research projects of our students have been greatly enhanced by the two instruments. The Mathematics Department developed an applied mathematics/computer science bachelors curriculum and courses for students in the sciences, mathematics education and engineering. Early in the project remote computer terminals were installed in the Mathematics Department which assisted in the integration of courses with these computing facilities. The Physics Department was able to include a new faculty member, a specialist in astrophysics, who was later transferred to a state faculty position. This was a very important addition to our faculty since it provided an entirely new, current and exciting research interest to our department. The major equipment purchase was a compound 10" Connoisseur series telescope with attachments. Videotape physics demonstrations for use in general physics were produced as were three films on Resonance, Moments of Inertia, and Motion. The Department of Psychology introduced into its curriculum developmental psychology. The University's upgraded an Instructorship afforded by the grant to a continuing Assistant Professorship. Courses in this area constitute an important and popular part of the curriculum.

54 FLORIDA INSTITUTE OF TECHNOLOGY. Melbourne, Florida 32901. H.P. Weber, Dean, Sciences and Engineering. 305-723-3701,Ext. 256

This project was concerned with improving Computer Sciences, Electrical Engineering, Mathematics, Mechanical Engineering, Oceanography (chemistry, biology, and physical options,) Ocean Engineering, Physics and Space Sciences Programs. A complete new common core program for the first two years was developed. Junior and Senior year courses and laboratories were developed by individual departments. Laboratories developed during grant period include General Physics, Fluids and Aerodynamics, Electronics, Electric Circuits, Digital Systems, Microwave, Heat Transfer, Thermal Systems, Geophysics, Material Science, Senior Physics, Modern Physics, Optics and Holography, Chemical Oceanography, Marine Soils, Physical Oceanography, Hydro Acoustics, Computation, Astronomy, and General Chemistry Laboratories. Demonstrations were developed for General Physics lectures. Laboratory experiments for above mentioned laboratories are available. Three course Humanities sequences for engineers and scientists were developed during grant period. Courses are now offered in Bioethics, World Religion, Philosophy, British Literature, American Literature, World Literature, Ethics, Spanish, French, German, Russian and Psychology. Course outlines and sequencing information is available. In summary, the project has resulted in a complete, comprehensive, integrated modern program of undergraduate engineering and science.

55 FRANKLIN AND MARSHALL COLLEGE, Lancaster, Pennsylvania 17604. J. M. Darlington, Associate Dean, (717)393-3621.

The project proposed to promote faculty and student research within the Biology Department; expand environmental and quantification studies and student research within the Geology Department; promote computer-related instruction and broaden professional competence within the Mathematics Department, provide research equipment, develop a techniques laboratory and improve instruction in the non-major program in the Physics Department. In Biology nine research laboratories were equipped. Preparation-room and controlled environment equipment was installed. A field vehicle was purchased for ecological studies. A preparator-technician was employed. Twenty selected students have been undertaking research in successive years. In Geology an environmental studies program was initiated. Equipment was purchased, research projects were conducted, three environmental-studies courses--one, interdisciplinary--were developed. For the first time in College history students (five) graduated with a concentration in environmental studies. A computer-terminal and electronic calculators permitted quantification studies. In Mathematics a staff seminar was conducted daily for six weeks in each of three summers. Two computer terminals and sophisticated desk calculators were purchased and used extensively by faculty and students. A visiting professor, appointed for a two-year term, developed a course in Computational Mathematics. More than five hundred students studied the application of the computer to the disciplines of Calculus, Linear Algebra, and Finite Mathematics. In Physics a visiting professor was appointed and evolved a self-paced, open-laboratory, one-semester introductory physics course, integrated with Calculus. Five electives followed, any one of which could be chosen as sequential to the introductory course. Evaluation by students was highly encouraging. A techniques laboratory was developed and widely used in a variety of courses. Extensive research equipment was purchased or obtained through the General Services Administration. A computer terminal, x-y plotter and electronic calculators were purchased and had wide application.

56 FRANKLIN AND MARSHALL COLLEGE, Lancaster, Pennsylvania 17604. J. M. Darlington, Associate Dean, (717) 393-3621.

The project proposed to accelerate development of a new Anthropology Department, enhance pedagogical and professional environments within the Mathematics Department, further professional activity, increase efficiency, and improve physical facilities within the Psychology Department. In Anthropology opportunity was provided two faculty members to make extensive studies in their specialities. Archeological field training was arranged for eight students in successive summers, teaching assistantships were organized for thirty-two students, including twenty-six majors. Equipment for teaching and field research was purchased. Senior majors increased from eight to nineteen, faculty from four to six. Substantial increase in student interest in Anthropology was evidenced. In Mathematics staff seminars raised the professional environment to a more sophisticated level. Able young mathematicians were attracted. A visiting professor contributed to the staff's professional growth as did expanded journal and book acquisitions. The pedagogical environment was improved by adding visual-aid equipment, experimenting with instructional concepts in introductory and sophomore-level courses and involving selected students as teaching assistants. The latter program had a substantial reinforcing influence on assistants, most of whom were majors, many of whom planned graduate study in mathematics. There has been a continued vigor in experimentation with content and method in the teaching of mathematics. In Psychology two post-doctoral fellowships added new dimensions to competencies of the staff. Provisions of ancillary personnel--electronics technician, secretary-librarian, primate laboratory caretaker, and veterinarian service--permitted the Department to raise the level of its activity appreciably. Sophisticated research and teaching equipment was purchased to complement construction of a laboratory almost tripling previously available space. In the period of the grant the educational program was improved, staff increased from five to nine, research productivity increased, student majors tripled.

FURMAN UNIVERSITY. Greenville, South Carolina 29613. Dr. Stuart Patterson,
57 Academic Dean, (803) 246-3550.

The science program at Furman has been strengthened with CoSIP support by upgrading the faculty through additions and professional renewal, by direct subsidy of research and other professional activities, by earlier and more extensive involvement of students in research, by providing improved and expanded support services to the teaching and research efforts, by expanding the library and laboratory inventories, and by greatly expanding the non-traditional aspects of the curriculum. Faculty positions were added in biology, geology and physics and, with supplementary non-CoSIP help, the position of research professor of chemistry and physics was created and filled. Research, professional travel, publication and/or study costs were covered by the grant for a majority of the faculty in every science department. Grants for these activities were made to 53 individuals including 10 students. Other students worked on professor's grants. As a result the Furman major in all science departments typically publishes or presents at least one paper based on his/her undergraduate research. The numbers majoring have increased since 1970 especially in the previously underenrolled physical sciences. Quality has remained high; four of the seven highest ranking departments in GRE scores are science departments. Alternative science courses for non-majors were devised, the most successful a topical course on energy. Field courses were expanded in geology and biology and new off-campus courses added. These are possible because of vehicles and field equipment obtained through the grant. Research opportunities were established for faculty and students at regional laboratories including ORNL, SRL, TUNL, and UNISOR. A machine and electronics shop with part-time staff were established to support the division's programs. Much equipment was built, and faculty and students have learned fabrication techniques. Research grants have been obtained in every laboratory science department. The CoSIP program allowed expansion and improvement of the sciences during a period when holding action was common.

GETTYSBURG COLLEGE, Gettysburg, Pennsylvania 17325
58 Dr. Leonard I. Holder, Chairman Department of Mathematics, (717) 334-3131

The COSIP program at Gettysburg College consisted of three main aspects: the purchase of an IBM 1130 computing system, the training of a nucleus of faculty in its use, and the introduction of computer techniques into science courses. As a result of the program the computer now plays a vital role in many of our undergraduate courses. All mathematics, chemistry, and physics majors, and many biology majors receive an early introduction to the computer in the freshman calculus course, where it is used in natural ways to supplement and illuminate the calculus. In addition, a significant number of social science students, in an elementary statistics course having a computer laboratory, learn something of the potential and limitations of the computer in their disciplines. The potential for use of the computer in the social and behavioral sciences, especially in simulation, as well as information processing is just coming to be realized, and it is expected that use will be greatly expanded in those areas. A total of 32 courses, from 9 disciplines involving 750 different students each year now use the computer routinely. This number continues to grow year by year. Approximately 36 faculty members now are able to use the computer. As a result, courses have been made more realistic, and non-trivial problems and projects previously impossible can be assigned. Talented students have devised sophisticated and innovative programs to increase the utility of the IBM 1130, and these have been disseminated widely among other colleges. The computer has been used almost exclusively for educational purposes, making possible a maximum amount of "hands on" experience by students and providing an atmosphere in which students with a special bent for computer science can develop their potential. The use of the computer has grown so rapidly that additional facilities will soon be needed, and this matter is currently under consideration.

59 GRAND VALLEY STATE COLLEGES, COLLEGE IV, Allendale, Michigan, 49401, Dr. Robert J. Toft, Dean of College IV, (616) 895-6611, extension 261.

Through the establishment of an hierarchical matrix of individualized credit bearing auto-instructional learning modules, each built around a single concept or topic, approximately 60% of an undergraduate liberal arts curriculum is being constructed in a self-paced mode, utilizing performance objectives, mastery learning and competency-based testing. Seminars, discussions, independent study and small group problem-centered projects constitute the remaining 40% of the work. Input from a National Advisory Board, consultants, and an outside evaluation team guides the process. The computer is used to manage the time-free system, and to maintain records through interactive terminals. Open admissions, free selection of coursework, self-pacing and open scheduling ensure wide participation by many persons traditionally denied access.

60 GRINNELL COLLEGE, Grinnell, Iowa, 50112. Waldo S. Walker, Dean of the College, 515/236-6181 Ext. 222.

The COSIP Grant to Grinnell College contributed substantially to increasing the research opportunities of science faculty, through a Sabbatical Assistance Program and a formal Research/Study Program, and to improve cross-disciplinary exchange among Social Science Division faculty through a formal Faculty Seminar Program. The Sabbatical Assistance Program made it possible for faculty in both Natural Science and Social Science Divisions to extend their regular 1-semester sabbatical leaves to a full year. The benefits to the College were of two kinds. The researchers were able to undertake more ambitious projects and the young people hired to make that possible were often excellent teachers who were able to enrich departmental programs while they were here. Although valuable at the time, the program has not been continued. The Research/Study Program provided funds for small research grants, ranging from $25. to $5260, to individual researchers (46 awards in all) from the Social Science Division. These grants and designated support for anthropology field studies were probably the most valuable programs undertaken by Grinnell College. The College has continued to support Research/Study Programs for all divisions since the COSIP Grant. The increased activity supported by these funds has provided a stimulating model for undergraduate students and a source of attraction to young faculty. The Faculty Seminar Program provided released time for cross-disciplinary studies by groups of Social Science faculty members. Four seminars, involving 5-15 faculty members each, were organized to study Urban Studies (I and II), Social Science and History, and Computer Use in the Social Sciences. Though short term effects on faculty members involved were generally considered positive, the seminar program was finally judged to be the least successful program supported by the COSIP grant.

GUSTAVUS ADOLPHUS COLLEGE, St. Peter, Minnesota 56082
61 Dr. John Kendall, Professor of Psychology, 507/931-4300 ext: 200

CoSIP at Gustavus Adolphus College was designed to strengthen science education through course and curriculum development, opportunities for faculty renewal and improvement, the addition of science technicians and the purchase of some additional laboratory equipment. The course and curriculum development involved one-semester leaves, summer projects, and consultants. The faculty improvement allowed for additional one-year leaves, special summer study, and short-term visits to other campuses. During the period of the grant, seven professors were able to devote at least one semester to curriculum development. Sixteen staff were supported during summers on course related activities. Five senior professors were given one-year leaves for professional renewal and twenty-six were able to participate in summer programs designed to increase professional skills. Three technicians were hired to assist the science departments in equipment maintenance, audio-visual techniques, and computer applications. The technicians spent considerable time improving the skills of both faculty and students in their respective areas. As a result of efforts by the computer technician, computer use by science departments increased over 70 percent in three years. Specific program developments include a program of landscape analysis in geography, a new course on totalitarianism in political science, an interdepartmental program in animal behavior, a revised undergraduate course in econometrics, programmed instructional material in genetics, a modular laboratory in introductory psychology, a stereoscopic atlas in comparative anatomy, a set of auto-tutorial film loops in physical chemistry, self-guided geology tours, and the implementation of Keller plans in physics and chemistry. In all, ten science departments, sixteen specific courses and forty-three different faculty profited by CoSIP support.

HAMLINE UNIVERSITY, ST. PAUL, MINNESOTA 55104. OLAF A. RUNQUIST, PROFESSOR OF
62 CHEMISTRY, 612-641-2252.

The four part Program initiated to improve Science instruction for both the underprepared student and the talented through, (a) curriculum enrichment and modification studies aimed at increasing quantitative abilities of underprepared students; (b) upgrading quantitative science instrumentation and computational facilities; (c) summer student research program; (d) a para-professional position in the natural sciences. Curriculum development resulted in production of new self-instructional materials for underprepared students in mathematics, economics, psychology and chemistry. More quantitative topics and techniques were incorporated into existing courses along with new teaching techniques. Computational facilities were increased through purchase of mini computer and programmable and non-programmable desk top calculators. Self instructional material was prepared and is available for calculators and computers. The quantitative nature of courses at every level has markedly increased. Scientific equipment available to all departments was greatly increased by purchase of new equipment, acquisition of surplus property and by instigating an all University interdepartmental loan system. Inventory of all campus equipment has been compiled and is available to all departments. All equipment available for interdepartmental loan is maintained by a common university repair budget. Through excess property program, science shop facilities and raw material supply greatly expanded, new research oriented laboratories and summer research program greatly increased shop use. Summer student research program provided faculty and students with time to engage in basic research, and resulted in several publications to date, and has increased awareness of the importance of research in the undergraduate training of scientists. Para-professional position was created to assist faculty in maintenance of laboratories and scientific equipment inventories. Creation of this position made the interdepartmental equipment loan program possible and resulted in a unified bid-purchase procedure for the science departments and materially lowered maintenance costs. As a result of summer curriculum development work in biology and physics a new environmental major established and a revised physics curriculum adopted.

63 HAMPDEN-SYDNEY COLLEGE. Hampden-Sydney, Va. 23943. Academic Dean Frank J. Simes, (804)223-4381

The Hampden-Sydney COSIP grant was twofold in its purpose: it was intended to strengthen individual department programs by providing outside consultation on curricular development and potential staff augmentation, and it was intended to generate conditions within the college in which independent study and research involvement as features of the various science curricula would be adequately supported in terms of library resources and more generally used within those programs. Seven departments were involved: biology, chemistry, economics, mathematics, physics, political science, and psychology. The college started the grant period with very conservative and somewhat dated programs in most of the science departments and very uneven program levels in terms of staffing, course offerings, and commitment to independent study. In departments with developed programs COSIP brought in a new full-time faculty advisor in an area not adequately covered by existing staff, or a series of consultants (each on a 3 to 5 day visit) for a similar purpose. A result of the above was curricular planning and expansion with a better balance among the area of specialty in each department, and a renewed emphasis on independent-study opportunities in each department. In departments with very small staffs or less fully developed programs, consulting committees were brought in during the first summer of the grant to plan the development of both the curriculum and the needed areas of specialty for additional staff to be hired. Subsequently, the college hired new faculty members in the suggested patterns, the new curricula were put into practice, and COSIP funds purchased substantial additional library resources in all of the departments. In all departments, more emphasis was placed on quantitative techniques: the college leased its first computer (IBM 1130) and COSIP funds purchased an electronic-calculator statistics laboratory for multi-disciplinary use. In the final year of the grant, departmental review committees were brought in to assess the progress of each department, providing both benchmarks and guidance for the improvement of the programs in future years.

64 HAMPTON INSTITUTE, Hampton, Virginia 23368 Dr. Victor Fields, Chairman, Department of Chemistry, (804)727-5249.

This COSIP project was undertaken with the goal of improvement within the Departments of Biology, Chemistry, Mathematics, and Physics. Within the Department of Chemistry improvements were achieved using faculty released time for curriculum revision and/or study. A radiochemistry course was one of the major improvements; American Chemical Society accreditation another; and student research programs still another. The Department of Biology used this project as an opportunity for faculty to gain the knowledge necessary for the program in marine biology. The Department of Mathematics concentrated on its programs for elementary school education majors. They have increased their emphasis on computer applications and have revamped their courses in numerical analysis. The Department of Physics emphasized student research with several papers being presented at various science conferences. A side benefit achieved through the grant was that of better interdepartmental relationships. General meetings and discussions clarified the significant relationships that exist between the various scientific disciplines.

UNIVERSITY OF HARTFORD, West Hartford, Connecticut, 06117. Dr. Frank M. Ganis,
65 Associate Dean for Science, (203) 523-4811, Ext. 536.

The most significant result of the COSIP grant awarded to the University of Hartford was the rapid growth of the comparatively new university campus. First and foremost was the enlargement and revitalization of the science faculty. This was accomplished by (1) allowing faculty to undertake individual research projects (2) providing opportunities of contact with the scientific community through meeting attendance and seminars (3) underwriting curriculum study projects (4) procuring scientific equipment and instrumentation (5) establishing masters' degree programs in the science departments through graduate assistant support. Because of the substantially increased size and strength of the faculty, the university is in a better position to become involved in community operations. All departments benefited from increased exposure to outside speakers and consultants. Undergraduate programs have been decidedly upgraded in all departments and two new graduate programs were inaugurated and consolidated. We feel that these programs were significantly involved in favorably altering both undergraduate and graduate enrollments at the university. Both the Psychology and Biology Departments managed to establish new graduate programs and develop their undergraduate programs to improved levels. Unfortunately, projected graduate programs in physics and chemistry did not materialize. Psychology benefited from a strong orientation towards the behavioral sciences. The Biology Department benefited from increasing student interest in conservation, ecology and the anti-pollution movement and very decidedly in the area of health science education. Chemistry also reaped benefits from this latter interest in the biological sciences. In every respect it can be said that the science and engineering faculties are demonstrably stronger than they were at the beginning of the COSIP program. This faculty strength has been noted particularly in the school's ability to provide a solid education in virtually any area of the basic sciences. The influence of COSIP on individual elements of the university has been striking but the best measure of success of the program has been the overall strengthening of the faculty and science programs in the university.

HARVEY MUDD COLLEGE, Claremont, California 91711. J. Arthur Campbell, Dean of
66 the Faculty. (714) 626-8511

COSIP funds enhanced scientific research activity and expanded opportunities for student involvement in teaching and research. Students coauthored 56 papers.

During three years of COSIP support eight post-doctoral fellows taught and, with eleven students, did research in the Chemistry Department. Research on homogeneous catalysis by transition metal complexes resulted in several publications by faculty and students; research in applications of quantum mechanics to surface effects including heterogeneous catalysis also was carried out jointly. A major effort went into establishing and staffing new courses in bio-chemistry and outfitting two student and one faculty research laboratories. The bio-chemistry program now promises to expand into a highly quantified advanced biology program with greatly amplified research capabilites.

Physics research activities were initiated and expanded in several areas. Astronomy was initiated with the hiring of a post-doctoral fellow in astronomy and the purchase of an Ealing 16" Research telescope, spectrometer, and photometer. One paper is in preparation for publication from faculty-student research carried out with the telescope. Three pieces of lecture demonstration equipment were built; a torsional wave demonstrator, servo-voltmeter, and drumhead resonance visualizer. A low-temperature solid state physics laboratory is being used for the measurement of transport properties of metals and semimetals and the measurement of various parameters which describe the state of magnetization of insulating materials. The low-temperature laboratory is capable of measuring resistivity at low temperatures for some of the europium chalgonides and will enable us to make significant contributions to the understanding of such semiconductors. Data has been obtained from ongoing faculty-student research on single crystals exposed to microwave radiation in the presence of a magnetic research.

Two engineering post-doctorates established research activities in information theory, computer simulation and systems engineering. Theoretical research, based on computer simulation that has provided some performance results, is continuing on the performance of specific data-compression techniques when the data is confused by noise. A faculty member and student are studying the dynamic response of a multi-unit fluid mixing process including controller setting.

HEIDELBERG COLLEGE. Tiffin, Ohio 44883. Dr. Martin Reno, Physics
67 Department Chairman. 419-448-2494.

The departments of biology, chemistry, mathematics, physics, political science, and psychology engaged in a wide variety of activities designed to improve and modernize the laboratory course offerings, increase and renew the expertise of the faculty, and improve the physical facilities necessary for this program. New laboratory exercises have been developed for Botany, Microbiology, Physical Chemistry, General Physics, Advanced Physics Laboratory, and Experimental Psychology. Project oriented laboratories have been established in General Chemistry, Organic Chemistry, and General Biology. Students and faculty have worked during vacations to improve laboratories, new laboratory apparatus has been implemented, and specialized equipment has been constructed. Off-campus study and research for two senior faculty members resulted in establishment of Keller Plan courses in basic mathematics and a continuing research project on marijuana extracts (Dr. John Groce). Four junior faculty members were supported for continued study toward the PhD degree. Student-faculty research programs have been established: nuclear magnetic research in liquid crystals (Dr. Raymond Wise), Mossbauer effect in intermetallic compounds (Dr. Stanley Schmidt), X-ray structure determination of biologically important molecules (Dr. John Jackobs and Dr. Martin Reno), viscosity studies of muramidase (Dr. Richard Kissling). Developments begun during the project will continue to influence the future course of science at Heidelberg. Project oriented laboratories are a regular part of the Chemistry Department laboratories; student-faculty research projects thrive in the Physics Department; Keller Plan and Guided Design courses develop in Mathematics and other areas; a flight simulator is a unique educational tool in the Psychology Department; and the Political Science curriculum points toward a more quantitative approach.

HOLLINS COLLEGE
68 Hollins College, Virginia 24020
Roberta A. Stewart, Assistant to the President, 703-362-6323

The CoSIP program afforded Hollins College with a means (1) to bring to the campus Visiting Scientists to meet formally and informally with students and faculty, (2) to provide faculty with funds to travel in connection with their research, (3) to make possible special faculty leaves for post-doctoral research, particularly for the younger members who were not eligible for sabbatical leaves, (4) to finance travel by students to other libraries and laboratories to utilize their resources, and (5) to hire temporary faculty to release regular faculty from some or all of their responsibilities to enable them to carry out research, undertake curriculum revision, or experiment with new teaching programs. Under the CoSIP grant, 61 Visiting Scientists visited the nine participating departments during the period of the program. These scholars not only spoke to classes and to general audiences but also acted as research and program consultants. Their presence on the campus broadened the horizons of all who came into contact with them; both students and faculty benefitted enormously from this aspect of the program. Twenty-four faculty in the nine departments received funds to support their research; 69 students worked with faculty as student research assistants. Students and faculty were thus able to further their professional development. Five faculty took leaves to concentrate on their research; their replacements were paid from CoSIP funds. Curricular studies were undertaken by faculty in biology, chemistry, economics, psychology, sociology, and statistics. As a result of these studies, several new courses were introduced and changes were made in existing ones. One faculty member concentrated on the high school-college science interface problem. Finally, 110 students were given full or partial support to travel to professional meetings, and to libraries, laboratories, and other places for research purposes. CoSIP support made possible the activities described above.

47

HOOD COLLEGE, Frederick, Md. 21701 Phyllida M. Willis, Professor 301-663-3131

69 The multidisciplinary COSIP program included a computer center and statistics lab, faculty self-improvement, visiting professors and scholars, and summer undergraduate research participation (URP). Provision for computer facilities and for faculty to gain increased competence with these enabled us to bridge the gap between our pre-COSIP cooperative computer science education program[1] and our current expanding use of this educational resource. Students majoring in mathematics, science, social science, education, home economics, and even humanities use the computer in ways ranging from simple calculation to problem solving, data analysis, and simulation. We are now considering increasing the computer facilities and adding new computer-dependent courses. Trends in the economics and psychology departments are for more emphasis on mathematics and computer applications. The influence of visiting scholars--Goodwin Watson's teaching on social sex roles and Jean Mayer's on nutrition--continues. A nutrition faculty member who did "self-improvement" summer study has introduced two new courses, Nutrition and Cultural Patterns, and Community Nutrition &Health. She has also been Hood's representative in development of the Maryland Coordinated Undergraduate Program in Dietetics, a cooperative venture of the U. of Maryland, Morgan State College, Hood, and the Nutrition Department of Johns Hopkins Hospital in Baltimore. A new course, Issues in Science, Philosophy, and Religion, has some of its roots in COSIP. Faculty released-time was used for improvement in the audio-tutorial biology lab and for individual research. Summer URP stipends were awarded to 14 students, majors in 8 different fields. Their work at N.B.S., N.I.H., U.S. D.A., Johns Hopkins, and the U. of Maryland, stimulated their interest in research, showed them what doing research is like, and provided guidance for their choices of careers. Eight of them have become full-time students in graduate school and in medical, law, and other professional schools; several others have done part-time graduate study. Some are using their experience in positions at N.I.H. or Federal Reserve. Arranging for a chemistry internship course at N.B.S. was facilitated by previous URP contacts. Faculty in non-science fields enjoyed auditing the COSIP Professor's history of science course and shared the general excitement of COSIP scholars' public lectures. Additions to the library in history of science and environmental topics are of continuing value. Scholarship in general has benefited.

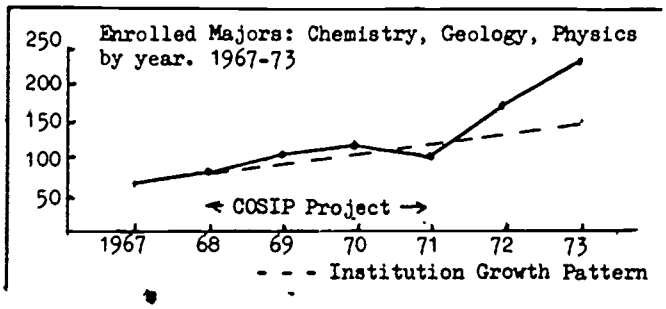
[1]Willis, P.M. and Fox, M.R., Liberal Education, vol. LV, no. 4, 1969, p. 545-550

70 HOPE COLLEGE, Holland, Michigan 49423. Dr. F. Sheldon Wettack, Professor of Chemistry, 616-392-5111, extension 2272.

The COSIP Grant at Hope College was designed to implement the development of a new Geology Department, to expand the experimental psychology program, and to strengthen all the sciences by generating an intensity of undergraduate research similar to that present only in the Chemistry Department prior to 1969. To this end several specific results can be noted. The Geology department now numbers 3 faculty and 30 majors, and the program is growing. In view of the renewed interest in the geological sciences, its presence promises to enhance the position of Hope among 4-year private colleges. Extensive equipment and library purchases necessary to launch this program were made with COSIP funds. Three additional experimental psychology faculty are now at Hope as compared with the pre-COSIP period. This area of psychology has grown commensurate with the staffing increase and the net result has been a much stronger overall psychology program. Psychology now graduates more majors than any department at Hope. The extension of undergraduate research to departments other than Chemistry has been a major outgrowth of COSIP. Approximately 42 students were supported during the three summers of the grant and all departments were involved. During the past three years 60-70 students have spent the summer at Hope working full-time on science research projects with faculty collaborators. The impact of this on the strength of the sciences at Hope has been very significant. A total of 27 individual faculty grants are now active in the departments supported by COSIP whereas 9 were active in 1968. In addition NSF-URP or SOS grants were received in Biology, Chemistry, Physics, and Psychology last year. Many other unfunded proposals have been submitted during the past three years and several more are now pending. In short a greatly increased intensity of research has occurred in all of the sciences and much of this increase can be traced directly to the "seed" money provided by COSIP in the form of summer stipends for student researchers.

71 HUMBOLDT STATE UNIVERSITY, Arcata, CA. 95521 John M. Borgerson, Professor of Physical Science. (707) 826-3220

The COSIP Project at Humboldt State University was directed toward a thorough revision of the upper division (Junior-Senior) majors curricula in the departments of Chemistry, Geology and Physics. The three programs were redesigned concurrently with an institution-wide conversion from semester to quarter system and went well beyond an arithmetic conversion of course numbers and unit credit. Major thrust was a program phased toward and culminating in a Senior Research Experience with allied seminars and independent study. COSIP support initiated or sustained ongoing research of modest scale of such a nature that a senior student could participate actively with a senior professor. Institutional matching support provided a new and modern physical chemistry and advanced project laboratory and a structure with related facilities at a field study station in the coastal range east of the campus proper. The latter facility makes possible meteorologic, seismologic, and astronomic investigations impossible or impractical at the sea level location of the campus. Suggesting an element of "delayed impact" insofar as the program effect is concerned, the enrollment figures for declared majors in the three departments is presented below. In the seven year period that saw total enrollment double, enrolled majors in the participating departments tripled. Curricular refinements and progress made possible by the COSIP grant have been successfully incorporated into the ongoing science program - and routinely accepted as an integral part of the normal curriculum - in the three disciplines.
Normal budgetary support has been sufficient to maintain the program since funding terminated in 1971.



72 ILLINOIS WESLEYAN UNIVERSITY, Bloomington, Illinois 61701, Wendell W. Hess, Ph.D., Director, Science Programs, (309)556-3060

The CoSIP grant to Illinois Wesleyan University provided expanded opportunities for such activities as astronomical viewing, behavior modification, faculty and student research, insightful consultants, visiting professors, computer computation and model building, and audio visual stimulation. The single purpose was to enhance and accelerate educational opportunities in six departments offering majors and in one multidisciplinary activity. The grant's impact surpassed all expectations and provided positive effects well beyond the specific areas involved. Physics and Psychology acquired major equipment. A 16" telescope completed observatory facilities, resulting in greatly enlarged possibilities for astronomical viewing by students and townspeople. A physiograph, videotape and other experimental equipment expanded and improved the entire behavior modification oriented curriculum in Psychology, contributing to a dramatic increase in major students. By providing released time to one of our faculty, the grant made possible a computer expert in residence, now able to work in many areas of computer application. Faculty and students in Chemistry, Psychology, Sociology and Political Science learned better how to conduct undergraduate research, with some significant results. Graduate study at major universities increased the effectiveness of the Economics faculty. The grant facilitiated the earlier completion of doctoral work by one member. The acquisition of audio visual packages by five departments demonstrably improved learning and teaching techniques. Visiting lecturers presenting new viewpoints and insights attracted attendance by the campus community that proved the value of these enriching experiences. The program's flexibility stimulated creative thought and action, and the sense of cooperation achieved among the disciplines during the grant period will have lasting impact. No major administrative problems were encountered, and only one line item of the grant remained inactive due to personnel illness.

73 JUNIATA COLLEGE, 17th and Moore Street, Huntingdon, Pennsylvania 16652
Dr. Donald M. Rockwell, Professor of Chemistry, (814)-643-4310 Ex. 71

Major aims of project: 1- to update and upgrade training of faculty; 2- to develop curriculum changes; 3- to improve computer facilities and provide more training in computer uses by faculty; 4- to improve laboratory facilities; 5- to strengthen library resources. Aim 1: met by grants of released time for faculty to do advanced course work at other institutions (three persons were enabled to complete their graduate degrees). Also several faculty members from social sciences engaged in an on-campus, eight-week summer seminar involved with course work in model building, simulation, computer useage and curriculum design. Visiting instructors were brought in for this seminar and several visiting speakers were engaged for occasional lectures to the participating faculty. Aim 2: fulfilled by inviting several faculty members to be involved in designing new courses in the social sciences and a new laboratory program for the chemistry department. These actions were closely meshed with the reorganization of the whole college curriculum which was occurring simultaneously. Aim 3: partially met by assisting in the support of the MERC computer system. When this failed to be viable, support was transferred to helping with the costs of a new IBM 1130 computer. Support also given for purchase of a plotter and a small laboratory computer. Additionally, several courses in computer were offered faculty. Aim 4: new laboratory equipment added in psychology, including constructing and equipping a group-dynamics laboratory. Major additions of equipment for biology and geology associated with setting up a new field station. Aim 5: numerous additions to library holdings, especially in social sciences. In general all aims were met successfully without major difficulties. Chief disappointment is that our computer facilities and program have not developed to the extent originally hoped for. New courses and laboratories are working well and faculty are pleased with student response. The group-dynamics laboratory and the field station are major additions to facilities and will have a strong positive effect on our scientific program for years to come.

74 KENYON COLLEGE
Gambier, Ohio 43022
Dr. J. M. Pappenhagen, Professor of Chemistry, (614) 427-2244

The objectives of the three-year COSIP grant had as central themes: faculty development, curriculum modernization and revision, use of computer facilities. During the period of the grant the College had the additional objectives of providing for the addition of women students, new faculty for expanded departmental programs, and both the construction and renovation of science facilities. Under the grant the combined resources of the College and NSF provided for salaries (for a laboratory preparator in biology, for summer and released-time support for members of six departments for curriculum development, computer studies, research and study), equipment for curriculum development in chemistry and physics, computer hardware, and faculty travel. Each of the six departments (biology, chemistry, economics, mathematics, physics, psychology) made significant curricular changes. Included among these were the redesigning of existing and introduction of new courses, both for majors and non-science majors, the preparation of teaching films. and the writing of laboratory experiments, computer programs, and text material for computer programing. Increased student interest and awareness, throughout the College, is evident from these changes. Some fifteen to twenty faculty members each year attended seminars, conferences, and professional society meetings, and learned first-hand of research and specialized subject matter. More than half of the members of the participating departments directly benefited from the summer study, research, and released-time portions of the program. Research grant applications and funding, improved course instruction, publications, and student independent study projects have resulted. The College has continued to build upon the thrusts of the COSIP grant as typified through the establishment of a college-wide faculty development grant program, a new department of anthropology and sociology, the synoptic major, and changes in the comprehensive examination program.

75 KING COLLEGE, Bristol, Tennessee 37620. Edward W. Burke, Jr., Professor, (615) 968-1187.

The COSIP Grant supported Honors Research, Faculty Released Time, expanding the use of computer for teaching, setting up a Science machine shop with a machinist and purchase of equipment for laboratory teaching. Student-faculty research was productive in Biology, Chemistry, Mathematics, Psychology and Physics using COSIP grant funds to provide stipends for summer. Students finished projects and wrote papers the following school year. The use of the computer for teaching in mathematics and other fields was expanded. The Project Director spent one semester at Vanderbilt University working on a physics course for non-science majors and studying the undergraduate physics curriculum. Two mathematic professors were released for one half time for one year to study and develop curriculum. A capable machinist was provided for the Science Shop. He makes equipment for demonstrations, laboratory, and research in Physics, Chemistry, Biology and Psychology. Telescopes and associated optical equipment for teaching and research in the Physics Department were designed and built. Laboratories were provided and renovated by King College and equipped with grant funds for Psychology so that experimental courses could be expanded. The Biology and Chemistry Departments were provided equipment funds and all departments included in the grant received extensive G.S.A. excess property which was extremely valuable.

KNOX COLLEGE
76 Galesburg, Illinois 61401
Lewis S. Salter, Dean of the College; (309) 343-0112

Chief program features aimed at two objectives; (1) making faculty-student research involvement an integral and continuing feature of the science program; (2) supporting science education programs by provision of store-room and lab technicians, needed instructional equipment, and underwriting an augmented visiting scholar program. In support of the first objective funds were expended to provide research support for members of behavioral science faculty, needed research equipment for new members of the physical science faculty and summer research stipends for students in both behavioral and physical sciences. The program is best described as conventional and non-innovative; no activities not previously present and supported by the college in at least rudimentary form were initiated. A comparison of physical science enrollments (measured in credit units) yields the following data: in 1967-68 (pre-COSIP) there were 1.847 science units awarded per FTE student and 120.54 per FTE physical science faculty member; in 1972-73 (post-COSIP) the corresponding figures were 2.061 and 126.62. The increases are 11% and 5%, respectively. Some continuing funds have been secured to maintain faculty-student research projects initiated with COSIP funds (e.g. anthropological investigations at Bishop Hill site supported by regular grants from the state). Machine, woodworking and electronics shops in new Science Center were almost completely equipped with surplus equipment procured under COSIP auspices, at tremendous savings. Impact on continuing science program was greatest in area of student-faculty research, particularly in behavioral sciences. Visiting scholar program had least continuing effect. Unplanned spin-off, made possible by flexibility of COSIP funding, was in area of new courses for non-science majors and inter-and trans-disciplinary courses developed (e.g. philosophy of science course team taught by chemist and philosopher, team-taught course in physics and the arts). Some wastage of funds for summer research occurred because "grants committee" composed of department chairmen was insufficiently tough on submitted proposals; a committee composed partly of scientists outside of the Knox community would probably have made better disposition of the available funds.

77 LAWRENCE UNIVERSITY. Appleton, Wisconsin 54911. Robert M. Rosenberg, Professor of Chemistry, (414) 739-3681.

The COSIP program at Lawrence was designed to strengthen independent study and research, to provide improvement in applied mathematics, statistics, and the computer center, and to provide a thorough study of the curriculum and make suggestions for needed change. An average of 12 faculty-student summer research projects were carried out in each of four summers. These projects have led to grants from external agencies, to development of interacting research communities, to increased enrollments in independent study and tutorials, and to increased support by the university for summer student-faculty research. Grant funds provided a basic complement of research equipment for the biology, geology, physics and psychology departments, on which they could build programs, and strengthened holdings in chemistry. Research oriented experiments permeated laboratory work in these departments. Acquisition of the Human Relations Area Files played a similar role for anthropology. The mathematics curriculum was revised, a statistician was added to the staff, and a statistics laboratory was equipped. Increased emphasis on the quantitative aspects of the social and biological sciences led to record enrollments in mathematics courses. The 1620 computer was equipped with two disk files, a PDP-11 time sharing system was purchased which now has sixteen terminals including two video terminals, a plotter, and several silent terminals with tape cassettes, and the university obtained on-site access to the 360-44 at The Institute of Paper Chemistry. Computer use is now common in almost every course in the natural and social sciences as well as in research. A manual and videotape film was produced for self-instruction in the use of the analogue computer. The curriculum study led to the formation of a sociology department and stimulated greatly the development of the computer center and computer use. New interdisciplinary teaching has developed in neuroscience, urban studies, and linguistics.

78 LINCOLN UNIVERSITY. Lincoln University, Pennsylvania 19352
Leroy D. Johnson, Dean of the College 215 - 932-8300

Science education at Lincoln University has benefitted significantly as a result of the COSIP grant used for the development of new curricula, the provision for instructional assistance, and a general enhancement of the physical facilities available for the sciences. Our adoption of a 4-1-4 curriculum which allows for independent study and off-campus experiences during the month of January was influenced by this grant. A complete rebuilding of the Life Science Building was financed in part by an Office of Education grant. The life sciences have also benefitted greatly from the building of a new greenhouse which allows for experimentation with plants throughout the year. The acquisition of major items of equipment including a Leitz fluorescence microscope, interference microscopes, centrifuges, in the biology department, and a multichannel analyzer, interferometer, and oscilloscopes in the physics department allowed for the introduction of research capabilities not possible before the grant. The provision for assistance in developing our computer program and our offerings in mathematics has made this center one of the most efficient operations in small liberal arts colleges. The center has conducted projects in computer analysis during our January interim. The psychology department has grown to include experimental and physiological psychology, and the teaching assistants provided by the grant have helped this department produce and maintain the third largest group of our graduates each year for the past several years. The increased facilities for both teaching and research as well as the opportunities provided by the grant for making innovations were invaluable in increasing the effectiveness of the science program at Lincoln University.

79 LOUISIANA TECH UNIVERSITY, Ruston, Louisiana 71270 Dr. P. B. Moseley, Associate Dean, College of Arts and Sciences, (318) 257-3160

The COSIP project was designed to improve teaching of chemistry, physics, and zoology at Louisiana Tech University. Summer salaries were paid to some members of the chemistry faculty to work on the reorganization of certain courses particularly laboratory courses. A number of items of equipment were purchased which have resulted in considerable improvement in the quality of the organic laboratories and the instrumental analysis physical and biophysical laboratories. The greatest improvement has resulted from the use of the infrared spectrophotometers and the preparative gas chromatograph. As a direct result of COSIP support, a strong undergraduate curriculum for physics majors was established. All physics courses were improved by revising lectures, including materials from recent literature, selecting new texts where appropriate, and introducing audio-visual aids and classroom demonstrations. To insure maximum improvement, the faculty member responsible for each course was given a two-thirds teaching load reduction. Similarly, an evaluation of the laboratory sections was made resulting in a locally written laboratory guide, a reorganization of laboratory procedures, and recommendations for new laboratory equipment. Faculty improvement was reflected by the increased research activity made possible by reduced teaching loads, equipment acquisition and the hiring of two new faculty members with new research interests. Research publications were increased. The zoology department improved its technological offerings to its students. Sophistication was afforded our students through modern equipment and instrumentation. This prepares a better informed student with more precise methods in the testing and measuring of scientific raw data. The zoology department studied, reviewed, assessed and altered its undergraduate curriculum for its majors. It established a basic concepts course at the freshman level and created a core curriculum from which advanced courses are structured. Duplication of information is minimized in this approach.

80 LUTHER COLLEGE. Decorah, Iowa 52101. Adrian M. Docken, Professor of Chemistry. (319) 387-1122.

This COSIP project has focused on strengthening the instructional program in the Departments of Biology, Chemistry, and Physics in four ways: 1) Curriculum development by expanding staff and course offerings, especially of an interdisciplinary nature, 2) an increase in research activity by both faculty and students, 3) an expansion of teaching facilities by remodeling and equipping existing space for biochemistry, cell and microbiology, and 4) obtaining technical help to release staff from supportive activity and routine chores. Additional faculty made possible by the grant are: a biochemist, a freshwater biologist, and a geophysicist. New courses that have been added include: Problems of the Environment, Geophysics, Computers and Digital Electronic Techniques, Biochemistry (2 levels), Aquatic Biology, Biostatistics, Animal Behavior (team taught by staff from Biology and Psychology), Mammalian Physiology (team taught by staff from Biology, Psychology, and Physical Education). The development of mini-courses has increased the interdisciplinary emphasis by making it possible for a student to take an integrated course taught during the first half of the semester by a physicist, for example, and by a chemist the second half. Two examples: Electronics-Instrumental Analysis; Physical Chemistry II-Quantum Mechanics. Academic year half-time research leaves for faculty as well as summer research stipends for both faculty and students have helped to increase student interest to a point far beyond any level previously reached. We now have an additional 3000 square feet of floor space for teaching and student research in biochemistry, cell and microbiology, well equipped with modern instrumentation.

MACALESTER COLLEGE. St. Paul, Minnesota 05414. Murray Braden, Professor of
81 Mathematics, 612-647-6338.

MACALESTER's COSIP program provided study and research opportunities for faculty members in Biology, Chemistry, Geology, Mathematics, Physics and Psychology, and provided stipends for summer research and study for students in those departments, under faculty supervision. For faculty members there were stipends for support of summer research and study, as well as for leaves of absence lasting one or two semesters. Several semester leaves were combined with sabbatical leaves. The leaves were quite effective in enabling faculty members to revisit the frontiers of their specialties and to rekindle their professional vitality and entnusiasm. A considerable amount of original research and writing was accomplished, with some publication realized and some pending. Another accomplishment was the development and revision of courses· a few examples being the creation of an interdisciplinary Environmental Science course and major program, creation of two courses on the computer, and developing materials for a drastic and innovative revision of the introductory psychology course.

MACMURRAY COLLEGE, Jacksonville, Illinois, 62650
82 Dr. Fred McCollough, Jr., Professor, Chairman, Chemistry Department
(217)245-6151, Ex. 352

A modernization of the curriculum and equipment in the Departments of Biology, Chemistry and Physics was undertaken in order to accommodate the reviving interest in the Natural Sciences in the 1960's. Extensive remodeling and renovation was carried out in the Biology Department. Audio-tutorial equipment was installed in the laboratories. Faculty offices were set up in conjunction with an adjoining seminar-library room. Course material was reorganized to fit the new format. In the Chemistry Department, emphasis was placed on up-grading the first two courses - General Chemistry and Organic Chemistry. Balances, Spectronic 20's, pH meters, gas chromatographs, and a Beckman Microspec were added. Courses were redesigned to reflect a more quantitative approach. The Chemistry Library was improved by the addition of periodicals. Extensive remodeling was also accomplished in the Physics Department. Equipment in the area of nuclear science instrumentation was added. A key addition was the purchase of a multi-channel analyser and an X-Y plotter. Extensive use of computer facilities (made available through a separate grant) has been made by both the Chemistry and Physics Departments in the implementation of the new program. As a result of the improvements in curriculum and equipment, students are prepared to undertake meaningful research at the undergraduate level. Enrollment in the science departments has not suffered the decline that has been experienced college-wide. Acceptance of our students in graduate and professional school has remained high.

MANCHESTER COLLEGE. North Manchester, Indiana 46962. Dr. William R. Eberly,
83 Professor of Biology and Director of Environmental Studies, (219) 982-2141.

A Computer Center with an IBM model 1130 computer and related keypunches and card sorter was established. The computer is used almost exclusively by students in a variety of courses and for advanced student research projects. A brief contact with the computer is a vital part of a required introductory course in science taken by all students in the college. Two audio-tutorial instructional laboratories were set up with twenty four stations in each laboratory. These facitities serve three courses throughout the year with a total enrollment of about 300 each term. This approach to science education has resulted in increased interest on the part of the student as well as higher levels of achievement. A number of pieces of advanced research instruments has greatly increased student interest in research as well as making possible a wider range of research projects. An integrated science core course involving staff from biology, chemistry, physics and mathematics departments has been developed and is offered to all students as a general education requirement for graduation. This course offers a variety of laboratory experiences in these fields. A number of faculty were supported on leave pursuing advanced study and research work which greatly enriched their own teaching capabilities.

84 MANCHESTER COLLEGE. North Manchester, Indiana 46962. Dr. William R. Eberly, Professor of Biology and Director of Environmental Studies, (219) 982-2141.

An Environmental Studies program and a full academic major in Environmental Studies has been established. The first year six students completed this major and the second year 16 were accepted. New courses which dealt specifically with environmental issues included Natural Resources and Man, Population and Environment, Economics and Public Policy, Politics and the Environment, Demography and Social Organization, and Environmental Ethics. Students pursue special independent research projects in environmental topics. A variety of conferences and workshops have been held dealing with outdoor education in public education, pollution detecting and measurement, ethical decisions in environmental matters, and population teaching resource materials. A graduate level course in Outdoor Education methods has been developed. A number of faculty have been supported in attendance at conferences and workshops as well as in advanced study. A self-instructional laboratory has been installed in which students can pursue special topics relating to environmental and natural resource topics. The entire faculty is occasionally provided with current environmental literature and other pertinent material as a kind of "in-service training". Many courses in the curriculum have included various environmental topics in the course of study. A student directed environmental action group has been established. At least one student originated course in this area has been accepted by the faculty for credit. The environmental studies program is interdepartmental and interdivisional. It has had a considerable impact in raising the environmental consciousness of the entire campus.

85 MARQUETTE UNIVERSITY
College of Engineering
Milwaukee, Wisconsin 53233
Dr. Walter M. Hirthe, Associate Dean, (414)-224-7259

The program had as its goal the development and implementation of quality laboratory instruction in the College of Engineering. The laboratories developed are in Environmental Engineering; Structural Analysis and Design Models; Circuits; Electronics; and Measurements, Properties and Systems. The availability of these facilities resulted in the restoration of meaningful laboratory instruction to the engineering curricula. Student response to improved laboratory instruction was favorable and resulted in improved performance in the classrooms and probably a higher retention of students in engineering. These facilities have also been made available to qualified undergraduate students for a variety of independent study and research projects. In addition to the laboratories under this program, the faculty has been stimulated to design other laboratories. In order to further laboratory instruction in circuit analysis and experimental problem-solving beyond that initially proposed, a mini-computer laboratory was established. Undergraduate students were largely responsible for the development of this laboratory and it is an excellent example of the student interest and involvement generated by the program. The enhanced facilities and equipment have also permitted many mini-experiments and demonstrations as part lecture courses in addition to more formal laboratory instruction.

86 MARYVILLE COLLEGE, Maryville TN, 37801. A. Randolph Shields, Professor and Chairman, Department of Biology, 615-982-5181.

The science program at MC has been enhanced through the development of interdisciplinary courses, the provision of "hands on" teaching equipment, and transportation facilities for extended field work. COSIP was vital in this development. The program has already spawned more that $20,000 in faculty and student originated research grants in chemistry and biology. The computer facility is getting extended use in the social sciences and is providing the opportunity for all students to learn programming as an aid to their undergraduate research. Audio-tutorial facilities are encouraging the development of course enrichment programs in all of the science fields. Student phase microscopes have improved microbiology. Research phase microscopes are opening up new areas of student and faculty research. Video-taping, physiograph additions and the "environmental" room have increased teaching and research in the behavioral sciences. COSIP has been instrumental in what we believe to be a successfully integrated multidisciplinary science program, and student response is helping to confirm this.

MARY WASHINGTON COLLEGE, Fredericksburg, Virginia 22401
87 Dr. Samuel O. Bird, CoSIP Project Director - (703)-373-7250, ext. 298.

Our program envelopes all natural and social sciences and is designed to enhance the investigative approach and to promote cooperation between departments where reasonable and natural. Each department upgraded abilities for quantitative approaches to problem solving; to this end a quantitative economist and a mathematical statistician were hired, remote terminals to off-campus computers and also to a local mini-computer (Nova) were installed. The result is new courses and new approaches in all involved departments plus computer programming and statistics courses to serve as general, background courses for specialized ones at higher levels. Analytic equipment has yielded sophistocated laboratory experiments and student-faculty research through the school term and into the summer. College funded research grants to students and to faculty have been coupled with federal monies to produce investigations involving some 60 faculty and student members of the College; about one-half of these were College supported. Seventeen faculty and students studied the geology, chemistry and biology of the local Rappahannock River over the past three summers. Joining of activities was fruitful, but not so much so as anticipated. Additional interdisciplinary programs and exercises developed or in process of development include a set of courses revolving around linguistics (CoSIP faculty person), psycholinguistics, and anthropology (new position next year); an introductory--all natural science course offered by faculty from all natural sciences; a growing geology curriculum, (1 faculty position from CoSIP) which is extending and giving application to studies in the related subjects of biology and chemistry; and growing nursing, physical therapy and pre-medical programs augmented indirectly by facilities added and intensified by our N.S.F. grant. The impact of our plan on the College is major; some of the results, especially those covered in the information above, were not predicted and many other such results will tie to our efforts of the past three years and to those of the more remote past.

MIAMI UNIVERSITY Oxford, OH 45056 Dr. Charles M. Vaughn, Professor & Chairman
88 Department of Zoology (513) 529-4918 282 Upham Hall

The Department of Zoology was the principal unit chosen for improvement in faculty research and scholarly activities, purchase of scientific equipment, undergraduate research projects, renovation and a visiting scientist colloquium. Course and curricular studies were undertaken in the transition from the trimester to the quarter calendar through university action, allowing budget modifications in the four categories. The university established an electron microscope facility after its deletion from the proposal. Three faculty members had sabbatical leaves and their replacements became full members of the department after initial service as replacements. Twenty-three faculty summer research awards doubled the research potential in the three summers. Student summer research awards were related to the increased summer faculty availability and were increased from five to seven and finally ten awards. Travel funds increased faculty and student presentations at regional and national meetings. The scientific equipment purchased the first year included advanced optical equipment, electrobalances, and spectrophotometer and were utilized immediately in advanced undergraduate laboratory courses. A funding moratorium and campus unrest required an extension of the grant and the final year involved extensive equipment additions in the three major subdisciplinary areas of ecology, physiology, and developmental biology. Quantification requirements and field recording equipment was required for ethology and aquatic biology. The Visiting Scientist Colloquium brought forty-one guest speakers to the campus in the three year period. Each speaker presented an interdisciplinary seminar as well as one in his special area. The speaker was available for student discussions during the visit. Guests were invited in both science and related social science departments.. The enrichment of faculty and students by research activities, new equipment and guest lecturers has helped to double the number of departmental majors since the program began. Interdisciplinary seminars are now common in the College of Arts and Science.

89 MIDDLEBURY COLLEGE. Middlebury, Vermont 05753. Grant H. Harnest, Chairman, Natural Science Division. (802) 388-7954

Middlebury's commitment to a major five-year development program in the natural sciences was given indispensable momentum by COSIP in establishing an environment conducive to substantive faculty-student research and curriculum development. Expansion of the faculty leave program provided stimulation for a critical mass of the faculty leading to new vitality in faculty and student research. Contributing to enhancement of research ambiance and curriculum improvement was the correlative short-term off-campus program. Faculty studied recent advances, new areas or learned new techniques. A two-weeks course has enabled our electronics technician to trouble-shoot time-sharing terminals. A professional glass-blower brought to Middlebury for a series of demonstrations led one faculty member to develop a winter-term course in scientific glassblowing. The success of the visiting lecture program in science, inaugurated under COSIP, has encouraged the administration to broaden the program to include all departments in the college, as well as continuing it in the sciences with funding at about the same level. Acquisition of modern equipment permitted the launching of up-to-date undergraduate laboratory experience, particularly in spectroscopy, chromatography, microscopy, cryogenics and electronics. In the physics department advanced laboratory techniques associated with advanced subjects have been assembled in one course which is structured on an individual project basis requiring the student to conduct library research and experiment planning, as well as execution. New instrumentation has also been a critical factor in developing a milieu fostering modern competitive scientific inquiry. Research activity has taken a quantum leap in the last five years. Publications how appear at the rate of ten or more per year as contrasted with one or two a decade ago.

90 MILLSAPS COLLEGE, Jackson, Mississippi 39210, Dr. George H. Ezell, Chairman, Natural Science Division, 601-354-5201

The primary purpose of the COSIP award was to provide the catalytic agent needed to expedite the development of existing and projected programs in scientific and related areas by means of renewed faculty interest in advanced study and research, development of undergraduate capability for research and teaching, new areas of study, contact with off-campus scientists, and improved laboratory facilities. To accomplish these objectives, the following programs were instituted: on campus faculty research, off campus faculty study, student internships, limited undergraduate research projects, development of marine science and computer science projects both on and off campus, and acquisition of equipment to provide research and instructional capability for both students and faculty. The grant provided for the relocation and refurbishing of a periodical abstract room in the science hall. In addition, improved facilities for the housing of experimental animals for biology, and psychology were realized. Instructional equipment was provided for each department participating in the grant. These ranged from the multi purpose audio-visual equipment and computer hardware additions to specific items for individual student use such as micromounts, analog computer components, petrographic microscope, electrophoretic apparatus, and atomic absorption cathode tubes. Several faculty publications resulted from research supported under the grant. A secondary result of such research was the completion of the terminal degree by one faculty member. The Gulf Coast Semester and the interdisciplinary computer science programs were formalized through the pilot programs developed under the grant. As a result of the grant award, we have developed new programs which continue to enrich our curriculum. Without doubt, our undergraduate students have been, are, and will be better trained individuals as a result of this grant. The primary limitation of projected goals of the project was the proper interfacing of student and faculty personnel within the time span available.

MINOT STATE COLLEGE, Minot, North Dakota 58701. Dr. Bruce W. Farnum, Prof.
91 of Chemistry, (701) 838-6101.

Amathematical statistics laboratory was set up, the mathematics library holdings were improved, and two PhD mathematics professors were added to the staff. In biology, a PhD physiologist was added to the staff, a fully instrumented lab for animal surgery was established, equipment for ecological field studies was purchased, and three controlled environment growth chambers were added. A plant physiology lab was also equiped with instrumentation. Earth Science library holdings were improved, a fully instrumented weather station was established, and a soils laboratory was equiped. A used electron microscope was purchased and set up for use in biological courses and undergraduate and faculty research. A research model petrographic microscope was added to the earth science equipment. Chemical instrumentation was improved through the purchase of a Varian T60 nuclear magnetic resonance spectrometer, an ACTA V UV-Vis spectrophotometer, a dual column FID gas chromatograph, an atomic absorption spectrophotometer, an Electroscan 3o, and a Kevex x-ray emission spectrometer, and a lab for environmental chemistry including a high volume sampler, dissolved oxygen meter, motor driven burette, and wet test gas flow meter. An electronics technician was hired, and a shop set up for instrument maintenance and repair. A polarimeter was also added to the chemical instrumentation.

92 THE MONMOUTH COLLEGE, MONMOUTH, ILLINOIS 61462, Ron Van Ryswyk, Dean of the College
Phone (309) 457-2324

Departments of Biology, Geology and Psychology combined efforts to improve the level of science instruction. Funds were expended for equipment, student and faculty research, implementation of new course work and renovation of facilities. The Biology program stressed moving students out of the classroom and into the field, especially at the Ecological Field Station studying invertebrates, vertebrates and plants found in and near the Mississippi River. Independent study and student research on a year round basis was provided and continues. In Geology, improved student functioning was stressed in the library, in the laboratory and in the field. Students were cross registered at Knox College. Thin-sectioning equipment was purchased for rock preparation laboratory work and student participation in summer work in the big snowy mountains of Montana was completed. The Psychology Department employed summer research experiences for promising students and purchased essential laboratory equipment used predominantly by students. Research included effects of cholinergic agents on responding maintained under differential reinforcement of low rate reinforcement schedules, attitude and personality adjustment in geriatic patients, brightness averaging hypothesis in perceptual phenomena of visual masking and finally a computer program for simulating animal performance in drl reinforcement schedules.

MOREHOUSE COLLEGE-Atlanta, Georgia 30314 Dr. J. N. Gayles, Professor
93 (404) 524-7851

The CoSIP-A project at Morehouse was designed to improve the general scientific research and instruction capability of the College. The approach was an "umbrella" approach concentrating largely in the areas of chemistry, mathematics, and physics with minimal support in the biology area. Specific improvements occured in the areas of faculty support for scientific research, research in instructional methods, scientific equipment acquisition, and student support for research and instructional assistance. In each of the departments affected by the grant we have had staff increases in number and depth of educational training. In fact, the mathematics department has almost doubled in size. We have also increased and improved science course offerings, concentrating largely on more interdisciplinary programs in lower division courses and increased specialty training in the upper division. Student enrollments have doubled in chemistry and shown significant increases in other departments affected by the grant. Student participation in stimulating research is a part of the reason for enrollment increases. The CoSIP program has helped us to advertise science as an interesting and worthwhile career choice. Faculty research output in the form of scholarly publications tripled during the course of CoSIP.

MORGAN STATE COLLEGE
94 Baltimore, Maryland 21239 Phone: (301) 323-2270, Extension 399
Horace A. Judson, Associate Professor of Chemistry, Associate Dean of the College

Significant efforts in motivating students toward careers in science; in science instruction and student faculty research; in the training of student tutors and laboratory assistants; in faculty scholarly activities in curriculum revision, new course directions, establishing audio tutorial laboratories and computerized instruction; in instructing students in the use of research scientific equipment; and in creating suitable science learning environments, were made in the three year interdisciplinary projects conducted in the College Science Improvement Programs at Morgan State College. The programs were administered under the umbrella of the Interdisciplinary Center. Science education activities were programmed in the Center in support of interdisciplinary goals and in the Departments of Biology, Chemistry, Mathematics, Physics, and Psychology, in support of disciplinary goals. Since one of the main thrusts of the entire COSIP project was toward the in depth motivation of a larger number of doctoral potential students, than would have been possible without the projects, the Interdisciplinary Center impacted several career and guidance deficiencies by programming "Images of Success", "Women in Science", and a Science Careers Information Center. The Department of Biology established an audio tutorial laboratory. The Departments of Chemistry and Psychology conducted summer student research programs. The Department of Mathematics projected programs on course and curriculum development, honors, and computerized instruction. The Department of Physics trained student tutors and laboratory assistants. The grant was time restricted in its potential impact on undergraduate instruction. A five year period would have produced greater results. Evaluations conducted showed significant improvements in programs conducted, and in the "successful management of the project." "Especially noteworthy outcomes" were establishing the Interdisciplinary Center, conducting the "Images of Success" series, adoption of individualized instruction by other departments, and interest in program by other colleges. The Director was Thomas P. Fraser, former Professor of Science Education.

MOUNT HOLYOKE COLLEGE. South Hadley, Massachusetts 01075. Kathryn M. Eschenberg,
95 Professor of Biological Sciences. 413-538-2359.

The COSIP Grant supported, in part, the renovation of the East Wing of Cornelia Clapp Laboratory, which houses most of the Department of Biological Sciences. The main purposes of the renovation in relation to the teaching of biology were to: (1) modernize basic utilities, including electric power, plumbing, gas, and ventilation; (2) redesign laboratories and offices for more efficient use of space and facilities; (3) relocate equipment and supplies into more logical combinations according to the sub-disciplines of biology. Examples of the first category of improvements are as follows. Substantial increase in total electrical power supplied to the building has provided corresponding power increases in teaching and student research laboratories. This has allowed more constant use of instrumentation without circuit overloads. New, more versatile hoods have replaced old, non-functional ones, and new ventilating systems in the animal rooms have improved the conditions for animal maintenance. Redesign of some teaching laboratories has allowed students easier access to sinks, hoods, supplies, and instruments, which in some cases could not even be located in the same room previously. Redesign of other rooms has created additional space for student research in areas associated with appropriate equipment and facilities. In addition, common service rooms have been established, which house all instruments and supplies associated with specific procedures—e.g., tissue fixation, sectioning, and staining. These improvements have helped immeasurably in our efforts to support student research and to accommodate the unexpected numbers of students who are engaging in various aspects of biological study. More fundamentally, however, the improved facilities have been essential to the implementation of a major revision of our curriculum, put into effect in 1972-73. The combination of modernized facilities and curriculum should assure that we will continue to play a significant role in educating women in science.

96 NEBRASKA WESLEYAN UNIVERSITY. Lincoln, Nebraska 68504. Dr. Walter R. French, Jr. Head, Physics Department. (402) 466-2371, Ex. 235.

Coming coincident in time with the Olin Hall of Science complex, the COSIP grant made possible a quantum step in the quality of science instruction at NWU. Most significant was the acquisition of more than $125,000 worth of scientific equipment, including computer expansion, calculators and research grade instruments. These expanded facilities, along with faculty released time and student research stipends, promoted a research atmosphere, and encouraged a greater involvement in research by science students and faculty. COSIP affected the teaching style directly in science courses, indirectly in many non-science courses as the use of new techniques such as auto-tutorial instruction were implemented. Courses became more quantitative as computational skills of students and faculty increased, and as modern research instruments were involved at lower levels of instruction. Equipment for the Nuclear Laboratory opened up many interdisciplinary research opportunities in addition to basic research in nuclear physics. Equipment additions in Biology permitted work in cell Biology. Chemistry curricular changes and library additions made possible American Chemical Society accreditation. A most important aspect of the entire COSIP program was the joint planning between the various science departments which has resulted in better understanding and cooperation among science departments as well as increased interdisciplinary teaching and research.

97 NORTH CAROLINA CENTRAL UNIVERSITY, Durham, N. C. 27707, Dr. A. Soldi, Chairman, Department of Physics, Phone 919-682-2171, Ext. 217.

We revitalized our physics program by equipping approximately 1,300 m^2 of renovated lecture, office and laboratory space by increasing the library holding, redesigning the laboratories, and restructuring the courses of our physics major program by augmenting our computing capabilities, expanding the use of demonstrations, and creating possibilities for faculty research and study. The grant allowed the physics faculty to experiment with individualized materials, to set up special student projects to gain experience in numerical methods, interactive computer terminals, course designs and production of audio visual aids. From the activities under the grant we have gained the experience needed to revise the goals and content of our service courses. Toward the end of the grant we began designing teaching materials for concrete operational thinkers. We have developed five new laboratory courses and two new courses in mathematical methods. We have developed a laboratory manual and a set of notes on mathematical methods that have proved moderately useful. We have improved the quality of the experiments offered in the laboratories. The physics department has been able to acquire further grants and to plan for new programs primarily because of the resources, experience and awareness gained through the COSIP grant.

THE UNIVERSITY OF NORTH CAROLINA AT GREENSBORO, Greensboro, N.C. 27412.
98 WILLIAM K. BATES, Associate Professor of Biology, (919) 379-5290.

The COSIP program at UNC-G was a multidisciplinary effort involving the departments of Biology, Chemistry, Physics, and Psychology. The goals of the four departments were to improve undergraduate research participation; to provide momentum for newly-developing graduate programs; and to further increase faculty research capabilities. An electronics shop was established as an interdisciplinary campus resource. In the Introductory Biology Laboratory, much descriptive material has been replaced by individual student experimentation in an Audio-Tutorial format. Biology students are also offered instruction in computing in connection with liquid scintillation and other radiotracer methods. Students of organic chemistry use nuclear magnetic resonance techniques in identification of structures. This work is closely related to certain faculty research projects, and has been further aided by Undergraduate Research Participation grants. The Department of Physics has used COSIP support to establish an intermediate level course in Modern Physics which involves independent student laboratory projects, and research programs in thermoluminescence and in elementary particle physics through the analysis of bubble chamber photographs. An interdisciplinary Electronics course has been established for students and faculty members from biology, chemistry, music, physics, and psychology. Support for programs in sensory perception, animal behavior, human learning, and physiological psychology have provided a sound foundation for establishment of the Ph.D. degree in Psychology during the period of the COSIP award. As a result of the COSIP program on our campus, undergraduate science laboratories have been substantially improved and students are able to participate in some stimulating types of research projects. One direct benefit of this improvement is an increase in the number of science majors who have continued their education in graduate and professional schools.

99 UNIVERSITY OF NORTH DAKOTA Grand Forks, North Dakota 58201 Dr. Roland G. Severson, Chairman, Department of Chemistry 701-777-2741.

The purpose of this project was to develop new curricula, to design new and revise old courses, to further the training of certain staff workers and to purchase certain library materials and laboratory apparatus for the improvement of undergraduate science education in the Departments of Chemistry, Geography, Mathematics and Physics. The Department of Chemistry developed and put into operation a new four-year undergraduate curriculum for chemistry majors with considerable integration of the four main fields of Chemistry. Separate laboratory and lecture courses were designed for the entire four-year program in order to accommodate the integration and correlation of material to be taught and to allow more extensive exposure to modern instrumental techniques, new developments in chemistry and current theory. The Department of Geography developed new teaching materials for their courses in Physical Geography, Astronomy, Meteorology, Climatology and Cartography. They planned, developed and completed a photo-cartography laboratory and completed the field research station which consists of a weather station, trailer classroom and astronomy observatory. A laboratory manual for physical geography, a computer program for climatic maps, a manual for remote sensing guides and a field station brochure were developed. Two staff members from the department received off-campus graduate training. The Department of Mathematics developed undergraduate computer-related courses in Numerical Analysis and in Applied Matrix Theory along with many computer programs to be used in these courses. This effort was largely responsible for the establishment of a Computer Science Department at UND. Three staff members of the department received released time to do advanced work in Mathematics and Mathematics Education at other Universities. The Department of Physics made extensive revisions in its undergraduate physics courses and laboratories through funds for equipment and released time for staff. New experiments using modern apparatus and new lecture demonstrations have been developed. These efforts led to the revision of the year course in General Physics into a new three-semester sequence and a modern laboratory in electronics was developed.

NORTHEAST LOUISIANA UNIVERSITY, Monroe, Louisiana, 71201; Daniel E. Dupree, Dean,
100 College of Pure and Applied Sciences, 318-372-2100.

The major activities of the COSIP grant at Northeast Louisiana University can be categorized in the following basic areas of endeavor:

1) Released time for on-campus research, research materials and equipment, and undergraduate research participation.
2) Course and curriculum study and improvement.
3) Off-campus research.
4) Utilization of technicians.
5) Instructional equipment.

The following accomplishments and improvements have resulted from this grant:

1) Several junior faculty members have been able to initiate significant research programs through released time for research and with the use of research materials and equipment made available by grant and university funds. Numerous scholarly papers and talks have resulted.
2) Support of undergraduate research has created an awareness of research among the student population in the sciences, and several papers by students have been accepted for publication and presentation at professional group meetings.
3) Study of courses offered for both science and non-science majors has resulted in better interdepartmental coordination and better service to students.
4) The opportunity for senior faculty to do research off-campus with reputable persons in their academic area has enriched and widened the scope of academic backgrounds of various faculty.
5) The employment of scientific technicians has enabled the departments to more adequately maintain laboratory equipment, and has made possible extensive savings on laboratory equipment maintenance costs.
6) Purchase of instructional equipment has enhanced the quality of laboratories. In particular, it has enabled the sciences to inaugurate an audio-visual laboratory in which normal classroom and laboratory instruction is augmented and through which various programs of independent progress instruction have been initiated.

NORTHERN ARIZONA UNIVERSITY: Flagstaff, Arizona 86001; Dr. Eugene M. Hughes,
101 Vice President for University Programming; 602-523-3983

The basic objectives of COSIP were to: (1) update course content in the sciences; (2) emphasize principles in science courses; (3) encourage investigation and hypothesis formulation by students; (4) systematically sequence courses to build on earlier courses and learning by students; and (5) provide special opportunities for learning for students who are gifted and motivated. Each of these was accomplished. Curriculum restructuring and innovation, including program redesign and course content and emphasis shifts, were accomplished in biology, chemistry, geology, mathematics and physics departments. In addition, the honors program was redesigned to place emphasis upon enrichment rather than acceleration, and upon independent study and research rather than upon faculty-structured learning experiences for carefully selected students. During the final year of project funding by NSF, curriculum revisions were made in political science and in sociology. These two departments modified their introductory courses to emphasize theory and methods of investigation. Quantitative approaches by students were encouraged by establishing special sections of introductory applied statistics courses and by developing a computations laboratory for these students. An additional objective of the program was to provide opportunities for faculty development for key members. The resulting activities took the forms of leaves for study at other institutions, released time for research and study at the home institution, and for visitation at commission headquarters or at other institutions with model programs deemed worthy of direct or adapted or partial emulation. Some of the unexpected spin-off benefits which have accrued are: (1) the development of a general attitude that curriculum revision is properly an on-going activity to maintain an academically healthy environment; (2) the development of skills by faculty in the process of capital equipment acquisition and (3) the growth of a balanced outlook toward the role of research in a predominantly undergraduate institution. In addition, the demonstrated success of the program funded by NSF has been sufficiently impressive to generate additional, state funding for programs of a similar nature in the humanities.

UNIVERSITY OF NORTHERN IOWA -- Cedar Falls, Iowa 50613
102 Robert C. Goss, Professor of Biology, 319--273-2539

Objectives for COSIP at UNI included the revision and modernization of course content in required courses for majors and non-majors, development of self-teaching units, introduction of new courses with investigative emphasis, provision of greater opportunities for independent study programs and faculty-student research projects. There has been a marked change in staff attitude toward the value of research. A number of undergraduate students were co-authors of journal articles. During the period of COSIP, there was a significant increase in the number of chemistry majors and in their grade point averages. Obtaining surplus property accelerated the development of an instrument repair shop. Field studies within the Earth Science Department were accelerated by obtaining surplus tents and a jeep. Activities in solid state physics provided the stimulus to develop in the area of nuclear physics. The Earth Science Department obtained standard laboratory equipment for physical and historical courses. The Biology Department made significant changes in its basic core requirement. COSIP funds were used by students for special study tours, visits to other institutions, workshops and trips to professional meetings. Approximately 200 students were involved. On one study tour biology students collected an ectoparasite (Marsupialichus) which had not been previously recorded from North America. One faculty member received his Ph.D. through the Leave of Absence phase of the grant. The effectiveness of the program was reduced by not providing a replacement for a faculty member on released time. It was difficult to hold faculty members accountable for their curriculum and research findings. Some of the curricular revisions were not particularly innovative. Student involvement in administering the grant was neglected until the last eighteen months. A student advisory board was formed and the students took a very active part in the final phase of COSIP activities, planning and evaluations.

NORTH GEORGIA COLLEGE. Dahlonega, Georgia 30533. Charles M. Yager. Director
103 of Development. 404-864-3391. Ext. 49.

The COSIP at North Georgia College was planned to positively affect all of the academic departments of the college which NSF classifies as sciences, including the "hard" sciences, mathematics, and certain selected social sciences. Categorized activities were developed to accomplish the five stated objectives of the project. First, the faculty was to be improved through a series of activities including advanced study leading to higher degrees: individuals were encouraged to participate in research and other scholarly activities. Second, the faculty was provided the time and means to work on course and curriculum development. There were occasions when this meant visiting other institutions for observation and study, attending institutes, working in libraries, etc. Third, laboratory and instructional equipment was purchased, although only a minor part of the budget was allocated for this purpose. Fourth, undergraduate research projects were promoted. Fifth, a computer capability was developed that started with no hardware, no software, and little know-how. The present wide-spread use of the computer in several of the academic departments of the college attests the value of this part of the project. A general increase in the science enrollment occurred during and after COSIP, although not in all disciplines represented. The college became more oriented to the sciences as a result of COSIP, and there has been a greater community awareness of the sciences.

OBERLIN COLLEGE. Oberlin, Ohio 44074. David C. Montgomery, Director, Institutional
104 Research & Planning. (216) 774-1221 Ext.1217.

The grant to Oberlin College supported curricular development in the History of Science, Ethology, Bio-chemistry, Chemistry, Geology, Mathematics, and the Social Sciences; it also advanced faculty development with respect to Mathematics. The visiting professor in the History of Science carried out a program for one year which demonstrated student interest in the subject. He also accumulated a library for the History of Science which is maintained. The visiting ethologist initiated a course which, with some change, is a permanent part of the curriculum. The Ethology library collection, initiated under the grant, is growing. The co-operation between the Biology and Psychology departments during the development of the Ethology program led to the introduction of a new popular major, Psycho-biology. A laboratory was developed for the upper-level Bio-chemistry course, and biological applications of chemistry were introduced into the introductory chemistry course. Audio-visual materials were developed to aid chemistry laboratory courses. The entire Geology curriculum was revised including the initiation of independent one-month modules in the introductory sequence. The study of the Mathematics curriculum resulted in, among other things, introducing more entry points into the calculus sequence, using the Keller plan for calculus courses, and initiating courses in operations analysis. The video-tape made of a Numerical Analysis course has been used by a number of other colleges. New introductory Social Science courses were developed with an emphasis on quantitative aspects. Computer based research was made a part of many Social Science courses, and the number of data sets collected under the grant exceeds that at almost any other college. The two-year course in mathematics for faculty members increased the confidence of participating faculty in using mathematics in their courses. All objectives were essentially met.

OBERLIN COLLEGE. Oberlin, Ohio, 44074. David C. Montgomery, Director, Institutional
105 Research & Planning. (216) 774-1221 Ext. 1217.

The current grant to Oberlin College is to support the development of materials and procedures for educationally disadvantaged students in the area of mathematics. The project has three specific objectives: (a) to develop diagnostic materials for determining a student's level of competence when he comes into the program, (b) to develop materials for instruction that would maximize progress for students in their areas of deficiency, and (c) to develop psychological approaches that will reduce inhibitions and increase motivation of students who have experienced failure in mathematics prior to coming into the program.

OCCIDENTAL COLLEGE, Los Angeles, California 90041. Frank L. Lambert, Professor
106 of Chemistry. 213-255-5151.

The two major goals of the COSIP were: (1) modernization of a relatively under-used avian biology facility, to aid instruction and increased student-faculty research in avian and marine biology, and (2) development of a vigorous program of student-faculty research in Biology, Geology, Mathematics, and Physics Departments by providing summer support and some essential equipment. These improvements were accompanied by remodeling and enlargement of Geology, Mathematics, and Physics facilities at College expense. At the time of the COSIP grant three young faculty members in Biology and one in Geology were added to the faculty. They lacked adequate research facilities and initial support for their research projects. With COSIP help, each initiated a vigorous program of work involving undergraduate participation and as a result they were able to establish themselves and now have sources of support. Two have stated that they would not have remained or accepted a position at the College without this essential starter aid. The summer research program, which involved as many as 17 students aided by COSIP and 13 on other grants in the sciences, was successful in bringing complete renewal of research at the College: at the end of COSIP, three times as many undergraduates were working on research both in summer and during the academic year as before it. Introduction of an inexpensive, instructor operated color videotape system in the invertebrate zoology laboratory (and others) enabled greatly improved lab instruction, especially in multiple section laboratories.

107 OHIO NORTHERN UNIVERSITY, ADA, OHIO 45810, Dr. Francis A. Gangemi, Chairman, Department of Physics, 419-634-9921.

From March 1970 through August 1973, Ohio Northern University was assisted in its program of Science and Engineering improvement with a grant of a quarter of a million dollars from the National Science Foundation. Generally speaking, the programs to which these funds were applied fell into the following major categories: 1) Faculty improvement and strengthening through advanced studies or creative scholarship. Science and Engineering faculty were permitted leaves of absence or released time for purposes of academic strengthening through class work, research, attendance at short subject matter courses, or other creative scholarly activities. 2) Course and curriculum improvement. An attempt was made to establish programs with emphasis on student development, independent study, undergraduate research, and student-teacher development. Such programs have been established and are being utilized on a limited basis. 3) Course and curriculum improvement. Science and Engineering faculty were provided released time specifically for course and curriculum development. This required in some instances the acquisition of major items of equipment. 4) The creation and support of an audio-visual program. The intention here was the creation of a centralized audiovisual facility to house, service, acquire and dispense audiovisual teaching aids and equipment on a campus wide basis. For the most part, the various programs involving released time activities for faculty development, curriculum and course planning, and student-teacher development proceeded as planned with considerable benefit accruing both to student and teacher. The audiovisual program however, was terminated after a three year operation which was generally felt to be unsuccessful.

108 OHIO WESLEYAN UNIVERSITY. Delaware, Ohio 43015. John N. Chase, Dean of the Faculty. 614-369-4431.

The development of OWU's science capabilities was accelerated by extending the possibilities for faculty research and study, by providing opportunities for faculty-student interaction, by enhancing interdisciplinary teaching, by augmenting the academic computing facility as well as the mathematical competency of the faculty, and by aiding individual departments in fulfilling specific goals. COSIP affected the curriculum, teaching style, and commitment to research of the science departments and its faculties. Summer research afforded unique experiences for students and the opportunity to move back into research for teachers. Computer usage both in number of problems run and time utilization increased by twenty-five percent. Seven new interdisciplinary courses in the sciences were developed over the period covered by the program. Greater awareness was gained of the needs of non-science majors in basic science courses. There were major effects on the operations of the participating departments. Botany-Bacteriology gradually accepted the assets of a limited self-tutorial approach. Chemistry adopted a topic-oriented curriculum designed to increase the flexibility and independence of students. Zoology experimented with the introduction of day and night informal laboratory hours and major and non-major introductory courses. The changes in curricula and teaching methods made possible with the support of COSIP funds enabled OWU's undergraduate science program to keep abreast of the dynamic developments within the scientific disciplines themselves.

OLD DOMINION UNIVERSITY, Norfolk, Virginia, 23508
109 Melvin A. Pittman, Dean, School of Sciences (804) 489-8000, ext. 447

Curricular innovations, development of interdisciplinary environmentally oriented courses for both non-science and science majors while providing for significant efficiencies in the instructional program emerged as the main goals of the ODU program. Most significant was the inauguration of a university-wide BS degree interdisciplinary program in which the student has much freedom in course selection. An ecological project on the Northwest River involving students and faculty from three departments has lead to a highly successful student research project on undeveloped habitats near the city of Virginia Beach. Over 300 requests were received for the final report. The major intent of Biology was the development of ecologically oriented courses and projects. This was accelerated by the acquisition of a mobile field laboratory and control environmental chamber. Projects in the Dismal Swamp led to a highly successful interdisciplinary Symposium that attracted national figures. The most far-reaching impact on Chemistry stemmed from audio-visual equipment that enabled videotaped experiments that reinforced laboratory experiments. Laboratory now deals only with techniques and is reduced in time by 67%. Student-faculty research and acquisition of specialized equipment has transformed Psychology from a department limited to lectures to one characterized with vitality in which students receive a variety of educational experiences. Physics emphasized undergraduate research on the urban-coastal environment giving special attention to atmospheric problems. All departments were greatly benefited with the use of the School of Sciences Shop equipment purchased by this grant.

PORTLAND STATE UNIVERSITY, Portland, Oregon 97215. Karl Dittmer, Dean, College
110 of Science. (503)-229-3821.

The introductory courses for majors in each of the departments of Biology, Chemistry and Physics were improved. In addition, Principles of Physiology and Advanced Inorganic Chemistry were upgraded. Audiotutorial instruction in General Biology laboratory for non-Science majors served as a model for other departments for possible adoption. The Principles of Biology course was re-designed with special emphasis on current concepts using modern equipment in new laboratory experiments. Contributing were many films to supplement lectures, film loops, zoological model series, blenders, balances, microscopes, pH meters, spectrophotometers, centrifuges, growth chambers, a Warburg apparatus, oxygen electrodes, and a gas-liquid chromatograph. More quantitative aspects were incorporated in the introductory course for Chemistry and other Science majors. New laboratory experiments were designed using modern equipment, such as single pan analytical balances, pH meters, spectronic-20 spectrophotometers. Students and faculty are enthusiastic about the new experimental approach and the faculty actively continues developing more experiments. Modern equipment has radically changed the advanced Inorganic Chemistry laboratory, making it exciting and rewarding to students. The adoption of the audiotutorial method of laboratory instruction in General Biology was well received by the faculty and many students. Some students would like more personal instruction, but all like the open laboratory schedule. The Vocabulary for Scientists course is now taught by the audiotutorial method. The student-tutorial, or self-paced instructional method, often referred to as the Keller method, was adapted for the introductory Physics course. Students like the open, self-pacing, laboratory schedule, but too many have not yet learned to pace themselves, resulting in too many not completing the course during the term. No significant improvement in learning and understanding was observed among students taking the course under the Keller plan in place of the traditional course. The Biology, Chemistry and General Biology improvements were made primarily by acquiring the much-needed equipment and supplies, whereas the Physics program required large amounts of faculty time.

111 PROVIDENCE COLLEGE, Providence, Rhode Island 02918, Dr. Theodore T. Galkowski, Coordinator of Grants, (401) 865-2173.

Our CoSIP project has effected significant improvements in the Departments of Economics, Mathematics, Political Science, Psychology, and Sociology. Interdisciplinary courses in Soviet Studies and Urban Research Methodology were conceived, tested, and are being implemented. Undergraduate research participation has been introduced in political science and sociology. Modern computational tools have been made available in a new Statistics Laboratory equipped with programmable calculators and computer terminals. The spectrum of faculty specialties has been broadened in economics by the addition of an econometrician and in mathematics by the addition of faculty in statistics and applied mathematics. The Sociology Department has acquired specialists in methodology, political sociology, and social stratification. Faculty research has been intensified in economics, political science, and sociology. Lecturer series were initiated in economics and political science. The Psychology Department has experimented with a team-taught course entitled "Perspectives on Control of Human Behavior." The hub of this course were lectures by nine eminent scholars in psychology and related fields. Faculty improvement has been achieved in economics, political science, and psychology. Political science majors are participating in an interinstitutional program of non-Western area studies at Brown University. The Psychology Department has attracted a capable animal behavior specialist who has developed a well-equipped and efficiently run laboratory. The experimental capabilities of sensory, physiological, child, and social psychology have been enhanced by equipment acquisitions. Barriers to cross-discipline cooperation and course development have crumbled as a result of the experience gained in developing interdisciplinary courses in Soviet Studies and Urban Research Methodology.

112 UNIVERSITY OF REDLANDS, Redlands, California 92373. Dr. Lowell Kent Smith, Asst. Professor of Biology; (714) 793-2121.

Redlands reorganized and updated its science courses, created new programs, revised its teaching methods, and enhanced student participation in research. The Division of Natural Sciences did long range planning, expanded its science for non-scientist courses, integrated two computer systems into its curricula, created a research program with a medical center, began regional conferences on science and human affairs, expanded its January Interim science projects, helped start Education Fairs, and began summer institutes for high school students. The Physics Department revised its courses, prepared new lecture-demonstration materials, hired a full-time technician, increased student research and instituted a "3+1" program-- culminating in a Physics Senior Institute-- and expanded its joint-major and interdisciplinary offerings. Biology introduced "mini" courses and investigative labs for freshmen, a cooperative education program, senior research courses, teaching via television and audiotutorial methods, and a stronger summer research program for students. Engineering began a new major in Computer Science, wrote new labs in most courses, began a cooperative education program, expanded its summer student research, and enhanced its Engineering Senior Projects (building a 2-man submarine, a 20 foot rocket, and a 2-man surface effect vehicle). Chemistry expanded its summer student research, completely revised its curriculum, integrated a number of sophisticated analytical instruments into its courses, initiated textbook writing and updated all its curricular materials. Mathematics aided two faculty members to complete doctorates, improved mathematics backgrounds of the faculty, initiated new courses in numerical methods, and improved teaching methods. Geology revised its courses, introduced new courses in geophysics, and added important major equipment and study collections for study and research. Spurred by the Division, the University completely renovated the biology--physics building, created an Interdisciplinary Division; began faculty grants for research and found funding for a ten year program in instructional improvement.

113 REED COLLEGE, Portland, Oregon, 97202. Prof. Marshall W. Cronyn, 503-771-1112.

COSIP at Reed College was designed to promote and support curricular change and innovation in the natural and social sciences. A statistical summary of the impact of the COSIP program may provide some measure of progress made toward the program's objectives: seven semesters of faculty released time for course and curriculum improvement in the fields of Biology, Psychology, Sociology, Economics and Physics; 50 grants to 44 faculty members assisted by 35 students for summer projects in course improvement and research; 26 grants to 17 faculty members for travel to special research facilities or participation in symposia and 49 visiting lecturers brought to the campus by the Biology Department's Visiting Lecture Program. Special equipment has been purchased and is in use by the Computer Center, the Psychology Department and the first-year course in Biology and Physics, the second-year Physics course and the Natural Science Course for non-science majors. Overall, forty of the forty-nine faculty members eligible for COSIP support in the Natural and Social Sciences have benefited from the program. In the three years of the program 30 courses enrolling 2400 student/semester units out of a total of 3700 student/semester units of instruction in these departments have been improved or replaced with completely new patterns of instruction. From a total of 9800 student/semester units of instruction in the entire college, 25% overall and 65% of the Mathematics and Science instruction have benefited from the COSIP grant. The Natural and Social Science faculty designated as the most beneficial aspect of the entire COSIP program, the support of student assistants who worked with faculty in summers on projects for course improvement through the preparation of new materials and laboratory experiments.

RIPON COLLEGE, Ripon, Wisconsin, 54971
114 David W. Carley, Chairman, Department of Chemistry (414) 748-8123

Major efforts of project were to develop capabilities in natural science research for students and faculty. A large undergraduate research program, development of visual aids, increased faculty research, improvement in laboratory content, and development of a college-wide computer program, must be considered as the major thrusts of the COSIP program. A significant failure in the program was an attempt to organize a Ripon College Research Center. Although the idea was considered sound, and sincere attempts were made to develop the center, inadequate cooperation and support from outside the college had a negative effect. The greatest impact on college development resulted from PDP-8 computer facilities acquired under the COSIP grant. Rapport and communication were improved throughout the college. Widespread use of the computer by nearly all departments enlisted the attention of even those most apathetic toward a college-wide computer expansion. Summer and academic year research increased markedly, and has subsequently maintained a high level. A rather complete audio-visual laboratory now serves science and non science majors. A new course in glass blowing exists, and much needed improvements in laboratory instruction were instituted through acquisition of NMR,AA, and other instrumentation. Development of new laboratory procedures and content for freshman and kinetics courses was direct result of COSIP. Audio-visual materials continue to be produced.

115 ROLLINS COLLEGE, Winter Park, Florida 32789
Dr. John S. Ross, Professor of Physics (305)646-2000, x2414

Our program was designed to provide faculty released-time for research and curriculum development during the academic year, and support for summer faculty research projects involving undergraduate students, for members of the departments of behavioral science, biology, chemistry, mathematics and physics. The released-time program was implemented by adding a faculty member to each department. Curriculum projects included the establishment of a human development laboratory, preparation of self-paced courses in calculus, chemistry and physics, and the design of a core curriculum for environmental studies. A proposal to the administration resulted in the acquisition of a PDP 11/40 time sharing system. Faculty research activities involved individual specialities or departmental projects on the "Behavioral Problems of Increasing Population Density" with an instrumentated colony of rats, or a continual investigation of the "Changing Ecology of an Urban Lake Chain Ecosystem." Successful features included weekly seminars interrelating all activities, promotion of interdisciplinary interaction, and the development of a more positive attitude by students toward research. Visiting consultants provided assistance and motivation to all members of the College in educational uses of the computer, learning and innovative teaching and lake modeling. COSIP helped in recruitment of students, increasing the number of science majors, expanded course offerings, utilization of a new science facility and the prestige assisted the College in its efforts to raise funds.

116 ROOSEVELT UNIVERSITY, 430 S. Michigan Avenue., Chicago, Illinois 60605. Rolf Weil, President (312) 341-3800.

The COSIP program included Anthropology, Biology, Chemistry, Geography, Mathematics, Physical Science, Physics, Political Science, African-American Studies. It has given impetus to curriculum improvement in all participating departments and cut short by years the time needed to bring offerings up to the present level. Acquisition of surplus government property was invaluable. Impact on students was significant. The Anthropology program has undergone complete revision. A full time appointment in Biological Anthropology was made and a course of study in this specialty instituted. Biology COSIP funds enabled the purchase of equipment for instituting three new courses. COSIP funds for Chemistry facilities and for visiting instructors led to course revision and equipment improvement and approval of the department by the Committee on Professional Training of the Am. Chem. Soc. As a result, enrollment in Chemistry has increased. The Geography equipment was installed and the laboratory was used for two new courses. As a result, enrollment has increased over 20% in two years. The success of the Mathematics tutorial program in motivating students led to continued support by the University for this program. Wide use has been made of the new equipment in updating courses in Physical Science. The experimental procedure at the General Physics level has been revised to increase pedagogical effectiveness. Over thirty new experiments have been devised, giving the student competence in experimental techniques. Political Science. The funds used in developing a course in Political Psychology resulted in excellent enrollment for two years. The library resources acquired are used by the entire department. African-American Studies. The focus of this program as: a) Southern Africa, and b) the South Atlantic. Research developed two new courses. A residential institute for approximately 40 high school and mostly college teachers entitled The Afro-American Experience was conducted.

ROSE-HULMAN INSTITUTE OF TECHNOLOGY. Terre Haute, Indiana 47803.
117 Dr. Charles C. Rogers, Prof. of Electrical Engineering.
812+877-1511 Ext. 226.

Primary COSIP effort was directed towards the acquisition and implementation of a DEC PDP-11/40 Timesharing Computer System and development of undergraduate course material in engineering, physics and chemistry, for use on the system. Material developed includes a computer emulator providing the user with communication in assembly language, MACRO-11, programs calculating electric and magnetic fields, Bode, Nyquist, and Routh-Hurwitz investigations in control systems, simulated chemistry experiments in order determination of rate constants and spectrophotometric simulation. Two Computek graphic display terminals are operational as well as Decwriters, ASR-33 Teletypes, and Ann Arbor terminals. Sony videocassette recorder-players were acquired and have been used for videotaping laboratory experiments in chemical engineering, digital electronics and theoretical mechanics, as well as presenting educational material available from the Hewlett-Packard Co. on Sony cassettes. The system has also proven valuable for convenient self-critique of instruction by videotaping classroom presentation. Departmental improvement projects were conducted in the study of environmental noise and noise pollutants, analog-digital and digital-analog conversion experiments, implementation of an undergraduate radioactive x-ray fluorescence system, and the expansion of the versatility of the Ruoff (Cornell University) course materials for Materials Science. A self-study laboratory in Mechanical Engineering was developed, however, its success has not met the original goals.

ROSEMONT COLLEGE, Rosemont, Pennsylvania 19010 Sister Mary Leo Bryan,
118 Professor of Chemistry, 215-527-0200

Curricular development, improved facilities, and expanded undergraduate research opportunities for three departments (biology, chemistry, mathematics) were achieved during the period 1968-71. In biology particular attention was paid to reorganization of freshman level courses in order to provide a stronger foundation for later major courses stressing molecular biology. The particular accomplishment of the Chemistry department was a total revision of the major course program featuring a 4-year integrated laboratory sequence with lecture courses based on broad concept areas rather than the traditional divisions of inorganic, organic, analytical and physical chemistry. Improved instruction in mathematics was achieved especially at the advanced level by providing opportunities for electives and research hitherto unavailable to the majors. Both the biology and chemistry departments benefited from the development of a mathematics course designed for science majors highlighting the applications of calculus, algebra, group theory, etc. to scientific problems. Laboratory facilities were improved and extended by relocating the laboratories for general physics and radioisotope counting, centralizing the location of major instruments and furnishing new laboratories for both physiology and chemical research. Still further benefits accrued from faculty visits to study experimental biology programs in other colleges and inviting consultants in chemistry at various stages of the curriculum revision. The three years of program building under the grant was a constant stimulus to the faculty to examine and improve the scope and methods of their instruction, and in the ensuing three years this attitude has not been lost. Student interest in research oriented projects requiring sustained and independent effort has been heightened and maintained by the improved surroundings and equipment which facilitate more professional methods of investigation.

119 ST. ANDREWS PRESBYTERIAN COLLEGE, Laurinburg, North Carolina 28352
G. Tyler Miller, Jr., Professor of Chemistry, (919).276-3652, Ext. 368

Two COSIP grants were used to develop an innovative and nationally recognized science program and a new approach to science building design. The new curriculum includes (1) an interdisciplinary science course for all freshmen, team-taught by the entire science faculty, and consisting of four minicourses per year in which key concepts are developed and related across disciplinary lines; (2) a new chemistry curriculum based on three basic courses, Bonding and Structure, Thermodynamics and Kinetics, and Chemical Reactions, taught at successively higher levels in spiral fashion; (3) a flexible contract major program in biology; (4) a project-oriented laboratory with traditional experiments being replaced by 2 to 4 open-ended projects per year; (5) production of cassette film loop and videotapes for most laboratory techniques and instruments; and (6) summer research and curriculum development programs. Curriculum implementation was greatly aided by a scientists-in-residence program in which 20 nationally recognized scientists served as teachers and in-depth consultants for two weeks periods. This transferable approach to initiating a new curriculum or revitalizing an existing one costs no more than the salary for one full professor. A new approach to science building design includes (1) a large, open multidisciplinary laboratory; (2) mobile, quick-disconnect multidisciplinary furniture; (3) a centralized logistics center with a self-service wall; and (4) a multidisciplinary instrumentation center and other support spaces containing over $500,000 of equipment. The building can be easily altered to meet changes in science education and the needs of individual students and professors. Since its opening in 1970, it has been visited by over 800 architects, scientists and administrators throughout the United States and the world and its features are now being used in a number of new science buildings.

120 SAINT JOSEPH'S COLLEGE, Philadelphia, Penna. 19131 Rev. John S. O'Conor, S.J., Professor of Physics 215 879-1000

The COSIP program has added a new dimension in depth to the science departments of Saint Joseph's College. The objectives have been: curriculum revision and updating; keeping our faculty abreast of new developments in the field; correlating lecture and laboratory into an integrated and properly phased sequence; establishment and development of closed circuit T.V. to improve and evaluate laboratory instruction in biology. Our lecture forums presenting such distinguished personalities as Drs. Teller, Wheeler, Pomerantz, Weber, and Hooke have increased the awareness of the Delaware Valley concerning our place in the scientific Academe. In the Physics Department, our objectives of integrating and coordinating lectures with laboratories have been accomplished, aided by a new 4.5 million dollar Science Center in which the same area may be used for both activities. The further objective of increasing and improving student-faculty research activities has advanced substantially - 22 projects in 3 years. Curriculum revision has resulted in greater flexibility, increased number of options, and encouraged self-study programs in all departments. Excess government property, predominantly electronic equipment, has been obtained through the grant in excess of $100,000 acquisition cost. The cameras and monitors of the closed T.V. installation are operated by teaching assistants in the Biology Department. This facility has been used with high success in courses of General Biology, Chordate Morphogenesis, Biological Techniques, Vertebrate and Cell Physiology, Neurophysiology, Genetics, and Marine Biology; the reception by students has been enthusiastic. Our new Science Center is wired throughout for T.V. use and when funds become available it will be extended to other departments. While the work initiated with COSIP is an ongoing process, we feel that it is clear that the achievements and prestige of the Physics, Chemistry, and Biology Departments have been substantially enhanced by the COSIP program.

ST. LAWRENCE UNIVERSITY. Canton, New York 13617. D.K. Baker, Vice President and
121 Dean of the College of Arts and Sciences. 315-379-5993.

A program to improve, renew and develop the undergraduate science program at St. Lawrence University 1970 thru 1973. The objectives of the program; Physics - a coordinated four-year approach to undergraduate Physics; Chemistry - a Junior and Senior laboratory for upperclass chemistry, and an introduction to modern science for non-scientists; Biology - an audio-tutorial Introductory Biology course for a liberal arts college; Mathematics - a flexible approach for entry into College Calculus; Geology - an open environment in undergraduate science; faculty released time and faculty summer curriculum and development grants provided the means for the development and refinement of curricular and course materials. The curricular and course materials. The curricular results range from the highly structured approach to Biology to the completely unstructured in Geology. All however have placed more emphasis on the student's responsibility for his own learning and for his rate of progress. Faculty research time under the grant was particularly useful in Geology where student majors were intensively involved in field research in a number of off-campus locations. The Geology department concluded its phase of the work with an evaluation conference and a planning retreat. A portion of the grant was used to introduce computers to a liberal arts campus where no hardware or competence was to be found. The result is a time-sharing mini computer and a present interest and demand to expand the system annually. New curricular formats, new teaching methods and one open-learning department resulted from the COSIP funding. The program provided a strong influence for renewal in the undergraduate science curriculum.

SAINT MARY'S COLLEGE, Winona, MN 55987 Brother George Pahl, President
122 (507) 452-4430

COSIP (7/1/68-6/30/71) enabled the departments of biology, chemistry, psychology, and physics to improve laboratory courses through equipment purchases, complete library holdings, develop and diversify faculty, improve teaching techniques, and increase undergraduate majors. Biology acquired auto-tutorial equipment and measurement instruments that enhanced the investigative nature of course presentation. Beginning COSIP from a position of relative strength, the number of majors increased. A visiting professors program began and expanded into several sophisticated and stimulating symposia. Independent study projects increased as a result of increased library holdings, equipment purchases, and increased faculty diversity and time. Telemetry and environmental monitoring equipment and physiological instrumentation made possible new programs in environmental education and allied health fields. The department is now in a position to launch strong programs in both areas. Chemistry developed a superior laboratory course. Research programs were enriched by greatly expanded library holdings, especially completion of CHEMICAL ABSTRACTS. Psychology majors increased from 27 ('68) to 99 ('73), 50% of whom attend graduate or professional schools. The department offers laboratory courses in experimental and comparative physiological psychology and independent research projects. Faculty increased from 2 to 8, 5 of whom have the Ph.D. The small department grew from a theoretical major to a theoretical-experimental-applied major, and the third largest department in the college. Physics improved the introductory laboratory and lectures, introduced a multi-discipline approach to advanced laboratories, especially in the areas of radiation biology and physical chemistry, and initiated an astronomy program for science and non-science majors. Purchase of new laboratory and demonstration equipment upgraded instruction. A strong base now exists for incorporating on-line computer techniques for acquisition and analysis of data in lab and research projects.

SAINT OLAF COLLEGE
123 Northfield, Minnesota 55057
Dr. Howard I. Thorsheim, Assistant Professor of Psychology, (507) 645-9311

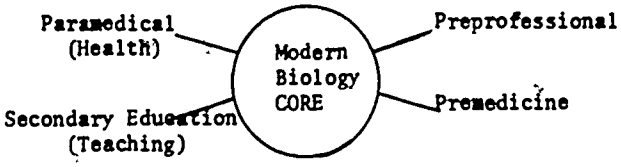
Major efforts and activities carried out under the COSIP grant were a remodeled building for Behavioral Sciences, purchase of modern equipment, stimulation of student and faculty research, and expanded curriculum. COSIP funding coincided with a distinct change in student orientation--toward overt experience, engagement, and activism. With that orientation, the goals of basic research appeared to students to be conflicting, or at least incongruous. However, with COSIP funding, Behavioral Sciences became engaged in launching a major overhaul in curriculum, spurred by faculty who had been on released time and summer-stipend projects which placed heavier emphasis on principles, methods, and methodology, with the objective being to make beginning courses more interesting and attractive. A major shift from the "lectures-questions" format was made, and was replaced by gaming and simulation, discussion groups, study-research teams, and contract evaluations. Behavioral Sciences have had growth both in enrollments and majors. In addition, the size of the Behavioral Science faculty has increased, and departmental budgets have increased by more than one third on the average. Behavioral Science is now viewed as a set of rigorous disciplines on this campus, distinct from the Humanities. Limitations in the implementation of the grant's objectives were two: (a) High staff turnover in relatively small departments due partially to COSIP accelerated leaves reduced the continuity of planning that could have occurred, particularly multidisciplinary planning; (b) The necessary coordination of projects and account-keeping required extra time beyond that anticipated when the grant was developed. In conclusion, it appears that the COSIP support helped shore up professional commitment which otherwise would have been in serious jeopardy, and provided a remarkably flexible means for accomplishing what St. Olaf College sought and desperately needed, far beyond what was envisioned when the grant was proposed.

SAINT PETER'S COLLEGE, Jersey City, N. J. 07306 George J. Hilsdorf, S.J.
124 Chairman, Chemistry Department (201) 333-4400

The Departments of Biology, Chemistry, Mathematics, Physics, and Psychology, along with the Library, participated in Grant GY-4699. First among the effects of COSIP is the fact that the sciences are now housed in totally new or totally renovated quarters and foresee no need for expansion. COSIP did not pay for this but it was crucial to the decision to invest over a million dollars to renovate the biology and chemistry building. COSIP equipment enabled the Psychology Department to become experimental; vastly improved the Biology Department's offering in Physiology; enabled the Chemistry Department to lay the foundation for what is now an excellent instrument laboratory; and completely changed the general physics laboratory. Because of this foundation subsequent grants were enjoyed. Psychology became a full major program, doubling its staff, revising its curriculum, and obtaining office and laboratory space. Biology and Chemistry obtained, and have kept, full-time technicians for their supply rooms and laboratories. The initiation of faculty leaves during COSIP has continued in all the departments through use of the college's Faculty Fellowships. Faculty research, stimulated by the leaves and summer grants, has continued. The program guided by the science consultant supported by COSIP enabled the Chemistry Department to obtain a two-year grant from the state of New Jersey for its continuance. While numbers of majors in the sciences has dropped recently, the enthusiasm for student research has not. Now, however, thare are no funds to help those who must work while at school. COSIP enabled our present Director of Data Processing to change the direction of his graduate studies and he has finished his work for the doctorate in that science. The computer sciences have grown under his direction and serve all departments. The Seminar in Applied Sciences is now a permanent part of the mathematics curriculum. In summary, COSIP stimulated and enriched each department participating.

SAVANNAH STATE COLLEGE, Savannah, Georgia, 31404. Margaret C. Robinson, Professor
125 Head, Department of Biology, Chairman, Division of Natural Sciences, 912-354-5717.

A five course sequence in Modern Biology, namely, Principles of Biology, Molecular & Cellular Biology, Organismal Biology, Biological Organization and Control, and Environmental Biology serves as the CORE of the biology curriculum around which four broad career options revolve and flexibility is assured for the biology major. The broad options provide career selections under preprofessional, premedicine, paramedical, or the teaching of biology in secondary schools. Fundamental to this "wagon wheel" curriculum plan, additional faculty were employed and other faculty motivated to seek refresher training. Curriculum revisions and expansion included the organization of selected old courses and additional new courses into five groups of major elective options. The grouping of elective options permits the student to acquire a minimum of twenty-five quarter hours in courses specific for or closely related to his career choice including research experiences. Basic equipment to support the curricular activities are distributed throughout seven "subject-matter" laboratories of a new air conditioned lecture, office, research facility. The major achievements of this project include greater interest and confidence among students to enter the medical profession and graduate schools; institutional recruiters have shown greater interest in and acceptance of our students; copies of our curriculum have been requested and circulated to other institutions; interdisciplinary paramedical options developed; finally, the improvement in faculty has generated interest in seeking innovative ways of serving our students as well as seeking resources for sophistication of student research participation.



SIMPSON COLLEGE, Indianola, Iowa 50125
126 William E. Updegraff, Head, Physics Department and Director of Computer Center
(515) 961-6251 Ext. 695 and 636

The project was designed to develop an awareness of the kinds of calculations, simulations and educational activities made possible by computers; to develop programming skills; and to actually implement many of these ideas by writing, debugging, and testing programs. Major thrusts were to add a staff consultant experienced in instructional uses of computers, to purchase or lease computer hardware, to provide travel to nearby institutions, to hire student programmers to provide faculty support, and to give released time to three faculty members during January terms to allow for time for computer-based curriculum development. A consultant was hired to direct the promotion of computer usage and teach programming languages. In the middle of the project, the consultant was replaced with a part-time faculty member who was able to provide excellent follow up support. Initial hardware consisting of 2-teletypes connected to a distant computer proved unsatisfactory. Consequently, a Hewlett-Packard 2000E computer system with 6 teletypes was leased for the program. After early bugs were remedied, this system proved to be an excellent, versatile, and easily-used academic computing facility. A computer science curriculum of five courses was developed and implemented. Approximately half of the student body and faculty were given hands-on computer exposure with results in the physical sciences and sociology being most dramatic. A few departments did not use the facilities to the extent that was expected, but it is hoped to remedy that situation in the near future. The lease of the equipment has been continued by the college to the present date and will be continued until purchase is completed. Generally speaking, the project more than achieved its goals.

127 SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY. Rapid City, South Dakota 57701. Lester W. Snyder, Associate Professor of Mechanical Engineering, 605-394-2404.

The general intention of this project was to alleviate apparent weaknesses and to enhance the obvious strengths of the science and engineering programs, focusing on five specific areas. Upgrading interdisciplinary courses consisted of: Development of an engineering oriented laboratory course in General Chemistry, which resulted in a 50 per cent reduction of faculty and freshman-student time; Revision and improvement of Introductory Physics, which resulted in reduction in time spent on traditional experiments, increased student interest, and a one-semester course; and Upgrading basic courses in Engineering Mechanics, which resulted in slight improvement in effectiveness of presentation. Development of teaching and research capability of the Department of Biology resulted in a department of considerable stature with expanded faculty (250 per cent) and expanded and modernized facilities. Alleviation of academic isolation of faculty consisted of financial assistance for: summer sessions, transportation to conferences and courses, and visits to campus of recognized specialists in science and engineering; all of which resulted in an intellectual interchange which was a tremendous boost to educational activity but did not generate other resources. Establishment of an audio-visual facility resulted in the establishment of a department of five people and considerable equipment which coordinates all instructional material and equipment and produces and reproduces specialized instructional material. Increasing undergraduate involvement in research did not generate other resources but resulted in extending research at the undergraduate level to a valuable part of the curriculum.

128 SOUTH DAKOTA, UNIVERSITY OF; Vermillion, South Dakota 57069. Wayne W. Gutzman, Chairman, Department of Mathematics, (605)677-5217.

A COSIP funded project enabled the University of South Dakota at Vermillion to establish an undergraduate computer science degree program and to ultimately expand educational and research activities to other undergraduate fields of study both on the USD campus and to remote state college campuses throughout the state. COSIP release time support for faculty members and advanced study funding for faculty coupled with the procurement of competent visiting educators and computer consultants provided great impetus to a developing computer educational program at USD. Formal education could thus supplement self education. COSIP funding also allowed for the timely purchase of selected peripheral devices such as a printer and plotter. These acquisitions improved previously limited student accessibility. Awareness of the value of this dynamic program has not been limited to students on campus and involved faculty members. The South Dakota Board of Regents has now established a State Wide Higher Education Computing Network on the USD campus. Currently the University at Vermillion and three state colleges are members of this network with other state institutions slated to join. COSIP provided timely funding and educational support capability which then enabled the University to successfully demonstrate the need and usefulness of educational and research computing in South Dakota.

SOUTHEASTERN MASSACHUSETTS UNIVERSITY, North Dartmouth, Massachusetts, 02747
129 Dr. Joseph P. Sauro, Dean, College of Arts and Sciences, (617) 997-9321, Ext. 312

The major aim of this COSIP Project can best be viewed in terms of the developing nature of this Institution. SMU was created by uniting two predominantly textile colleges (New Bedford Institute of Technology and Bradford Durfee College of Technology) and incorporating these as the core of a new University. SMU found itself in a period of rapid expansion both as to new programs and as to the number of students enrolled. In this situation, it was critical that funds be available to: give released time to faculty for review and improvement of curricula offerings; give released time to faculty members principally from the predecessor institutions for the purposes of faculty improvement; involve students in the design and the development of laboratory facilities; initiate on-campus research involving undergraduate students.

The main success has been in the area of curriculum development. By involving students in the planning and testing of new laboratories, the Biology Department now has a strong program which is highly laboratory supported, including a mobile field laboratory. The Chemistry Department's efforts in curriculum development led to initiating a four-year combined B.S./M.S. program. The COSIP Grant enabled SMU to involve undergraduate students in research projects which, although very demanding on the faculty members' time, proved of significant value and is being continued within our budgetary constraints. Our efforts for faculty improvement would have been more fruitful had concerned faculty been utilized more in the planning stages of this portion of the Grant. Overall, the support of COSIP funds enabled SMU's undergraduate science program to make significant strides in the respective scientific disciplines.

SOUTHWESTERN AT MEMPHIS, Memphis, Tennessee 38112, Robert L. Amy, Professor of
130 Biology, 901-274-1800

Our program involved the utilization of funds to support a variety of teaching and research activities in six of our academic departments. The Biology Department initiated an annual field studies program in which students and faculty participated in an extended trip to a wide variety of habitats far removed from our geographic area. The program has been continued and expanded with college funds and has become the central activity around which we have built a very successful ecology program. The Chemistry Department supported summer research for students and faculty and brought in a number of consultants to evaluate their overall program. Such activities have been instrumental in enhancing and up-dating their research and teaching capabilities. The Physics Department was able to establish strong ties with the High Altitude Observatory in Boulder by initiating research programs with them involving both students and faculty. Working relationships between the two institutions continue with increasing mutual benefit. The Psychology Department has obtained basic equipment for demonstrating various behavioral phenomena in their general course, in upper-level laboratory courses and for use in individual student research projects. The Department of Anthropology and Sociology purchased the initial ten-years of the microcard edition of the Human Relations Area Files and have added annual sets using college funds. The complete set is available to all of our students and has been widely used by them in preparing research papers some of which have been presented at professional society meetings. The Mathematics Department has found that the most beneficial effect was derived from the funding of released time for their faculty. During the grant period they started research projects which still continue and planned new course offerings which are now part of the curriculum. In summary, the entire campus has benefited by the stimulus provided by the various phases of the program just described, not only in the departments directly concerned but in related areas as well. In our experience, few federal programs have had greater catalyzing effects in up-grading our educational efforts.

SOUTHWEST TEXAS STATE UNIVERSITY, San Marcos, Texas 78666
131 W. E. Norris, Jr., Dean, College of Arts and Sciences (512) 245-2172

During the three-year period September 1, 1970 through August 31, 1973 Southwest Texas State University utilized a COSIP grant which was multifaceted in its approach to strengthening undergraduate education in the Sciences. Following a detailed study of the mathematics curriculum a number of changes were accomplished. Considerable time was devoted to improvement of elementary laboratory instruction in Biology, Chemistry and Physics; in several cases new laboratory manuals resulted. The use of closed circuit television (operated by the School of Science) in the standardization and improvement of elementary laboratories was extensively explored. The conclusion was reached that such an operation at the "School" level was not practical financially which led to transferring this activity to the university-wide system. Selected undergraduate students (excluding freshmen) were afforded the opportunity to participate in a number of projects. Twenty-six participated in research projects in Biology, Chemistry, and Physics. The Biology Department employed and trained 128 sophomore and junior students as assistants to graduate laboratory instructors. Twenty-two advanced undergraduate students were trained by the Mathematics Department as lecture assistants. Released time was afforded a mathematics professor to work with graduate teaching assistants. With regard to physical facilities and equipment: one chemistry laboratory was renovated, a separate building containing two laboratories, a small animal room, and an instructors' office has been completed and furnished; three twelve-passenger vans have been purchased for field trips. Library funds were made available which allowed an accelerated acquisition rate of both books and periodicals for the Sciences. The atmosphere of faculty productive scholarship was greatly enhanced in the School of Science by the granting of five one-semester research leaves, twenty-two reduced teaching loads (one semester each) and five summer leaves for study. A full-time purchaser was provided for the School of Science which was very helpful in freeing departmental chairmen of this routine, thus permitting them more time for academic pursuits.

132 SPRING HILL COLLEGE, MOBILE, Al 36608. Magda B. Arnold, Chairman, Division of Social Sciences, 205-460-2361.

The Division of Social Sciences was upgraded by making each of four participating departments (Economics, Political Science, Psychology and Sociology) fully autonomous, and providing one additional faculty member for each. As a new approach, a Decision Seminar was instituted in which Juniors and Seniors acquire techniques of discussing and investigating current social problems and decide on a feasible course of action. A motivation test (Arnold's Story Sequence Analysis of the Thematic Apperception Test) is given to all students at the beginning of freshman year and at the end of the grant period. In the follow-up interview with social science students, they gain insight into attitudes that hamper their achievement. If their motivation index improves during the grant period, compared to that of non-social-science students, it can be assumed that the new program played a role in their increased motivation; results will be known by the end of 1974/5. The increase in faculty has resulted in better rounded departments, better instruction and a new professionalism in the division. Faculty members have been able to attend professional meetings and have given several papers there. Student assistants, provided by the grant, have gained valuable experience and are of considerable assistance to the faculty. The addition of laboratory apparatus has made it possible to provide laboratory experience in comparative as well as in general psychology.

STEPHEN F. AUSTIN STATE UNIVERSITY. Nacogdoches, Texas 75961. Dr. W. I. Layton,
133 Head of Department of Mathematics. 713/569-3005.

COSIP grant provided for the improvement of the undergraduate science capability of the departments of biology, chemistry, mathematics, and physics. All of these departments received support for released time for faculty research. This released time was provided to improve the undergraduate research programs of the departments. The physics and chemistry departments received support for consultants for each of the three years to assist in curriculum evaluation. The mathematics department received support for an additional Ph.D. each year for three years. Faculty holding the Ph.D. were procured in several areas of specialization in the mathematics department. The University took on the permanent funding of the COSIP Ph.D.'s and in addition also added three new Ph.D.'s from its appropriation during the term of the grant. The biology department's participation in the grant dealt primarily with training undergraduate students in the concepts of research by allowing the student to become involved with a problem of his own choice under the direction of a graduate faculty member and to make available two special courses to expand the microbiology program. The physics department received funding for training a staff member in handling radioactive materials. This resulted in significant improvement of the laboratory instruction in nuclear physics. Approximately forty-six percent of the direct costs involved in this proposal were used for the purchase of equipment. Equipment was a prime need of all of these departments because of the rapid growth of the University. Curricula in all four departments were materially strengthened. Through the support provided in this grant the departments of biology, chemistry, mathematics, and physics have made progress which would otherwise have taken ten or more years. All four departments took full advantage of available excess property. The physics department in particular obtained fantastic quantities of equipment.

STETSON UNIVERSITY
134 DeLand, Florida 32720
George L. Jenkins, Chairman, Physics Department, 904-734-4121-328

Major activities supported: development and implementation of student-faculty research programs in Physics and Biology, and professional improvement of the Mathematics teaching faculty. The research program has resulted in the presentation of 7 papers by biology and 5 by physics students and staff at professional meetings. One paper has been published by each of the departments in leading professional journals. The research has been concentrated in the areas of aquatic biology, microbiology, and physiology in the life sciences and in electron magnetic resonance in physics. Implementation achieved by awarding summer research stipends to students and staff and acquisition of specialized microscopes, field equipment, a UV-visible spectrophotometer, a magnetic resonance spectrometer, liquid nitrogen facilities, technical assistants and the establishment of field stations. Curricular modification include course additions in Radiation Biology, Aquatic Biology, Solid State Physics, establishment of student seminars and Honors Programs. Faculty upgrading accruing to program: attraction of an outstanding biologist as department chairman, addition of a solid state physicist and advancement to Ph.D. status of two teaching mathematicians. Research-participating students have won graduate fellowships at Cal. Tech., Princeton, Columbia, and elsewhere. Among the spinoff effects of the COSIP program are university curriculum changes requiring 12 hours distributional requirements in the Natural Sciences to be met by courses specifically designed for non-scientists. Also the Biology Department has established a permanent working relationship with the local Lake Woodruff National Wildlife Refuge in field research aimed at maximizing the effectiveness of that national effort. The anticipated qualitative improvements in scientific instruction have been met.

SUSQUEHANNA UNIVERSITY. Selinsgrove, Pennsylvania 17870. Frank W.
135 Fletcher, Director of Environmental Studies. 717-374-2345.

The scope of the science program at Susquehanna University was broadened and given new dimension by concentrating improvement efforts on the development of a cross-disciplinary curriculum of environmental studies, which was designed to demonstrate the common ground and interrelationships among the sciences and between science and society, to expand the horizons of the University's science program beyond the campus to the contiguous region, and, by employing the ecosystem as a central theme, to increase curricular emphasis on mission-oriented and problem-solving activities. Seven courses in environmental studies were introduced or restructured, which entailed the addition of a regional planner to the staff. These courses are interdisciplinary in nature and rely strongly on computer, audio-visual, and field experience learning methods. A small watershed, which contains forest, agricultural and urban environmental elements was designated as a natural field laboratory for ecosystem research and instruction. The depth of the science program was increased by extensive expansion of joint student-faculty research activities, by increasing opportunities for independent study at the underclass as well as senior level, and by raising the level of the joint research projects by utilization of sophisticated analytical methods and equipment, computer model simulation, and insistence on publishable results. These projects involved staff and students from the departments of biology, chemistry, geology and mathematical sciences. A new environmental sciences laboratory for water quality analysis and aquatic ecology study was constructed. A fully equipped meteorological station was established, and a hydrologic monitoring network was set-up.

SWARTHMORE COLLEGE, Swarthmore, Pennsylvania 19081. Charles E. Gilbert, Provost
(215) 544-4045.
136

Swarthmore's COSIP project has two principal purposes: to provide more realistic, responsible laboratory work for students in the natural and social sciences; and to bring the natural sciences (and engineering especially) together with the social sciences in curricular work bearing on public policy concerns. Toward both objectives the project provides equipment and released time for development of improved laboratory procedures in the natural-science departments. It provides a Center for Social and Policy studies as a social-science laboratory and a common facility for students and faculty members in engineering and the social sciences. It provides two transitional faculty appointments in engineering and in applied mathematics (statistics) to help bring about the joinder of engineering and the social sciences. To date, the Center for Social and Policy Studies has been established and is functioning as a center for student and faculty research, a laboratory for social-science courses, and a forum for interdepartmental interests. New laboratories are under development in Engineering, Chemistry, Physics, and Psychology. A new course sequence in statistics, devised by the appointee under the COSIP grant, now exists.

137 SWEET BRIAR COLLEGE, Sweet Briar, Va. 24595. Dr. Jane C. Belcher, Dorys McConnell Duberg Professor of Ecology. (804) 381-5604.

Seven departments in natural and social sciences were strengthened through equipment, faculty training, curricular study and innovations, faculty-student research projects and development of environmental studies to achieve more intellectual interplay among the seven, between sciences and humanities, between Sweet Briar and neighboring colleges, and between college and community. New equipment includes calculators, laser, and modular instrumentations. The behavioral scientists, through summer courses and workshops, computer training, employment of a visiting professor and participation in a faculty seminar, familiarized themselves with applications of quantitative methods to their own disciplines. Released time permitted two biologists and members of the chemistry department to study new ways of presenting elementary biology as well as biology curricula at comparable colleges, prepare a new chemistry course entitled Science, Society, and Technology, and plan ways of curricular collaboration between the three local colleges. Visiting scholars in psychology presented lectures and seminars for general audiences and majors, and described interdisciplinary experiments on their campuses. Two biologists and a sociologist, employing student assistants, supervised summer research projects on biological rhythmicity, inventory of local flora and fauna, and demographic characteristics of Amherst County. A new course, Conservation: Agenda for Tomorrow, initiated efforts to establish interdisciplinary environmental studies focused on the natural and cultural features of the college's neighboring area. The course, open to the public, brought some 20 speakers of national distinction representing numerous disciplines. A Coordinator of Environmental Studies was hired and has directed two interdisciplinary summer research projects, focusing the intellectual interests of staff and students representing natural and social sciences on an environmental problem of local concern. He is also directing the newly established Coordinate Major in Environmental Studies, involving, to date, a faculty seminar and an introductory course taught by representatives of the sciences, literature, art and religion.

138 TENNESSEE TECHNOLOGICAL UNIVERSITY. Cookeville, Tennessee 38501. Donald Caplenor, Dean for Undergraduate Studies, (615) 528-3229.

This program was a broad-spectrum attempt to upgrade the level of undergraduate instruction in six departments: biology, chemistry, earth sciences, mathematics, physics, and sociology. Major emphases were to stimulate faculty to update knowledge and methods and to ensure active, personal involvement of students in the educational process. In two departments the major thrust was toward development of adequate tutorial procedures and methods; in another, curricular revision was the chief aim, resulting in separate tracks for students with different goals and in audio-tutorial instruction for some. A television system was developed in one department. In other departments the central issue was faculty renewal. Faculty members were supported in further study, in seminars, in visits to institutions with outstanding programs, and by having outside consultants visit the campus. In a survey of former participants (three years after termination) the most positive lasting results of the program were listed in order of priority as (1) Increased flexibility in curriculum, (2) improved quality of teaching, (3) higher level of faculty competence, (4) improved curricular approaches, (5) increased opportunity for student research and individual study, (6) improved attitude of instructors toward undergraduate instruction, and (7) increased familiarity of faculty and students with modern equipment and approaches. Lowest effect was stated for (1) impact on other institutions, (2) effect on career choices of students, and (3) salvage of students from academic failure. It is the consensus of those involved that the COSIP A program was the most effective general improvement program ever instituted on the campus. Specific and general positive effects are clearly apparent in the departments involved three years after termination.

139 TOUGALOO COLLEGE, Tougaloo, MS 39174. Mr. John Garner, Associate Professor of Physics, (601) 956-4941, ext. 26.

Improvement of college science, especially in Biology, Chemistry, Political Science, and Computer Science. The Department of Biology released faculty from routine laboratory preparation, inventory, etc. by employing a laboratory assistant; and increased physical science content, particularly chemistry, through the purchase of the needed equipment, in introductory courses, ecology, genetics, and cell biology. The Department of Chemistry added an instrumental methods course and modern instrumental techniques to intermediate and advanced chemistry courses, began faculty research with student involvement, improved library holdings in journals and spectra, relieved over crowding by adding a laboratory, increased audio visual supplementary materials in general and organic chemistry, and released faculty from routine laboratory preparation, inventory, etc. by employing a laboratory assistant. The Department of Political Science improved student and faculty expertise in statistical sampling techniques, questionnaire formulation processes, and interviewing procedures. The College increased the relevance of computer science by increasing the percentage of the student body using the computer from 5% to 60% through employment of a part-time computer center director and addition of an academic users' computer room. The Natural Science Division released faculty from routine clerical work by employing a divisional secretary.

140 TRINITY COLLEGE. Hartford, Connecticut, 06106. Dr. Robert Lindsay, Professor of Physics, Project Director. (203)-527-3151.

Seven science departments cooperated to improve instruction within their disciplines, to create a multidisciplinary program in both urban and environmental studies, and to promote interdisciplinary faculty and joint faculty-student research. This involved the revision of courses, the development of new courses, the modification of curricula, and appropriate research activity. New and improved courses and curricular changes were made in five departments: Chemistry (5 courses; 34% chemistry enrollments affected), Mathematics (5;13), Physics (5;32), Sociology (3;54), and Biology (1;3); and in the new Urban and Environmental Program (8;100). Signal results were: Chemistry--a self-paced introductory laboratory and the development of a biochemistry major; Mathematics--a coordinated change in curriculum to strengthen the major and to increase cognate skills required of non-math majors by other departments; Physics--an increased use of the computer in introductory laboratories and the development of an advanced laboratory; Sociology--the application of computer-based data analysis in the introductory course; Biology--the development of an ecology course; Urban and Environmental Studies--the initiation of an effective multidisciplinary program in a small liberal arts college. Ten research projects were conducted by faculty and students from all participating departments. Interdisciplinary research (Engineering + Psychology; Chemistry + Physics) produced one publication and three delivered papers. Three COSIP-supported activities attracted outside funds for their continuation: for curricular design in Chemistry and for research in both Chemistry and in Engineering. Trinity College continued COSIP-generated improvements in two areas of science education. The College increased its financial support for computer-based instructional innovation and it established a fund to support faculty research. These COSIP-stimulated changes and improvements in the sciences have augmented the quality of instruction, increased interdisciplinary cooperation, and enhanced faculty-student interaction at Trinity College.

TRINITY UNIVERSITY, San Antonio, Texas, 78284, Robert V. Andrews,
141 Dean of Engineering, (512)-736-7511.

Multidisciplinary CoSIP Program involved departments and aims as follows: Chemistry - course and curriculum development - revamping of content and laboratory methods in introductory and upper level courses - inauguration of two beginning chemistry courses - development and incorporation of visual aids for selected topics and laboratory instruction - emphasis on relevance of chemistry in modern world. Engineering Science - incorporation of research into undergraduate curriculum for selected seniors in place of continued design emphasis, particularly for those planning graduate work - develop new design sequence involving all engineering students - increase existing design content of curriculum and attempt to relate to actual engineering practice - introduce computer use into curriculum and develop problems, programs and routines for engineering student use on computer. Geology - develop, equip and use a mobile field laboratory research facility consisting of house trailer to provide living quarters as well as facilities for field analyses and examinations. Purpose to provide undergraduate research opportunities, aid faculty research projects and enhance required geology majors field trip. Mathematics - increase the strength of background and interest for beginning mathematics majors - initiate noncredit, specific topic courses to fill special needs of undergraduate students and for freshman review - provide teaching experience for mathematics majors - provide colloquia and research seminars for faculty, students and for interdisciplinary enrichment. Sociology-Anthropology - develop laboratory manual for biological anthropology and lay groundwork for primatology program - provide research opportunities for undergraduate students and study sociological problems of Mexican-Americans.

UNIVERSITY OF TULSA, Tulsa, Oklahoma 74104, Dr. Edward S. McKay, Professor of
142 Chemistry 918-939-6351, Ext. 511

In the Chemistry Department the program concentrated on curriculum development, newer teaching techniques, laboratory instrumentation, student research, faculty up-dating, and visiting lecturers. A self-paced course in physical chemistry was developed and is in use. A series of instructions for the laboratory are currently being completed. A similar program in organic chemistry consisting of written objectives and self-paced examinations has also been prepared and is in use. Developments continue. Classes in general chemistry have summaries of lectures available and take part in proven effective lecture-laboratory experiments. New instrumentation made undergraduate research meaningful and prepared students to work independently. Although several movies were made the process was abandoned because of the variety of commercial films now available. Several of the faculty benefited through summer courses, and/or research at other institutions subsidized by COSIP. A new course "Polymer Chemistry" is a result of up-dating of one of our faculty. A program of visiting lecturers, although effective, was found difficult to schedule. With College reorganization into divisions, some activities anticipated in the past will need to be re-evaluated. In the Physics Department emphasis continues on Engineering Physics which gained ECPD accreditation. Development has occurred in introductory and advanced labs, teaching techniques and instruments, student involvement and resources. New courses are Methods of Applied Physics (Fr.) [computer solutions to mechanics, heat and sound problems] and Modern Physics Lab (So.) [state-of-the-art techniques in spectroscopy, on-line computer, vacuum techniques, and physical optics]. Equipment includes Wang Calculators, a CRT computer terminal, X-ray fluorescence and a Varian vacuum system. Teaching equipment besides calculators and computers include film cassette and sound insfruction in lab technique, data analysis, operation of instruments (X-ray, oscilloscopes, counters). Student research (year round) is interdisciplinary with Chemistry and Earth Sciences. Students are involved in 2 week trips to Oak Ridge, and other society and professional meetings. Conference on Engineering Physics Curriculum scheduled for June 1974. Extensive development of laboratory and demonstration equipment has also occurred.

TUSKEGEE INSTITUTE. Tuskegee Institute, AL 36088. J. H. M. Henderson, Director,
143 Carver Research Foundation. 205-727-8224.

A new course improves the mathematics of freshmen, especially majors in natural science. A curriculum in computer science, with typical enrollment around 15 in the earlier courses, opens a new avenue for mathematics majors. An added professor teaches in the curriculum. Central to these projects is a new digital computer whose use is extending throughout science courses and research. In physics, opportunities are increased by semi-research equipment for upper-division laboratory and research projects; also by teaching aids; especially by a new course relating physics and the life sciences; lastly by visitations. A scientific instrument maintenance service is being established. In the new math course, the digital computer presents automated practices in basic computational mathematics, scores them instantly, and advances the student to the next lesson as soon as mastery is demonstrated. In the same course students program the computer and thereby learn basic mathematics. Conventional paper-and-pencil work rounds out the course. The course tested self-paced modular instruction and found it effective with a strong and ambitious 5 percent of the class, also with a weak but dogged 10 percent. It continues with laboratories and a nearly-conventional pattern of examinations and grading. The digital computer is a relatively powerful multiterminal timeshared machine, the Hewlett Packard 2000 F. It's equipment, maintenance, and software have been excellent; however, maintenance of teletype terminals and modems is a continuing problem. Other fundings have doubled disc storage and provided more terminals for a total of 36, dispersed about campus for maximum availability to a university community of 3500. Workload will soon justify more disc storage. Principal usage is by undergraduates doing course work, freshmen in the new math course, and life-science research projects processing large files of statistical data. Social science and English departments are exploring automated teaching.

UPSALA COLLEGE, East Orange, N. J. 07019. Dr. James J. McRoy, Chairman,
144 Psychology, 201-266-7158.

A comprehensive program to upgrade the college's work in the burgeoning social sciences was instituted between 1971 and 1974, with seven specific foci: (1) reorientation of the economics curriculum toward greater use of quantitative methods, through released faculty time for curriculum analysis, use of a visiting scientist in econometrics, and establishment of an economics calculator laboratory; (2) upgrading of library holdings in political science, especially in Asian materials, newly-reprinted sets of official papers, and back issues of learned journals; (3) inauguration of African governmental studies through employment of a visiting professor for two years; (4) improved laboratory facilities in psychology, both by major renovation of one entire floor of a classroom building and by purchase of $10,000 worth of experimental apparatus and equipment; (5) introduction of biological methods into psychology through acquisition of a physiograph with full accessories; (6) expansion of the seminar program in sociology through employment of a visiting professor for two years and through extensive purchase of computer survey software for use in student research projects; and (7) establishment of a multi-disciplinary urban data bank, which relates to economics, political science, and sociology.

145 VALLEY CITY STATE COLLEGE Valley City, North Dakota, 58072 Dr. Charles E. Walker, Professor & Divisional Chairman, 701-845-7452

Our project was principally aimed at up-grading our instructional staff. Before the grant, we had only one doctorate in all the departments involved in the project, and very little training beyond the masters level. Now, at the end of the program, two geographers, a biologist and a physical/earth scientist are quite near their doctorates, two mathematicians have each obtained a full year of additional study, and our two chemists have picked up additional specialized course work during the summers. Before the project, there was virtually no audio-visual equipment available in the division, and laboratory equipment was generally quite limited. Partially as a result of the "Excess Property" provision, an unexpected windfall, we were able to secure projectors, tape recorders, a transparency maker, and considerable "used" but still very welcome laboratory equipment. The entire project was worth this originally unscheduled benefit, for providing a bit of dignity to the 'bare-bones' existence of State Funds. The biggest surprise, and most rewarding educational experience, was from the relatively minor funds for students as assistants and in research. Almost as an after thought, some students were assigned to a Research Project in conjunction with summer time Curriculum Research. They were asked to conduct a survey (Chemical and Biological) for the entire length of the Sheyenne River which borders the campus. The students were completely 'turned-on' by their first exposure to a real investigative experience without the answers in the back of the book, and learned a great deal. This has affected our thinking a good bit toward the traditional laboratory, where a demonstration-experiment must be completed in a brief period.

146 VERMONT, UNIVERSITY OF; Burlington, Vermont 05401. Howard Duchacek, Associate Professor, Mechanical Engineering. (206) 656-3320

The COSIP grant to the College of Engineering, Mathematics and Business Administration was made for the purpose of strengthening the engineering programs. It has contributed to the Continuing Education of faculty members by partially supporting sabbatical leaves for six members and by providing expenses for 11 other faculty members to attend short courses, symposiums, or conferences. By these means there has been an increase in both the morale and expertise of older faculty members and an improved climate exists for revising and updating the engineering curricula. A total of twenty faculty have participated in Research Initiation activities partially supported by COSIP. To date this has resulted in nine paper presentations. Three papers are in preparation and several proposals for further work are in progress. Curriculum and Course Development has taken place partly through COSIP stimulation and partly due to internal administrative and budgetary pressures. The engineering curricula have been extensively revised toward a less structured format and a common core of courses has been developed for the first three semesters. New courses have been developed in safety and professionalism, and courses are being combined and consolidated in the areas of thermal science, engineering materials and applied mechanics. Two new degrees, a Bachelor of Science and a Bachelor of Science in Engineering, have been approved. These have little formal structure and are directed toward the science oriented student who does not want a traditional engineering program. New physics, chemistry and mathematics courses have been developed for the engineering curriculum. Funds were supplied on a matching basis to purchase Laboratory Equipment. The grant extended through a most opportune period for making changes in the engineering program and its effects have generally been positive.

VIRGINIA MILITARY INSTITUTE. Lexington, Virginia, 24450.
147 Richard B. Minnix, Professor of Physics, 703-463-6225.

A program involving nine departments of instruction provided: 1) opportunities for faculty members to obtain additional or refresher training through summer or academic year study; 2) released time for planning the improvement of courses and curricula; 3) support for faculty members to initiate modest research projects involving undergraduates; 4) support for visiting lectures, consultants, etc; 5) instructional equipment and other materials needed to revise courses or install new curricula. A new biochemistry laboratory was constructed and equipped. Additional study provided for members of three separate departments resulted in completion of four doctoral degrees. Superior research was produced by undergraduates in six departments; notable accomplishments were the development of a modified technique for orienting crystals to within several minutes of arc and development of a monolithic double crystal spectrometer, both for x-ray studies. Extensive computer soft ware was developed for data reduction in general and physical chemistry laboratories. A new course and laboratory on interfacing mini-computers to allow automation of data measurements was developed. New laboratory materials were developed for use in general and organic chemistry. Curriculum studies were carried out in civil engineering, mechanical engineering, and political science. These resulted in the addition of several new courses and revision of others; civil engineering laboratories have been restructured utilizing programmed texts. An experimental course in engineering is being taught using the case method of teaching. A new course and laboratory on vibrations was developed in engineering. A study of demonstrational lectures in physics was carried out including the assembly of an extensive collection of demonstrations. New instrumentation has allowed psychology students to study human behavior under various conditions of stress, coordination, coping, and sleep.

VIRGINIA STATE COLLEGE, Petersburg, Va. 23803, David M. Stone, Calvin M. Miller,
148 Co-Directors, 804: 526-5111.

This 3-year project's mission is pedagogic and infrastructural improvement through academic field research activity; its primary goal is pedagogic development through a blending of the theoretical, interdisciplinary and practical, experiential elements of survey research. Development of institutional research capability, faculty and administrative practice are important subsidiary goals. Research publication is an integral element of all of these goals. To date 100 students, 15 local faculty from 9 departments and programs, over 12 community persons, 2 community groups and numerous administrative personnel as well as RAPS's consultants have participated in the program or had some consultative relation with it. Presently RAPS is completing the second survey in its panel study of political socialization which is based on two tri-strata random samples of approximately 500 respondents each. Students and faculty jointly plan and develop all phases of the effort. The program correlates with the professionalization of student participants as evidenced by improved graduate and professional school acceptance for graduates of RAPS's parent department (Political Science), and their development of conference panel presentations; faculty development of 2 articles for publication, 2 panel chairmanships, scheduled development of 2 panel papers, participation by RAPS staff in the University of Michigan's summer consortium, release of small articles to the press by faculty and the advent of interdepartmental planning for joint development of a RAPS based social science laboratory, research consultation by higher administration regarding development of college community related research, expanded program participation by whole sociology classes, supplementary support for RAPS in the form of ICPR membership for the college, joint work by RAPS and the Computer Center leading to the development of new computer programs, support for a supplementary census project and further consultative support for projected omnibus activities developed on the basis of the use of RAPS's research capabilities in a local government support mission.

149 WABASH COLLEGE, Crawfordsville, Indiana 47933. Edward L. Haenisch, Professor of Chemistry, Chairman of the Department and of the Science Division. (317) 362-1400.

The major intent was to strengthen research activity by members of the Science Division which includes mathematics. Secondary aims were to improve instruction and create interest in science. The grant was built around nine faculty research initiation projects which included funds for involving 28 students. Five major instruments vital to the research projects were purchased. These also are used widely in teaching. Subscriptions to 37 new periodicals, some back runs and advanced treatises were also added to the library. Colloquia programs were strengthened in all departments and brought many prominent scientists to campus. A field laboratory was installed in a 180 acre wooded biological preserve and it has been shared with neighboring institutions. Currently 75% of the Division Staff are engaged in research and independent study is required of all biology majors. The College has outstanding instrumental facilities in biology and chemistry. The library is a useful research tool. Departmental colloquia are strong. Marked declines in student enrollment in science have not been experienced.

150 WASHINGTON COLLEGE, Chestertown, Maryland 21620
Joseph McLain, President (301) 778-2800

The original project goals in terms of activity were two-fold: to establish a new interdisciplinary social science seminar, and to establish a digital computing activity or center. In terms of educational philosophy these two goals can be summarized in terms of a single aim which was the "development of 'networks' cutting horizontally across the vertical barriers between the three Divisions (Humanities, Social Sciences, Mathematics, and Natural Sciences) of the College" as well as between the individual departments within these Divisions. It was the feeling that the artificial and often spurious distinctions defining the disciplines in many cases lead to a fragmented educational experience for the student although they may simplify the structuring of a curriculum. Both of the abovementioned major goals were undertaken in an attempt to overcome these barriers. A new interdisciplinary course, called "Interdisciplinary Community Research Seminar" (ICORS) was established to this end. The original purposes of this course were to teach social science majors methods of research into community problems and to accumulate data on the local region that would be of use to people in the area as well as scholars interested in regional research. It was soon discovered that the faculty had to structure the course to some extent if meaningful data were to be collected. In connection with the course, statistics became a required course for economics and sociology majors, so that digital computing would be easier to introduce at a later time.

Under the grant a program in computing was begun. Washington College began with rented time from a local firm's computer and finally developed a Center of its own. As the demand increased it became apparent that the patchwork coverage of the Center would not suffice and the College added a position for Director of Computing. With this addition the hardware configuration was expanded and three courses in computer science were added.

151 WASHINGTON AND LEE UNIVERSITY. Lexington, Virginia 24450. William J. Watt, Dean of the College. 703-463-9111.

The COSIP Grant supported a program designed to improve and expand undergraduate research and individual instruction in all sciences. Methods used included visiting scientists who came to the campus for one-to-three day visits, effectively keeping students and faculty aware of new developments in their fields; a year-long visit from a distinguished practitioner of non-Western economics which did not seem to have much effect on the campus, although the books purchased by him have served as a nucleus for an interdisciplinary program in Asian studies; curriculum development in geology leading to a popular and successful course "Field Methods in Appalachian Geology" for our Spring Term and the revision of the stratigraphy course to include extensive field work; the preparation of seven sound films and study materials for courses in the calculus; two postdoctoral physicists who carried out research and some teaching, stimulating additional faculty and student research activity; faculty development through academic-year leaves and support for attendance at meetings; curriculum revision in politics courses emphasizing use of the computer in the analysis of student gathered and CSEP data; and obtaining sociology films for a course on Black America and a computer game on the city. The most helpful COSIP project was that which supported multidisciplinary undergraduate research during the summer. Our experience with this program proves that it is the most effective way of interesting students in scientific careers and in sustaining their interest in science during their undergraduate years. A total of 81 students participated in 42 projects. The COSIP grant has strengthened our science instruction and will continue to be of great assistance to us in the foreseeable future.

152 WEBER STATE COLLEGE
Dr. Ralph W. Monk, Director of Research
Ogden, Utah 84403 801-399-5941 - Ext. 633

As a result of the COSIP Project seven disciplines (Botany, Chemistry, Geology-Geography, Microbiology, Physics, Psychology and Zoology) have launched faculty and student research and instructional programs not heretofore considered feasible. Botany investigations have developed interesting and significant faculty and student research including ecological taxonomic and physiological problems. Many of the results have been published in regional and national journals. One ecological study is now being published for the National Park Service. The Chemistry Department faculty and students have completed many COSIP sponsored projects including such projects as reaction rate studies, specific ion studies and now coal research, a joint collaborative effort between Utah University and Weber State College. Geology and Geography faculty have developed interesting and significant work in Paleobotany and important geography research dealing with spatial population problems. The Microbiology Department faculty and students have done significant work on cancer and insect control related problems. One microbiologist as a result of his COSIP research has been invited to participate for a summer at a National Cancer Center. The Physics Department faculty and students have produced significant and important results on such problems as computerized study of cross sections of atoms and molecules, biofeedback investigations and low energy electron diffraction studies. One member of their department was invited to continue his research in cooperation with the Physics Department of Utah State University. A number of important developments have occured in the Psychology Department. Students and faculty investigated color vision behavioral studies of rats and also monkeys under different stress conditions. Zoological research has dealt with mercury in hair and polymorphism in island mice populations. The results of this research have been published in National Journals. Numerous students have developed expertise in research. Two groups of zoology students have received two National Science Foundation Grants for their student originated studies.

87

153 WHEATON COLLEGE, Norton, Massachusetts 02766
Dr. Barbara Shapiro, Dean of the College (617) 285-7722 x212

The College Science Improvement Program has contributed significantly to the quality of the science program at Wheaton College by giving students an opportunity to participate more actively in scientific affairs and by encouraging young scientists to maintain currency in their fields. The provision of adequate laboratory and classroom facilities in our new Science Center greatly improved our capabilities; the programs initiated and funded under COSIP provided the impetus and support for increased research undertaken by both students and faculty. A faculty Committee on Advanced Study and Financial Aid awarded twenty-three Faculty Research Grants to junior faculty members in the natural and social sciences. These grants enabled recipients to either initiate new research projects or to expand and add vigor to existing projects. Funds for Student Research allowed eighteen students to discover the nature of independent research and engage in projects which did not have to be restricted by the availability of materials and equipment. Teaching Assistantships were awarded to nine students who all reported that their teaching experience increased their subject knowledge and stimulated or confirmed their interest in teaching careers. Twelve summer Study and Research awards provided faculty with funds for field work and other summer scholarly activity away from the campus. A Student Internship Program was successful in assisting six students while they worked in Washington Congressional offices or in the laboratories of active scholars. New equipment purchased with COSIP funds contributed significantly to the improvement of our laboratory facilities and made it possible to present subject matter at more advanced levels. The Visiting Scientists Program attracted large audiences and helped generate student interest in scientific affairs throughout the campus. The rapid development which the natural and social sciences have undergone at Wheaton College in recent years was undoubtedly stimulated by the COSIP grant.

154 WIDENER COLLEGE, Chester, Pennsylvania 19013. Irvin M. Gottlieb, Professor of Chemistry. (215) TR6-5551

An interdisciplinary curriculum in Physical Science has been developed which integrates certain broad concepts from chemistry and physits through mathematics utilizing for its base a study of molecular phenomena for the elucidation of the architecture, structure, and transformation of matter. Several of the separate traditional disciplines which comprise physical science were rearranged and recast into a unified structure. Mathematics was integrated as it found areas of relevance of application to various concepts, as a unifying and generalizing factor and not for its own sake. A concurrent curricular second objective was the evaluation and judgement of science and technology in social, ethical, economic, and humanistic terms so that the student might become cognizant of the impact of science and technology on society. As a result the student would then have acquired an understanding of science, a serious and responsible interest in the ways and means by which scientific knowledge is used in the complex civilization of which he must consider himself an integral part and would be stimulated to pursue further his studies in physical science and its applications. A third concurrent objective would be to make more efficient use of the resources of a small college since the maintenance of separate faculties and facilities in each discipline is becoming prohibitive costwise. This interdisciplinary program could be considered as the first step in the long-range program for the improvement of instruction in science in small liberal arts colleges. A second step could be the integration of the biological sciences with the chemistry, physics and mathematics. Ultimately all science instruction could be integrated into a single program, once this crucial experiment for the education of the scientific elite could be undertaken and evaluated.

155 WILKES COLLEGE, Wilkes-Barre, Pennsylvania 18703. Ralph B. Rozelle, Professor of Chemistry. (717) 824-4651

The COSIP grant at Wilkes College resulted in a number of benefits in the academic program through direct funding and considerable benefits as a result of the surplus equipment available through the General Services Administration. Direct funding enabled the establishment of an environmental science curriculum, expanded faculty research activity in the natural sciences and mathematics and renovation of an advanced analytical chemistry laboratory. Indirect funding through the access of surplus equipment weighed heavily in providing equipment and materials that helped get new programs in electrical and materials engineering off the ground. In estimation the excess property dollar value was probably more than 3-4 times the NSF direct funding dollar.

156 WILLAMETTE UNIVERSITY. Salem, Oregon 97301. Donald R. Breakey, Chairman, Department of Biology 503-370-6333.

Major activities included summer faculty stipends for course improvements; support for undergraduate student technicians and undergraduate teaching aides; and purchase of equipment and teaching aid materials. The purchase of equipment included acquisition of an I.B.M. 1130 computer system. The basic system is being continually improved with the addition of hardware and software. This facility has been made available for direct instructional functions as well as aids in teaching (e.g. writing Organic Chemistry exams). Non-academic functions are not allowed to take a higher priority of computer use than the academically related functions. Thus many considered the facility of tremendous importance in the total instructional program. Improvement in the total science library holdings was carried out over a three year period. Summer stipends awarded faculty for course improvements did result in several new innovations developed within courses and a smoother adjustment to a new academic framework (i.e. course system). Additional equipment consisted of several items including basic equipment for the development of psychology laboratories. The eligibility for excess property resulted in the acquisition of a bus now used for science field studies. This has had a great impact upon the presentation of many science courses for the field demonstration of classroom discussions. Several items could not be completed, including adding a half-time shop person. Undergraduate laboratory teaching training was valuable and is being continued by the University.

157 WILLIAM AND MARY, COLLEGE OF. Williamsburg, Virginia 23185. Dr. George Healy, Vice President for Academic Affairs. (804) 229-3000.

COSIP began in 1968 to support the development of five social science departments: Anthropology, Economics, Government, Psychology and Sociology. Upgrading of faculty and curriculum revision were the program's major accomplishments. First priority of the program was to provide permanent faculty members with opportunities for field research otherwise not available, in order to upgrade professional capabilities. In the four years of program support 22 faculty members from 5 departments were provided one-semester leaves of absence for research projects, and 15 faculty members from 4 departments were supported for shorter periods of time. The results were a greatly improved faculty in all five departments, a fact reflected in a considerably higher level of professional awareness, participation in professional meetings and publication. The second major goal of the Program was the upgrading of the social science curriculum. The goal was achieved, and surpassed. The social science curriculum was revised, and as a result of the impetus within the five departments supported by COSIP, the College was prompted to engage in a full-scale curriculum revision, the first in thirty years. All five social science departments produced major curriculum revisions. 28 new courses were introduced, or underwent major content revisions. Two departments developed major new data resources. Funds provided for equipment allowed for the development of demonstration and audiovisual materials to enrich course offerings in two departments. One department was able to introduce and maintain an internship program for undergraduates, and three departments radically altered the character and methodology of their introductory courses.

158 WILLIAMS COLLEGE. Williamstown, Massachusetts 01267. Thomas McGill, Chairman, Science Executive Committee. 413-597-2446

In June of 1967 Williams College received a three year grant from the COSIP Program A to purchase integrated laboratory facilities for a new Science Center in order to extend and strengthen undergraduate research participation in the departments of biology, chemistry, geology, mathematics, physics, and psychology. By pooling the resources of faculty and students in the several scientific disciplines, it was planned to make available a range of instruments and facilities not available within any separate department nor normally seen in institutions of the size and character of Williams. The long-term goal of the program was to strengthen the college's ability to recruit both students and faculty and thus to maintain its position as an important source of well-trained scientists. Positive results of the program can be seen in several areas. Provision of sophisticated equipment has enhanced the college's ability to recruit and retain research-oriented faculty of high caliber. The improvement of instrumentation and facilities for faculty research has in turn improved the opportunities for undergraduate research. Undergraduate research with faculty members has been carried out in the context of course projects, independent study projects, NSF Undergraduate Research Participation projects, and senior honors projects. The College has experienced no diminution of its ability to place science students in high quality graduate and medical schools. Various items of equipment have been used with good effect for course demonstrations and associated laboratory work. In some cases new courses have been organized around key items of equipment, especially in the January Winter Study Term.

159 WINONA STATE COLLEGE. Winona, Minnesota 55987. Dr. Frederick W. Foss, Jr., Head Department of Chemistry, 507-457-2101.

Undergraduate science programs in eight academic departments were strengthened by one or more of the following: Support of undergraduate research programs, purchase of new equipment or remodeling of facilities to allow the introduction of new courses, support of faculty improvement and upgrading of library holdings. The greatest impact upon the institution was the recognition by faculty, administration, and students that decent, albeit modest, scientific research could be begun at Winona State and that it can and does enhance the undergraduate program. Ongoing undergraduate research programs in the chemistry, physics, earth science, sociology, and psychology departments were established and the college began allowing reduced teaching loads for those who request them for research time. A separate Department of Psychology was established and an economics major was introduced through the COSIP project support. Two mathematics teachers, one chemistry teacher, and one physics teacher received additional training (two received the doctorate) as a result of COSIP support. Several new quantitative economics courses were made possible by the equipping of an economics laboratory. New laboratory courses in Earth Science are being offered because of a renovation of the laboratories and equipment purchases (as for example, Astronomy II because of the purchase of telescopes). Equipment purchases made it possible for the Biology Department to introduce four new courses: Cell Physiology I and II, Advanced Comparative Physiology, and Limnology. A 36-foot houseboat has been equipped as a floating laboratory for use on the Mississippi River in the Winona area. Library journal holdings have been upgraded in mathematics, physics, earth science, biology and (especially) chemistry.

UNIVERSITY OF WISCONSIN - LA CROSSE
160 La Crosse, Wisconsin 54601
Dr. Roland W. Christensen, Chairman, Department of Mathematics, 608-784-6050

The COSIP program for Wisconsin State University, La Crosse - now the University of Wisconsin - La Crosse - was designed to upgrade the undergraduate instruction in Biology, Geography, and Mathematics. As a result of the program, the Biology Department has improved its beginning course entitled "Principles of Biology". This course is now taught with a completely audio-tutorial approach. The Department has also revised its curriculum and upgraded its faculty. Now the Department has a modern curriculum and an impressive faculty. This Department is now working closely with the Fish Control Laboratory headquartered in La Crosse and with the River Studies Research Association. The department has already had an impact upon ecological affairs in the La Crosse area and should continue to be a leader in these matters in the future. The Geography Department has improved its equipment for the teaching of Physical Geography I (Weather and Climate) and Physical Geography II (Maps and Landforms). In addition, the Department has considerably upgraded its equipment for Systematic Climatology, Interpretation of Aerial Photographs, Field Techniques (Mapping), and Advanced Cartography. The Department has considerably improved its faculty also. The Mathematics Department now has a calculator laboratory which consists of twenty electronic Wang 320 calculator keyboards. The Department also has equipped a research laboratory with four electronic Wang 320 keyboards, two Monroe 1610 electronic calculators, two Wang 700 electronic calculators with a plotter, and a terminal connected to the University's 360 computer. This improvement in the statistical capability of the Department has been accompanied by an increase in the faculty who are capable of teaching courses in statistics. The Department now has ten doctorates on a staff of eighteen. Of these, five are qualified to teach courses in undergraduate statistics. In addition, two of the people without doctorates are nearing completion of a doctoral program in statistics. The Department also has two people capable of teaching numerical analysis. Thus the Department now has the capability to offer a major in statistics and is able to satisfy student needs in numerical analysis.

UNIVERSITY OF WISCONSIN-MILWAUKEE
161 Milwaukee, Wisconsin 53201
Dr. Verne C. Cutler, Chairman Department of Mechanics, 414-963-4963

Increased faculty expertise and professional competence, modifications of existing and introduction of new current interest courses, introduction of new teaching methods and programs, and incorporating experimentation as a fundamental aspect of teaching engineering concepts were the major efforts. Forty-two faculty either attended regular courses on campus or attended summer short courses in areas in which they were weak or unfamiliar. Eighteen faculty from four departments were involved in reviewing, revising, and implementing changes in laboratory and theory courses. Many regular scheduled meetings were held to discuss innovations and fundamental philosophy. The result was the development of a new experimentation laboratory with the emphasis on statistical applications and "hands on" experimental work by all undergraduate students. A realignment of basic core laboratories resulted with laboratory work tied directly to the related theory courses. Models and fatigue laboratories were developed and equipped providing students an opportunity for individual verification of fundamental principles and hypotheses. An unplanned but rewarding program in Water Resources Engineering was begun with the help of a COSIP funded consultant. Through his efforts, a meeting of the International Water Resources Association was held on campus. The establishment of a new creativity concept for freshmen level Graphics courses through the aid of specially prepared tapes gave students the choice of self-study or regular class attendance. Twelve students received creativity awards at the national annual meetings of the American Society for Engineering Education - more than any other College in the country. Sitting-in on courses in related fields resulted in a greater awareness of course content in other areas and a more open-minded attitude. This was noted by a sharp increase in the number of undergraduate interdisciplinary programs of study approved for individual students. The development of key undergraduate laboratories and improvement in the laboratory sequence was a major accomplishment. Many faculty benefited by attending summer short courses and as a consequence so did students by being exposed to fresh approaches and up-to-date concepts. All planned goals were essentially accomplished.

WITTENBERG UNIVERSITY
162 Springfield, Ohio 45501
Dr. Harold W. Sundelius, Associate Dean of the College, (513) 327-7923

The Wittenberg University COSIP grant was awarded in 1967 to the departments of biology, chemistry, geology, physics, and psychology to aid in implementing an inquiry-oriented curriculum in which faculty and students participate in research at all levels. Funds were expended to provide released-time for faculty to initiate research programs appropriate for undergraduate independent study projects, for curricular innovations, for development of laboratory modules, for purchase of equipment, supplies, and library resources, for student stipends, and for faculty travel to professional meetings and conferences. As a direct result of the grant, each department developed an introductory course for non-science students which focused on aspects of the sciences essential to understanding contemporary societal problems. In addition, a learning-by-doing inquiry approach was incorporated into virtually every course with relatively sophisticated apparatus, such as nuclear particle accelerator, electron microscope, and x-ray diffraction, available to science students at all levels. Special programs in marine biology, field biology, radiation, nuclear, and laboratory medicine, experimental psychology, physiological psychology, and environmental geology were developed. All departments benefited from equipment purchases made possible by the grant, including a 400 KV nuclear particle accelerator, NMR and AA spectrometers, and various audiovisual components. Excess government property, mainly electronic items, valued at more than 3/4 million dollars, was acquired because of the grant. In spite of generally declining enrollment in the sciences, the total number of science majors has increased. Biology, psychology, and geology showed the largest gains. Measures of the vigor of the sciences, due in part to the COSIP grant, include increases in the number of students entering graduate school, the number of graduate appointments received, the number of papers published by faculty, and the number and quality of student independent study and course-related projects completed.

WOFFORD COLLEGE
163 Spartanburg, South Carolina 29301
B. G. Stephens, Dean of the College and Professor of Chemistry, 803-583-5365

The COSIP project strengthened the College's ability to provide quality education in the experimental sciences primarily through the acquisition of laboratory equipment; the establishment of a sabbatical leave program; the development of faculty-student summer research programs; the addition of a biochemical-molecular biological component; and the acquisition of audio-visual and library materials. Laboratory equipment was purchased to improve electronics instruction, to enhance the biology and physics departments' capabilities to conduct year-round research and independent study, to implement the psychology department's general experimental and physiological program, and to upgrade the chemistry department's basic courses in analytical, organic, and inorganic chemistry. Three professors (physics, biology, psychology) took advantage of the sabbatical leave program by conducting year-round research projects. Fourteen projects involving six professors and twenty-eight students were conducted under the faculty-student summer research project. A biochemist-molecular biologist was added to the science staff to teach his speciality and to replace the COSIP Project Director half time. The psychology department added a video component to its laboratory. Video tapes of intricate experiments are used to show large groups the details of various psychological techniques. The physics and chemistry departments' library holdings were upgraded significantly. In addition to these major improvements, consultants were brought in (and visited) to advise the administration about various aspects of science education; a natural area for ecological experimentation was sought; aerial overflights for geology courses were initiated; and an inter-term junior-senior science seminar was established. These activities were underwritten by Federal COSIP funds; also several important COSIP components were sponsored by College funds. They were the strengthening of science instruction for nonscience majors; the renovation and air conditioning of the building that houses the biology, chemistry, and physics departments; the establishment of new quarters for the geology and psychology departments; and the strengthening of computer services.

164 WOOSTER, THE COLLEGE OF, Wooster, Ohio, 44691. F. W. Cropp, Dean and Vice President for Academic Affairs. (216) 264-1234, Ext. 436.

COSIP monies enabled science education to advance more rapidly than otherwise possible through curriculum revision, faculty and student research, and equipment purchasing. Biology Department size was increased by one faculty member who released time for curriculum revision resulting in a three-course Biology core, six non-science major courses, and changed emphasis in all major courses to investigative rather than descriptive. Chemistry - From faculty research evolved topics for student independent study projects; a number of publications also resulted; there were new experiments developed for the general course. Economics - Faculty research led to publications and development of independent study topics. Geology - Equipment purchased led to curricular changes and an up-dated laboratory program; geology majors have increased 500% in the senior class and 200% in the junior class. Mathematics - Additional training for faculty members improved the teaching of mathematics courses. Physics - Equipment purchased was used for low temperature research. Psychology - Complete course revision including team teaching, different mechanisms of learning, and different courses; faculty research. Sociology - Accelerated faculty research and converted departmental emphasis to a more scientific, quantitative approach: new research projects for student independent study resulted; the present staff has a much more scientific orientation. Political Science - Empirical nature of the subject was developed.

WORCESTER POLYTECHNIC INSTITUTE, Worcester MA. 01609; Allan E. Parker, Chairman,
165 Projects Board 617-753-1411 Ext 313

Grant supported activities in the Departments of Chemistry, Mathematics, and Physics. Chemistry:- Faculty research initiation funds supplied to four faculty members. Their research aided by a number of students, has been successful; stimulating research not only during the grant but subsequently, with a number of papers published. Curriculum studies under development were implemented. Major change was in laboratory work with consolidation of several courses and areas into a unified program with independent projects strongly emphasized. Five lecture demonstration experiments were developed. Support was provided for the development of "Chemical Principles Exemplified," the publication of these being a continuing program in the Journal of Chemical Education. Mathematics:- Curriculum of the freshman-sophomore year was modified to provide an improved background for engineering and science students and to accommodate conflicting viewpoints of mathematics faculty as to pure versus applied mathematics. Graduate studies were carried out by four members of the faculty, two of the four receiving their doctorates. Physics:- Considerable revision was made in the materials presented in the freshman-sophomore physics courses. During this work, faculty became acquainted with "Individually Prescribed Instruction." Extensive effort was expended in developing such material for these courses; now offered in both this as well as the traditional format. Most other departments are offering such courses or experimenting with this method. Laboratory experiments of introductory courses have been updated and new experiments developed, e.g., quantitative investigations of polarized light. Solid state laboratory, including cryogenic facilities, was equipped and made operational. Essentially the original objectives were attained. Perhaps the greatest impact on the school was from the curricular studies and the emphasis on student project research with supporting equipment provided. This supplemented other activities which led to the WPI Plan described in the abstract prepared by Dean Grogan, under another COSIP grant made to this school.

WORCESTER POLYTECHNIC INSTITUTE. Worcester, Massachusetts 01609.
166 William R. Grogan, Dean of Undergraduate Studies. 617/753-1411 Ext 404.

The NSF (CoSIP) grant provides three years of support related to the redesign of the entire undergraduate program which involves 2000 students of whom over 1800 major in science or engineering. The WPI educational approach awards degrees on the basis of demonstrated competence. Flexible curricula are tailored to the individual student, self-teaching through multi-media approaches is emphasized with project work playing a major role in the learning and evaluation process. The program is in the fourth year of a seven-year implementation period, and in the second year of CoSIP support which concentrates on four areas: Advising, Projects Development, Competency Examinations and overall WPI Program Evaluation. Orientation programs have been held for 107 academic advisors while "Operational Catalogs," with on-line computer registration and advisor systems established to aid construction of individualized student programs have been developed. Project liaison with over 200 corporations and agencies, faculty educational programs, and new systems for project information, registration, cost-control and evaluation are being established. Currently 408 students are registered in 287 projects involving 107 faculty. The projects include work with 59 off-campus agencies or corporations, and WPI's three regional project centers. WPI is now opening a CoSIP-supported model residential project center in Washington, D.C. Five faculty and 92 students have been selected to participate in 1974-75. All 12 academic departments have developed competency examinations, with 80 administered by June 1974, and 410 by June 1975. To measure the effectiveness of the WPI Program in meeting stated objectives and observe the dynamics of collegiate change, CoSIP supports (1) overall evaluation by a national advisory panel, (2) external evaluation of undergraduate achievement and attitudes; (3) external evaluation of faculty attitudes towards the program and response to the changes it requires. All studies are now in their second year. Major results will be reported in 1975.

IV

COSIP B PROJECT ABSTRACTS

167 AMHERST COLLEGE, Amherst, Massachusetts 01002. Dr. Gerald P. Brophy, Professor of Geology, 413-542-2233.

A COSIP-B interinstitutional program in Geology involving Williams, Amherst, Mt. Holyoke and Smith Colleges (WAMSIP) has created a lasting atmosphere of faculty and student cooperation and interchange which has greatly strengthened our individual academic programs. Field studies were conducted for three years by two groups, one in Colorado and one in North Carolina, each group composed of faculty and students from the four colleges. Field research was used as the basis for courses of identical nature at each college. Students and staff conducted joint studies and were interchanged. The courses focused on a common problem, one in Petrology and one in Paleontology-Stratigraphy. Interinstitutional meetings during the academic year were frequent and provided a forum for discussion of results obtained and problems generated. The program has resulted in the modernization of related courses with (1) a marked increase in the use of current literature, (2) development of course content around a research problem; (3) use of sophisticated instrumentation by undergraduates; (4) strong interinstitutional cooperation in Geology; (5) evaluation of institutional programs by the group and recommendations to improve areas of weakness, (6) cooperation in acquiring of new staff with expertise in areas not currently represented among the colleges. The program relied heavily on the Excess Property Program, which proved invaluable. In summary, the program has strengthened our departments and markedly increased the numbers of students majoring in Geology at each of the four colleges.

168 ASSOCIATED COLLEGES OF THE MIDWEST, Chicago, Illinois 60610. Irma M. Lucht, Director, ACM Periodical Bank, 312-664-9580

The COSIP grant made possible the creation of the Periodical Bank's balanced collection of heavily used periodicals which provides the basis for rapid periodical article photocopy service to member libraries; it helped in the addition of access to the periodical collections of major research libraries in the Chicago area; it supported studies of periodical use that have been the basis of Periodical Bank acquisition and retention policies, and that have included analyses of the use patterns of the member library collections; and it has facilitated the extension of Periodical Bank service to 50 additional libraries as associate members. Because of its location in the Newberry Library building, the Periodical Bank already had access to a rich periodical collection in the humanities. The grant made it possible to increase greatly Bank holdings of scientific periodicals. These have been heavily used. Seven out of ten of the most heavily used periodicals have been science periodicals acquired with the aid of the grant. A central feature of the service has been speed. Requests are received by teletype, mail, or automatic telephone message recorder, and are processed within four to twenty-four hours for items in the central collection and sent by first class mail. The daily courier service to cooperating libraries has been successful in making the great collections of these research libraries quickly available to a broad spectrum of academic libraries ranging from community colleges to complex universities, and from Florida to Oregon. The usefulness of this service is attested by the rapid and continued growth in the number of associate member libraries, which pay an annual membership fee and photocopy charges that promise to make the Bank self-supporting in a relatively short time.

169 ASSOCIATED COLLEGES OF THE MIDWEST, Chicago, Illinois 60610. Dan M. Martin, President (312) 664-9580.

This COSIP grant provided support for a program appropriately called "The Argonne Semester." The program allowed up to fifteen students per semester from member colleges of the Associated Colleges of the Midwest (ACM) to spend a 24-week period at Argonne Laboratory for study and research. Several faculty members were also involved spending up to 14 months there. The faculty chiefly pursued their own research and also taught the student seminars. The students engaged in research under the direction of an Argonne research scientist and participated in a nuclear science-oriented interdisciplinary seminar as well as in a disciplinary seminar. During the 24-week period spent by students at Argonne, 16 weeks were spent in a combination research-seminar program and 8 weeks were spent doing full-time research. The program success was heavily dependent on the individual relationship between the student and the Argonne scientist and generally speaking this important one-to-one contact was successfully worked out. Difficulty was encountered with the interdisciplinary seminar and with declining student interest in the program.

170 ASSOCIATED COLLEGES OF THE MIDWEST, Chicago, Illinois 60610. Dan M. Martin, President (312)664-9580.

This inter-institutional program was designed to provide undergraduate students in biology, economics, sociology, political science, psychology and anthropology a field research laboratory for the application of concepts and methodologies learned in the classroom. The small Central American state of Costa Rica was the stage for this experiment. The program's central thrust was to demonstrate that field research is an effective and appropriate educational mode for undergraduates. It consisted of an intensive one-month orientation and language training period in San Jose, a four-month period for field research interspersed with seminar meetings, and a final two-week period for reporting and integrating research results. Students participating in the program received one full semester of academic credit. Scientists from member college faculties were employed to supervise research projects and to lead seminars in the program thereby providing valuable professional opportunities. Costa Rica is an extraordinarily rich site for botanical, zoological and social sciences research and University of Costa Rica faculty often served as expert consultants on selected topics. Several students contributed sections of a study of municipal government in Costa Rica which was published in Spanish and adapted for use in Costa Rican schools. Another group of students took part in a continuing study collecting base line data on a remote agricultural and forest region of Costa Rica in which sudden modernization will soon be introduced by a large bauxite mining operation. Although financing this program without NSF assistance is difficult, excellent relations with Costa Rican institutions and continuing student and faculty interest have led ACM to continue its operation.

171 ATLANTA UNIVERSITY CENTER - Atlanta, Georgia 30314 Dr. J. N. Gayles, Professor (404) 524-7851

The CoSIP-B Project in the Atlanta University Center was designed essentially to buttress undergraduate chemistry instruction using audio-visual and other media techniques and also to provide a central service for Atlanta University Center Chemists as regards information concerning innovations in chemistry instruction in the specialty areas of chemistry. A major single undertaking of this program was the summer 1972 pre-college chemistry-physics program for 19 students who had been admitted to either of the four A. U. Center undergraduate colleges. The course presented the basic principles of elementary chemistry and elementary physics in a unified manner and was successful in assisting many of the students in their preparation for the 1972-73 school year. The effectiveness of the program was reflected in the students' grades for the following semester. An additional major feature of the project was its institution of a program of instruction in the history of science and technology. The project has engaged in a wide variety of chemistry instructional improvement activities and central information resource activities. The project has involved students in a research environment, laboratory experimentation test environments and in responsible positions as research laboratory assistance.

172 AUSTIN COLLEGE. Sherman, Texas 75090. Frank C. Edwards, Dean of Educational Research and Development and Professor of Chemistry. ph. 214/892-9101.

Austin, Bishop, Dallas Baptist, and Texas Wesleyan Colleges within the TAGER consortium (The Association for Graduate Education and Research) created the TAGER Institute for Environmental Studies in Undergraduate Sciences (The TIES-US Project) to improve undergraduate learning through cooperative efforts. The main TAGER resource, the Green Television Network, established primarily to enhance graduate education in the region and provide continuing education for employees in science-based industries, was utilized extensively. Cooperative efforts among departments were developed wherever possible but the Institute was structured across disciplinary lines into four areas--Experimental and Theoretical Studies, Science Teacher Education, Urban Studies, and Ethnic and Racial Studies--to meet educational needs and as a strategy of cooperation. Experimentation in ways of using the Network included traditional courses by lecture with one teacher on video with audio "talkback" from distant students, a more interactive two-way audio/video mode, TV planning conferences, TV "office hours," interdisciplinary team-taught courses with faculty leadership at each location, seminars utilizing resource persons in the region and visiting speakers, use of the TV side-bands to connect remote terminals to central computing facilities, and summer conferences for high-ability high school students (with supplementary NSF-SSTP funds). The TIES-US Project helped extend TAGER activities to undergraduate education and programs beyond the natural sciences and engineering, thereby enriching curriculum offerings. Experimentation in TIES-US with curricular restructuring and use of educational technology stimulated change on each campus. The Learning Center of Dallas Baptist College provided a special focus for restructuring courses using behavioral objectives and levels of competency, and for planning and training for media usage, particularly modular learning units on TV tape for central distribution to study carrels. Finally, The TIES-US Project provided experience of value to planning and implementing further regional cooperation.

GREAT LAKES COLLEGES ASSOCIATION. Ann Arbor, Michigan 48018.
173 William J. Gilbert, Albion College, Professor of Biology, (517) 629-5511, Ext. 266.

This program had two objectives: To provide, as an adjunct to the curriculum of each of the member colleges, a seashore experience for a number of inland college students and 2) to survey the undergraduate opportunities for students in marine sciences. Twenty two students from 11 of the 12 Great Lakes College Association (GLCA) colleges participated in a six-week course titled Marine Biology held at the University of California Santa Barbara (UCSB). The course was designed to emphasize an understanding of the organisms associated with and the ecology of a number of habitats, including esturine, innershore, mud flat, sandy beaches, rocky intertidal, subtidal, kelp bed, and deep water. This curriculum-improvement aspect of the program required cooperative effort between the GLCA, which was responsible for designing and coordinating the program and UCSB and its Marine Science Institute which provided the facilities and acted as the fiscal agent. The survey of marine opportunities for undergraduate students was completed and a report submitted to the GLCA and NSF. The report consisted of three main sections in addition to its introduction and recommendations. These sections were 1) Current opportunities for (GLCA) undergraduates in existing programs, 2) Opportunities for (GLCA) programs utilizing facilities of other institutions, and 3) Opportunities for GLCA owned and operated facilities.

KANSAS STATE UNIVERSITY, Manhattan, Kansas 66506 C. E. Hathaway, Head
174 Department of Physics, 913-532-6786

From September 1969 to August 1972, Kansas State University joined with six non-Ph.D. granting institutions to form the Consortium for the Advancement of Physics Education, an experiment to determine what services can be provided for the college physics departments by a university, and what benefits can be derived by the university through such interaction. CAPE conducted a number of programs supported by a COSIP-B grant. The junior-senior symposium which emphasized student involvement in "hands on" experimental physics was the most successful activity. These symposia on "Low Energy Nuclear Physics", "Computational Physics", and "Modern Optics" involved students in experiences that motivated further studies. Initial expectations of the senior honors research grants were too high. Some proposals were of excellent quality, but most required extensive revision and elucidation. Apparent problems were: (1) faculty suggested projects to students which were too grandiose; (2) faculty needed to make a stronger commitment in overseeing the projects. Nevertheless, the performance of independent senior projects proved to be a valuable tradition to be established. The junior-senior summer research assistantship program was satisfactory but did not produce uniform enthusiasm of the faculty at K.S.U. Student reaction was strongly positive. The faculty summer program ranged from straight collaboration with K.S.U. research groups to the development of pedagogical materials. More experimental projects to be continued at the home institute would have been of greater educational benefit. The faculty symposium on physical science teaching was successful in stimulating thinking. The presentations were excellent and the discussions were active. There were long lasting changes in attitude, thinking and morale toward the teaching of physical science. The program to provide KSU shop facilities to the schools failed because of lack of time of and personal contact with personnel in the colleges.. An overall view indicates the project was worth the effort expended. Participating physics majors enjoyed those activities that strengthened their professional motivation and training.

175 MASSACHUSETTS, UNIVERSITY OF. Amherst, Massachusetts 01002. Thomas Arey, Assistant Chairman of Astronomy Program. 413-545-2194.

The National Science Foundation through the COSIP B program has provided a grant to the Five College Astronomy Department (Amherst, Hampshire, Mount Holyoke, Smith and the University of Massachusetts) to implement a locally based teaching and research program in radio astronomy. The focus of the project has been the construction of a meter wavelength radio observatory--the Five College Radio Astronomy Observatory. The observatory consists of four 120' diameter antennas operating at meter wavelengths. Two small buildings house an observing room for the electronics and generators. Four more antennas are under construction. The observatory is a major addition to the scientific facilities of the United States and has yielded data on 1) the long term variation of pulsars, 2) cosmic radio bursts of unknown origin, and 3) changes in pulse shape of pulsars. The Five College Observatory has proved an excellent vehicle for involving students with, and training them for careers in science. Undergraduate students have participated in construction (both of antennas and electronics) as well as in the gathering and analysis of the scientific data. Senior theses based on data taken at the observatory have been published in the astronomical literature. In addition, students have done pedagogical projects including the construction of an interferometer for studying active regions on the sun. The observatory is also visited by larger courses of non-science students presenting them a clearer idea of scientific research and of radio astronomy in particular. It has proved very effective in giving a sense of reality to astronomical research for such students. Five College Astronomy provides a successful example of inter-institutional cooperation. Courses are planned in common, and are open to students from all five campuses. The radio observatory has proved an important focus to educational activities in the Five College Department.

176 MEMPHIS STATE UNIVERSITY, Memphis, Tennessee, 38152
William H. Zuber, Associate Professor of Chemistry 901-321-1631

NSF GY-6879 proposed to establish a cooperative effort between Memphis State University and 10 smaller schools to expose faculty and students from these smaller schools to some advanced chemistry courses and modern chemical instrumentation. We were able to offer advanced courses in organic, physical, inorganic and biochemistry for students in 6 of these small schools. These included both formal courses during the academic year and tutorial classes during the summer. This program helped establish a cooperative program for upper division classes for 3 of the small schools in Jackson, Tenn. This should allow a stronger chemistry major for these schools to be offered. A consultant program helped one of the schools, Rust College, Holly Springs, Miss., obtain accreditation from the Southern Association. An undergraduate research program was started at this school. This program was aided by the use of the library and research equipment at Memphis State. Two faculty members from 2 of the schools were able to obtain coursework and research leading toward the completion of a graduate degree. Approximately 40 students from 6 schools in 3 years were able to obtain training in chemistry that was not previously available. This training helped some of these students enter graduate school and professional schools. Three of the schools (in Jackson, Tenn.) were able to establish a schedule to continue offering courses such as physical chemistry and instrumental analysis. One of the other schools (Rust College, Holly Springs, Miss.) has offered physical chemistry on a regular basis since the termination of the grant.

MIDDLE-ATLANTIC EDUCATIONAL & RESEARCH CENTER (FRANKLIN & MARSHALL COLLEGE),
177 Lancaster, Pennsylvania 17604. Paul W. Ross, Director of Academic Computing. (717) 393-3621.

The grant provided for training faculty in the participating colleges in extending their use of the computer in their classroom activities. A coordinator visited the colleges at regular intervals. Two three-week summer training sessions in programming, and development of classroom materials were held. Franklin & Marshall College, Juniata College, Lebanon Valley College, Messiah College, and Wilson College participated in the program. The computer was a Univac (RCA) Spectra 70/46 time-sharing system. The coordinator visited the institutions at 6 to 8 week intervals, giving short seminars, and consulting with individuals desiring to use the computer in their classroom activities. Support also involved production of documentation for specific computer applications, testing of programs and ideas, and occasional short seminars describing new system features and general approaches to be used for certain kinds of problems and advanced concepts. Lectures were given before student and faculty groups not previously involved in computer use. The estimated penetration of computer utilization in most faculties was estimated to be 20-25%, the largest concentration in the natural sciences.

NEW ENGLAND COLLEGE. Henniker, New Hampshire 03242. Taylor H. Loop,
178 Assistant Professor of Geology. 603-428-2354.

A unique, cooperatively conducted undergraduate program in Marine Science was supported by N.S.F. funding COSIP-B (GY-8429) for the academic years of 1970-71, 1971-72, and 1972-73. The program involved ten member institutions within the New Hampshire College and University Council (NHCUC) and Suffolk University. By utilizing faculty with expertise in specific marine related disciplines from the member institutions, the program exceeded the resources of any single institution. The program consisted of a fall and spring introductory course which was conducted each Saturday on the campuses of member institutions. The introductory courses were inter-institutional and multi-disciplinary in nature with as many as ten faculty participating each term. An additional six week summer institute offered a program of three courses representing specific marine disciplines, two of which must be selected by each student. The aim of the program was to (1) create an awareness and an appreciation for the field of marine science and (2) to provide a basis upon which students might pursue marine disciplines in depth. The enthusiasm of participating students and faculty provide ample testimony as to the merit of this effort. Currently, we are offering a program which is funded by the member institutions of NHCUC-SU and is a direct outgrowth of the program which was developed under the previous three years of N.S.F. funding.

OCCIDENTAL COLLEGE
179 Los Angeles, California 90041
John S. Stephens, Jr., Professor of Biology
213-255-5151

The VANTUNA Oceanographic Consortium developed a deepwater oceanographic teaching capability for more than 50 Southern California educational institutions. Cosip support (1969-71) enabled Occidental College to accept ownership and convert an 85' fishing vessel into a well equipped teaching/research ship. These funds also supplemented operational costs during the initial two years of operation. Because of the VANTUNA, an oceanographic emphasis has been established at Occidental and new courses in Biological Oceanography and Advanced Marine Biology developed. This program is responsible for attracting many gifted students to the college. Undergraduate students at Occidental are responsible for much of the shipboard instruction for user institutions, an uncomparable undergraduate experience. The program has stimulated student/faculty research and Occidental is now responsible for monitoring fish populations of San Pedro Bay including Los Angeles Harbor. Two faculty/student research papers have been published on this study. Occidental's Biology program now receives grant support in marine environmental studies from four public and private agencies. A non-science program in Marine Studies has been developed and supported in the area of man's impact on the coastal zone. All programs have stimulated interdisciplinary work at Occidental, especially between the Biology, Chemistry, and Economics Departments. The VANTUNA is now established as an important Southern California teaching facility. She operates 3-4 days/week all year. During 1973, 38 institutions made use of the VANTUNA. Eight of these colleges and universities are largely dependent upon this facility for their marine program. The consortium nature of the program has strengthened interinstitutional cooperation and communication, and a number of interinstitutional research programs are now underway. Cooperative programs have also developed between the VANTUNA and a number of State and City agencies.

180 PACIFIC NORTHWEST ASSOCIATION FOR COLLEGE PHYSICS. Department of Physics, University of Washington, Seattle, Washington 98195. James B. Gerhart, Executive Officer. 206-543-2770.

The incorporation of varied teaching techniques and locally prepared materials into introductory physics and physical science courses at community colleges, four-year colleges, and graduate universities throughout the Northwest was the focus of this project. First-year activities centered on six weekend conferences, two in each of three natural geographic subregions. Greatest emphasis was given to discussion of effective ways of leading students to grasp basic concepts in mechanics, electricity and magnetism, and relativity. Participants also became closely acquainted with the teaching and research facilities of two major institutions in their area, and they exchanged views with their colleagues on how physics was being taught in the region. Consideration of imaginative approaches to physics teaching nationally, particularly as they were directed to special types of students, was left to a seventh conference, this one region-wide in attendance. The capstone of the entire project was a summer institute devoted to local preparation of instructional materials. Drawing on the content of previous conferences, nearly thirty instructors met for two months with a resident faculty of three. The techniques and materials developed by each individual were implemented during the project's second year and reported at a region-wide conference at the end of that year. The final project activity was a four-day workshop on the preparation of test questions. Several important benefits have accrued from this program. First, it has involved instructors in preparing or adapting their own materials rather than having to accept or reject in toto those of another group. Second, it has mixed together instructors from all types of institutions and emphasized their common concern for effective teaching rather than exaggerating the artificial barriers that already separate them unduly. Third, it has demonstrated that a moderate sized group with substantial commonality of interest is effective both in sharpening the ideas of the individual and in encouraging him to productive effort. Finally, it has illustrated the obvious facts that summers are the periods of the year in which small-college faculty have the time to work on course improvements but that local funds and stimulation rarely exist for their support.

181 PACIFIC UNIVERSITY. Forest Grove, Oregon 97116. David R. Malcolm, Chairman Division of Science and Mathematics. 503-357-6151.

The Malheur Environmental Field Station Consortium has completed renovation and conversion of a former job corps center located on the Malheur National Wildlife Refuge in Oregon into an established center for ecological and other field studies; acquired the basic scientific equipment and library necessary for undergraduate instruction at the station; and developed a strong and well-balanced summer program. During 1973 over 3,000 people enjoyed the use of the accommodations provided by the station. Staffed by a director and an assistant director, the station is open throughout the year furnishing accommodations for field trips by grade and high school, college, and amateur groups; providing a site for short courses in specialized topics offered by member institutions of the Consortium, and offering facilities for undergraduate research. An adequate inventory of basic field, laboratory, storage, analytical, and A-V equipment has been achieved. A modest and selective library has also been developed. By installing laboratory furniture and cabinets, sinks, and additional electrical outlets, four undergraduate teaching and six undergraduate research laboratories have been provided. A fully-equipped dark room and specialized storage and animal rooms are also available for use. The summer session, consisting of four sequential three-week terms, has increased its enrollment each year. Courses have been offered in biological, geological, and archeological fields. An even broader spectrum of courses is anticipated for this year. The visiting scientist seminars have been highly successful. Students come to the station not only from the 17 colleges in the Consortium, but from throughout the Pacific Northwest and across the country.

182 SAINT AUGUSTINE'S COLLEGE. Raleigh, North Carolina 27611. Jeffery Gipson, Professor and Chairman, Department of Chemistry. (919) 832-8173.

A consortium with Meredith College, Raleigh, North Carolina to increase availability of courses to students from each institution and to enhance teaching capabilities of certain faculty from each institution through further study. Examples of courses available at St. Augustine's College not offered at Meredith College are radiochemistry, entomology, statistical inference, and juvenile delinquency. Among the courses available at Meredith College not offered at St. Augustine's College are biochemistry, plant anatomy, mathematical statistics, and comparative cultures. Purposes were well served during these interchanges which are continuing. Six faculty members were given leave to do further study. Of these six, two were able to complete terminal degree work. A new course, instrumental analysis, was added to the science division offerings at St. Augustine's College as a result of the ability to purchase additional scientific instruments through the COSIP grant. A combined workshop concerning the family and human relations was held by the two sociology departments during the COSIP grant period. Four consultants were invited to give their views on the operation of the program and to evaluate any aspect of it. Comments were favorable in all cases.

ST. JOHN FISHER COLLEGE (NAZARETH COLLEGE OF ROCHESTER). Rochester,
183 New York 14618. Clarence G. Heininger, Jr., Professor of Chemistry, (716)586-4140.

The departments of biology, chemistry, physics and mathematics of the two colleges redesigned several courses so that a larger number of students would be served by fewer course offerings, and developed new laboratory programs. The subject matter of the four-semester, 16-credit-hour calculus-differential equations sequence was adjusted so that biology majors could satisfy their minimum needs with the first semester of the sequence, and chemistry majors could satisfy theirs with three semesters, so that elementary calculus and general physics could be taken simultaneously, and so that computer utilization would be introduced. The one year course in modern physics was arranged so that the first semester could serve the chemistry department as a course in structure and bonding. The electronics laboratory was made independent of the junior course in electricity and magnetism and opened to any student with a background equivalent to high school physics. New laboratory experiments were developed in general biology, plant physiology, plant-morphology, ecology, cytology, modern physics and inorganic chemistry. A non-major biology course concerned with man and the environment was developed. A goal of the project had been to increase the cooperation and coordination between the two colleges. This happened in physics and mathematics.

SETON HILL COLLEGE. Greensburg, Pennsylvania 15601. Sister Ann Infanger,
184 Professor of Biology. 412-834-2200.

A three-year COSIP-B grant triggered an extensive cooperative program between the biology departments of Seton Hill College and Saint Vincent College. The program includes an exciting new curriculum which provides for undergraduate students to be actively involved in teaching and research and allows faculty to teach in just their special areas. Each professor teaches his main subject in a topics course for nonscience majors, in a portion of the general biology course for science majors, in one advanced course, and in senior research, teaching, and seminar. All biology courses are offered to students of both colleges, and there are no duplications. The faculty are stimulated to conduct research in order to encourage students to collaborate. Students majoring in biology study general chemistry and general biology as freshmen. In the sophomore year they choose an area of concentration: cell biology, organismic biology, or population biology. They elect four advanced courses, two in their area of concentration and two others. Seniors participate in research, teaching, and seminar in their area of concentration. The curriculum change was advised by a consultant, Dr. Ariel Loewy of Haverford College. Equipment and materials needed for the program were obtained by grant purchases and federal excess property. To up-date their knowledge, four of the six biology faculty received salaries and travel funds in order to conduct research and study in the summers. Contact with biologists from other colleges was provided also by visiting lecturers. Students were aided by assistantships for research and teaching. A "fall-out" from the grant was the stimulation of other departments of our colleges to increased cooperation, and the initiation of regional meetings for biology teachers of colleges of western Pennsylvania and West Virginia. The academic deans, biology faculty, and biology majors are enthusiastic about the new curriculum and improved biology facilities.

185 SIMMONS COLLEGE and EMMANUEL COLLEGE, Boston, Mass. 02115. James U. Piper Chairman, Simmons College Chemistry Dept., 617-738-2181.

The Chemistry Departments of Emmanuel and Simmons Colleges initiated a cooperative effort to increase efficiency in teaching upper-division courses, provide facilities for a modern laboratory curriculum and make more time available for general curricular improvements. In 1968 the NSF Instructional Scientific Equipment Program made possible purchase of a nuclear magnetic resonance(NMR) spectrometer and initiation of interinstitutional courses in the junior and senior years. These courses are listed in both College catalogues, students register by normal procedures and no tuition exchange is involved. Further support was obtained in 1970 under an NSF COSIP type B grant. At present each department is responsible for a six-course core program for its own majors. Six advanced courses are offered interinstitutionally to provide electives for the junior and senior years. Various methods for distributing the responsibilities for these courses have been tried. A mass spectrometer was placed at Emmanuel to balance the NMR spectrometer housed at Simmons. Further equipment acquisitions combined with construction of new facilities at Simmons and renovations at Emmanuel have resulted in excellent facilities. The combined interests of the faculties result in a wide variety of senior-research opportunities. No cooperative program is free of difficulties. Institutional decisions(the calendar being the foremost example) affect the program and the individual departments must learn to work together. However, in this case, the Chemistry Departments of two women's Colleges located across the street from each other have been able to achieve significant improvements in their programs by a cooperative effort.

186 SOUTHERN COLLEGE UNIVERSITY UNION (SCUU)
Danville, Kentucky 40422
Harold N. Hanson, Dean of Instruction, Centre College (606) 236-5211

The purpose of this project was the planning of inter-institutional cooperation in the natural and social sciences among the members of this consortium. These members include: Birmingham-Southern, Centenary, Centre, ~~Emory and Henry~~, Fisk, Hendrix, Millsaps, Southwestern-at-Memphis, University of the South, and Vanderbilt University. The project included site visits to each member institution by the director, the planning and execution of the SCUU conference for natural scientists and mathematicians, the planning and execution of the SCUU conference for social scientists, and continued meetings of the Science Policy Committee of SCUU for purposes of implementing ideas growing out of the conferences. Ideas which have been implemented include: library program; the Oak Ridge Science Semester; and the investigations of joint degree programs involving the university (Vanderbilt) and the liberal arts colleges. These joint degree programs will result in substantial savings in time and money to the participating students.

TENNESSEE TECHNOLOGICAL UNIVERSITY, Cookeville, Tennessee 38501
187 Dr. Robert E. Martin, Tech Aqua Director. (615) 528-3140

The Tech Aqua Biological Station was founded in 1970 to strengthen the teaching of undergraduate biology through the study of living organisms in their natural habitats and to provide facilities, equipment and support for research in field biology. The Tech Aqua Consortium, composed of eleven public and private institutions in Tennessee and Kentucky, established a program of field biology courses offered during the summers of 1970 through 1972 and used the facilities for many class field trips and conferences. The Consortium was reorganized in October 1972 and now consists of ten members. Tech Aqua occupies 550 acres of Corps of Engineers land on Center Hill Reservoir. The 19 buildings with more than 30,000 square feet include: two teaching laboratories, three dormitories, a bath house, a cafeteria-auditorium, a research laboratory-library, eight staff houses, the Small Group Unit, a maintenance building, a storage building and boat dock. The teaching staff is drawn primarily from Consortium schools in which 60 PhDs have expressed interest. More than 30 of these have proposed courses with 18 people from eight schools having served as instructors in four summer programs. The Advisory Group has selected courses in Freshwater Algae, Freshwater Invertebrates, Limnology, and Ichthyology as a 'core' with four other courses being offered each summer. During the Summer '70 Session, 15 students from three schools completed 96 quarter hours credit. Twenty-six students from four schools completed 252 hours in 1971. Thirty-three students from five schools completed 313 hours in 1972. Forty-eight students from eleven schools completed 624 hours in 1973. Operational expenses have grown much faster than income with a $23,097.80 deficit in 1970-71 increasing to $33,228.48 in 1971-72 and $37,137.24 in 1972-73. Income from all sources amounts to approximately 30% of the $60,000 annual budget. The Tech Aqua Biological Station program is growing and accomplishing its original objective inspite of being relatively unknown outside the Consortium. This quality program will continue to grow as funding permits. The independent research program is increasing though not reducing the deficit significantly.

THE UNIVERSITY OF TENNESSEE, Knoxville, Tennessee 37916, J. M. Googe, Professor
188 and Head, EE Dept., (615) 974-3461.

This program was designed to reduce the problems of articulation for electrical engineering students at small Tennessee colleges who transfer to the University after two years. These students are always handicapped in EE because they have not had three sophomore circuits courses which are prerequisite to all further courses. Eleven permanent staff members were chosen from smaller institutions to come to U.T.K. to take these courses. They then returned to their schools with sets of laboratory equipment necessary for teaching the circuit theory courses and labs. The following schools were invited to participate: Bethel College, Carson-Newman College, David Lipscomb College, East Tennessee State University, Hiwassee College, Knoxville College, Middle Tennessee State University, Tennessee State University, University of Chattanooga, Tennessee, Wesleyan, University of Tennessee, Martin. The results of the program were disappointing in that the number of transfer students did not increase. The principle benefit of the program was the excellent lab equipment obtained by the participating schools.

UNIVERSITY OF TENNESSEE, KNOXVILLE COLLEGE, KNOXVILLE, TENNESSEE 37916
189 Charles A. Lane Associate Professor of Chemistry 615-974-2959

The purpose of the project is to establish cooperation between the chemistry departments at Knoxville College and The University of Tennessee. This project has resulted in the establishment of undergraduate research at KC, new equipment for both schools, and student exchange. The student exchange has resulted in savings since KC does not have to offer physical chemistry laboratory for 2-4 students and UT does not have to schedule an extra quarter of qualitative organic analysis. The undergraduate research program has been very active and is still expanding. The satisfaction with the program at KC is very high. Although the grant terminated September 1974 the cooperation and programs continue, and the KC chemistry department has independently obtained a much larger grant for undergraduate research and training.

V

KEYWORD INDEX TO SMALL COLLEGE SCIENCE

The index consists of a keyword permutation of indexing statements provided by the project director for each COSIP grant. There are two major categories of index entries as indicated by the letter "C" or "N" in the far right hand column of each entry. The letter "C" refers to a COSIP project activity, the letter "N", a non-COSIP related undergraduate science activity. Every index entry (whether "C" or "N") is keyed to a COSIP project abstract, (the number in the far right hand column), and thus the institution where the activity occurs. Obviously not all indexed activities will be referred to in, or implied by, the corresponding abstract. The interested reader may contact the listed project director for further details.

To illustrate the utility of the index, consider the following statement which describes a non-COSIP supported activity at the college whose abstract number is 108:

Computer Modeling for Non-science Majors

This statement will emerge in the index in four separate alphabetical locations as follows:

Non-science Majors. =	**Computer** Modeling for	108 N
for Non-science	**Majors.** = Computer Modeling	108 N
Majors. = Computer	**Modeling** for Non-science	108 N
Modeling for	**Non-science** Majors. = Computer	108 N

The reader searching for any one of the keywords (boldface type) is referred, by the abstract number, to the appropriate institution and provided with a local contact person.

KEYWORD INDEX

This index consists of a permutation of keyword phrases that identify programs, projects, benefits, and other special features developed at the participating institutions and described in the preceding abstracts section. The number in the right-hand column is the abstract number. The prefix C indicates that the features referred to have been COSIP- funded. The prefix N indicates that the features have been developed, without the benefit of COSIP funds, at the institution identified in the abstract.

```
    COMMUNITY AND OFF- CAMPUS SERVICE.=                          N 084
IES.=              OFF- CAMPUS STUDY AND RESEARCH OPPORTUNIT     C 057
 PARTICIPATION.=   OFF- CAMPUS SUMMER UNDERGRADUATE RESEARCH     C 069
 REMOTE STATE COLLEGE CAMPUSES.=                                 C 128
          INSTRUCTIONAL CAPABILITIES INCREASED.=                 C 152
  EXPANSION OF RESEARCH CAPABILITIES.=                           C 057
ND INSTITUTION RESEARCH CAPABILITY IMPROVEMENT.=   FACULTY A     C 148
S.=                VIDEO CAPABILITY IN PSYCHOLOGY LABORATORIE   C 163
                COMPUTER CAPABILITY IN SCIENCE INSTRUCTION.=     C 025
    DEVELOPED COMPUTER CAPABILITY.=                              C 103
 UNDERGRADUATE RESEARCH CAPABILITY.=                             C 082
BASIC COMPUTER LANGUAGE CAPABILITY.=                             N 121
     COMPUTER SCIENCE CAR POOLING.=                              N 131
      MASS SPECTROMETER CARBON COMPOUNDS CHEMISTRY COURSE.=      N 055
                        CARBON-14 DATING LABORATORY.=            N 096
        LINN COUNTY DAY CARE CENTER.=                            C 028
.=               FACULTY CAREER DEVELOPMENT PERSONNEL PROGRAM    N 007
                 BIOLOGY CAREER ELECTIVES.=                      C 125
                         CAREER INTERNSHIP PROGRAM.=             C 062
SCIPLINARY PARA-MEDICAL CAREER PROGRAM.=              INTERDI    N 125
OTIVATION.=      SCIENCE CAREERS DOCTORAL POTENTIAL STUDENT M    C 094
IP PARTICIPANTS SCIENCE CAREERS MOTIVATION.=          NON-COS    N 094
TICIPATION INFLUENCE ON CAREERS.= UNDERGRADUATE RESEARCH PAR     C 069
              INDIVIDUAL CARRELS FOR CHEMISTRY LABORATORIES.=    N 185
                         CARTOGRAPHIC LABORATORY INSTALLED.=     C 116
                  PHOTO- CARTOGRAPHY LABORATORY.=                C 099
L CONCEPTS.=             CASSETTE AUDIO RECORDINGS OF CHEMICA    C 008
OR LAB TECHNIQUES.=      CASSETTE FILM LOOPS AND VIDEOTAPES F    C 119
EMBLIES.=                CATALOG OF LECTURE DEMONSTRATION ASS    N 008
    COMMUNITY RESOURCES CATALOG.=                                C 115
E USE.=                  CATALOGS OF SPECTRA FOR UNDERGRADUAT    N 118
    RACIST ATTITUDES IN CEDAR RAPIDS SCHOOLS.=                   C 028
       AIR POLLUTION IN CEDAR RAPIDS.=                           C 028
TORY.=   REMODELING FOR CELL BIOLOGY AND MICROBIOLOGY LABORA     C 080
OLOGICAL PRINCIPLES AND CELL BIOLOGY.=          COURSES IN BI    C 116
       KELLER METHOD IN CELL BIOLOGY.=                           N 046
RCH INSTRUMENT USAGE IN CELL PHYSIOLOGY.=               RESEA    C 046
RSES IN COMPARATIVE AND CELLULAR PHYSIOLOGY.=             COU    C 159
                 ECOLOGY CENTER - GREAT MOUNTAIN FOREST.=        C 065
                 SCIENCE CENTER - TALCOTT MOUNTAIN.=             C 065
                COMPUTER CENTER AND HARDWARE.=                   C 126
                COMPUTER CENTER AND STATISTICS LABORATORY.=      C 069
               FILM-LOOP CENTER CHEMISTRY.=                      N 074
      ACADEMIC COMPUTER CENTER DEVELOPMENT.=                     N 098
                COMPUTER CENTER DIRECTOR.=                       C 005
=            ESTABLISHED CENTER FOR COORDINATION OF RESEARCH.    N 006
                         CENTER FOR DIGITAL COMPUTING.=          C 150
EGIONAL USE OF LEARNING CENTER FOR INSTRUCTIONAL DESIGN.=  R     C 172
                COMPUTER CENTER IN SCHOOL OF ENGINEERING.=       N 143
                COMPUTER CENTER INSTRUCTION RESEARCH.=           N 113
                COMPUTER CENTER PHYSICS PSYCHOLOGY.=             C 113
                COMPUTER CENTER.=                                C 083
MPROVEMENTS IN COMPUTER CENTER.=                            I    C 030
 AND MATERIALS RESOURCE CENTER.=                   CURRICULUM    C 040
ION OF FORMER JOB CORPS CENTER.=                       CONVERS   C 181
TERDISCIPLINARY SCIENCE CENTER.=              ESTABLISHING IN    C 094
   LINN COUNTY DAY CARE CENTER.=                                 C 028
      MATERIALS STUDIES CENTER.=                                 C 035
EVELOPMENT AUDIO-VISUAL CENTER.=                            D    C 039
IO-VISUAL TEACHING AIDS CENTER.=                          AUD    C 107
                   MEDIA CENTER.=                                N 038
UNIVERSITY AUDIO-VISUAL CENTER.=                                 N 057
                 SCIENCE CENTER.=                                N 158
     SCIENCE ACTIVITIES CENTER.=                                 N 174
  ENVIRONMENT EDUCATION CENTER.=                                 N 086
NTED BEHAVIORAL SCIENCE CENTER.=              LABORATORY ORIE    N 094
ONAL ENVIRONMENTAL DATA CENTER.=                        REGI     N 002
TED COMPUTER CALCULATOR CENTER.=                STUDENT OPERA    N 067
          AUDIO-VISUAL CENTER.=                                  N 152
  ENVIRONMENTAL STUDIES CENTER.=                                 N 158
TERDISCIPLINARY SCIENCE CENTER.=                            IN   N 086
   EDUCATIONAL COMPUTER CENTER.=                                 N 091
          LAKE BIOLOGY CENTER.=                                  N 086
 UNDERGRADUATE COMPUTER CENTER.=              ESTABLISHMENT OF   C 015
E RESEARCH AND TEACHING CENTER.=   OFF CAMPUS NATURAL SCIENC     N 043
```

INTEGRATEO SEQUENTIAL	CHEMISTRY LABORATORY PROGRAM.=	C 118
TES.= PHYSICAL	CHEMISTRY LABORATORY FOR UNDERGRADUA	C 189
	CHEMISTRY LABORATORY MANUALS.=	C 038
METALLURGICAL	CHEMISTRY LABORATORY EQUIPMENT.=	C 044
ORGANIC	CHEMISTRY LABORATORY EQUIPMENT.=	C 082
	CHEMISTRY LABORATORY RENOVATION.=	C 034
INTEGRATEO	CHEMISTRY LABORATORY COURSES.=	C 101
CIENCE MAJORS.=	CHEMISTRY LABORATORY COURSE FOR NONS	N 010
INTEGRATEO TWO YEAR	CHEMISTRY LABORATORY SEQUENCE.=	N 010
NORITY STUDENTS.=	CHEMISTRY LABORATORY TUTORIAL FOR MI	N 116
EQUIPMENT/ORGANIC	CHEMISTRY LABORATORY.=	C 079
IMPROVED PHYSICAL	CHEMISTRY LABORATORY.=	C 047
NOED SELF-PACED PROJECT	CHEMISTRY LABORATORY.= OPENE	C 067
IGITAL LOGIC DEVICES IN	CHEMISTRY LABORATORY.= USE OF D	C 073
JUNIOR-SENIOR	CHEMISTRY LABORATORY.=	C 121
SPECIALIZED PHYSICAL	CHEMISTRY LABORATORY.=	C 071
ENVIRONMENTAL	CHEMISTRY LABORATORY.=	C 091
CTION PROGRAMS/PHYSICAL	CHEMISTRY LABORATORY.= DATA REDU	C 147
PROJECT ORIENTED	CHEMISTRY LABORATORY.=	C 062
FORENSIC	CHEMISTRY LABORATORY.=	N 019
ROJECT-ORIENTED ORGANIC	CHEMISTRY LABORATORY.= P	N 070
ADVANCED	CHEMISTRY LABORATORY.=	N 070
OMPUTER USE IN PHYSICAL	CHEMISTRY LABORATORY.= C	N 110
GENERAL	CHEMISTRY LEARNING RESOURCES ROOM.=	N 044
	CHEMISTRY LIBRARY HOLDINGS.=	C 096
ON.=	CHEMISTRY LIBRARY PERIODICALS ADDITI	C 082
IENCES.= PHYSICS AND	CHEMISTRY MAJOR OPTION FOR HEALTH SC	C 120
TEGRATED CURRICULUM FOR	CHEMISTRY MAJORS.= IN	C 099
CURRICULUM STUDIES	CHEMISTRY MATHEMATICS PHYSICS.=	C 165
	CHEMISTRY OF THE ENVIRONMENT.=	C 120
INTERDISCIPLINARY	CHEMISTRY PHYSICS COURSES.=	C 101
LAB EXPERIMENTS BIOLOGY	CHEMISTRY PHYSICS PSYCHOLOGY.=	C 074
IZED SYSTEM INSTRUCTION	CHEMISTRY PHYSICS.= PERSONAL	C 115
CURRICULUM DEVELOPMENT	CHEMISTRY PHYSICS.= EQUIPMENT	C 074
AUDIO-VISUAL INORGANIC	CHEMISTRY PRE-LAB INSTRUCTION.=	C 141
MS.= STUDENT	CHEMISTRY PSYCHOLOGY RESEARCH PROGRA	C 094
BIOLOGY	CHEMISTRY PSYCHOLOGY BUILDING.=	N 041
JORS.= FLEXIBLE	CHEMISTRY REQUIREMENT FOR BIOLOGY MA	C 118
SPACE RENOVATION FOR	CHEMISTRY RESEARCH.=	C 014
NONCREDIT	CHEMISTRY SHORT COURSES.=	N 116
RESEARCH SUPPORT FOR	CHEMISTRY STUDENTS AND FACULTY.=	C 130
ENCE.=	CHEMISTRY TOPIC-ORIENTED COURSE SEQU	C 108
.= TUTORIAL SESSIONS/	CHEMISTRY TOPICS AND INSTRUMENTATION	C 176
AUDIO-VISUAL	CHEMISTRY TUTORIAL.=	N 019
N.= CLINICAL	CHEMISTRY UNDERGRADUATE CONCENTRATIO	N 111
S GLASSWARE FOR ORGANIC	CHEMISTRY.= FLAMELES	C 010
ORATORY IN INTRODUCTORY	CHEMISTRY.= SELF-PACED LAB	C 140
BIOCHEMISTRY MAJOR IN	CHEMISTRY.=	C 140
BIO-ORGANO-ANALYTICAL	CHEMISTRY.=	C 171
STUDENT EXCHANGE IN	CHEMISTRY.=	C 189
LABORATORY EQUIPMENT IN	CHEMISTRY.=	C 024
RSE AND APPLICATIONS TO	CHEMISTRY.= BIOCHEMICAL COU	C 104
ROMATOGRAPHY IN ORGANIC	CHEMISTRY.= GAS CH	C 133
LTY RESEARCH INITIATION	CHEMISTRY.= FACU	C 165
AUDIO-TUTORIAL ORGANIC	CHEMISTRY.=	C 171
DERGRADUATE RESEARCH IN	CHEMISTRY.= UN	C 189
OPHOTOMETRY IN FRESHMAN	CHEMISTRY.= SPECTR	C 133
RRICULAR DEVELOPMENT IN	CHEMISTRY.= CU	C 137
RUMENTATION FOR ORGANIC	CHEMISTRY.= INST	C 091
TITRATIONS IN FRESHMAN	CHEMISTRY.= POTENTIOMETRIC	C 133
LABORATORY PROJECTS IN	CHEMISTRY.= INDEPENDENT	C 136
ISUAL AIDS FOR PHYSICAL	CHEMISTRY.= AUDIO-V	C 142
PECTROSCOPY IN FRESHMAN	CHEMISTRY.= S	C 133
SITIONS FOR PHYSICS AND	CHEMISTRY.= LIBRARY ACQUI	C 163
OPHOTOMETRY IN PHYSICAL	CHEMISTRY.= INFRARED SPECTR	C 133
STRENGTHENING GRADUATE	CHEMISTRY.=	C 052
ER PLANS IN PHYSICS AND	CHEMISTRY.= KELL	C 061
CALORIMETRY IN PHYSICAL	CHEMISTRY.= SOLUTION	C 133
ACED COURSE IN PHYSICAL	CHEMISTRY.= SELF-P	C 142
CEPTIBILITY IN PHYSICAL	CHEMISTRY.= MAGNETIC SUS	C 133
CORE CURRICULUM IN	CHEMISTRY.=	C 185
RESEARCH FACILITIES IN	CHEMISTRY.= IMPROVEMENT IN	N 079
O-TUTORIALS IN PHYSICAL	CHEMISTRY.= AUT	C 061
STRUCTION IN FIRST-YEAR	CHEMISTRY.= SELF-PACED IN	N 118
PES PRE-LAB INSTRUCTION	CHEMISTRY.= TV TA	N 010

120

	COURSE	IN ADVANCEO BIOCHEMISTRY.=	C 029
COMPUTER RELATEO	COURSE	IN APPLIEO MATRIX THEORY.=	C 099
ONE SEMESTER FIRST	COURSE	IN BIOLOGY.=	N 140
MODULAR	COURSE	IN BUSINESS.=	N 017
OGY.=	COURSE	IN COMPARATIVE ANIMAL PHYSIOL	C 047
UNDERGRADUATE	COURSE	IN ECONOMETRICS.=	C 061
A GEOPHYSICIST.=	COURSE	IN ENVIRONMENTAL PROBLEMS BY	C 080
	COURSE	IN INSTRUMENTAL ANALYSIS.=	C 047
BIOLOGY.=	COURSE	IN INSTRUMENTS AND METHODS IN	C 046
COMPUTER RELATEO	COURSE	IN NUMERICAL ANALYSIS.=	C 099
SELF-PACEO	COURSE	IN PHYSICAL CHEMISTRY.=	C 142
OR.= ASTRONOMY	COURSE	IN PHYSICS FOR NONSCIENCE MAJ	N 027
TELESCOPE AND ASTRONOMY	COURSE	IN PHYSICS.=	C 072
TION OF HUMAN RELATIONS	COURSE	IN SOCIAL SCIENCES.= INTRODUC	C 068
TICS.=	COURSE	INNOVATION HISTORY OF MATHEMA	C 055
BIOLOGY	COURSE	LAB EXERCISE IMPROVEMENT.=	N 009
STUDENTS.= MATHEMATICS	COURSE	MATERIALS FOR SOCIAL SCIENCE	C 096
	COURSE	OFFERINGS NONSCIENCE MAJOR.=	N 115
TOPICAL PHYSICS	COURSE	ON ENERGY.=	C 057
HY AND RELIGION.=	COURSE	ON ISSUES IN SCIENCE PHILOSOP	N 069
CONTRACT EVALUATION OF	COURSE	PERFORMANCE.=	C 123
FRESHMAN SEMINAR	COURSE	PROGRAM.=	N 029
APPRENTICESHIP	COURSE	PROGRAM.=	N 108
ZOOLOGY INTRODUCTORY	COURSE	REDIRECTION.=	C 108
SUMMER SALARIES FOR	COURSE	REORGANIZATION.=	C 079
INTEGRATED SCIENCE	COURSE	REQUIRED.=	C 083
INTRODUCTORY	COURSE	REVISION.=	C 031
ADVANCED	COURSE	REVISION.=	C 031
HEMISTRY TOPIC-ORIENTED	COURSE	SEQUENCE.= C	C 108
ICS COMPUTER CONSORTIUM	COURSE.=	STATIST	C 016
ATED BEHAVIORAL SCIENCE	COURSE.=	INTEGR	C 039
ERING DESIGN LABORATORY	COURSE.=	ENGINE	C 136
REVISED CALCULUS	COURSE.=		C 183
O SELF-STUDY STATISTICS	COURSE.=	SELF-PACE	C 009
LOGY AND POLITICAL LIFE	COURSE.=	BIO	C 028
INTRODUCTORY ECONOMICS	COURSE.=	MULTIMEDIA	C 039
MPED NUMERICAL ANALYSIS	COURSE.=	REVA	C 064
NEW BIOCHEMISTRY	COURSE.=		C 066
LOGY VISITING SCIENTIST	COURSE.=	BIO	C 113
SELF-PACED CALCULUS	COURSE.=		C 115
SCIPLINARY INTRODUCTORY	COURSE.=	MULTID	C 178
REVISED MODERN PHYSICS	COURSE.=		C 183
ASTRONOMY	COURSE.=		C 066
MODERN ELECTRONICS	COURSE.=		C 070
NONSCIENTIST CHEMISTRY	COURSE.=		C 121
ED INTRODUCTORY BIOLOGY	COURSE.=	REVIS	C 068
OPEN LABORATORY PHYSICS	COURSE.=	SELF-PACED,	C 055
FIED FIRST-YEAR BIOLOGY	COURSE.=	TEAM-TAUGHT UNI	C 118
CHEMISTRY KELLER	COURSE.=		C 120
PHYSICS AND LIFESCIENCE	COURSE.=		C 143
SCIENCE AND TECHNOLOGY	COURSE.=	HISTORY OF	C 171
DENT-TAUGHT MATHEMATICS	COURSE.=	STU	C 009
NONMAJOR GENETICS	COURSE.=		C 038
ADVANCED LEVEL ECOLOGY	COURSE.=		C 046
SELF-PACED PSYCHOLOGY	COURSE.=		C 081
GY LABORATORY AND FIELD	COURSE.=	ECOLO	C 140
L ENVIRONMENTAL BIOLOGY	COURSE.=	LOWER LEVE	C 046
HISTORY OF SCIENCE	COURSE.=		C 069
GLASSBLOWING	COURSE.=		C 089
SCIPLINARY CONSERVATION	COURSE.=	INTERDI	C 137
ECOLOGY	COURSE.=		N 078
FRESHMAN DESIGN	COURSE.=		N 117
ED BUSINESS MATHEMATICS	COURSE.=	REVIS	N 182
NCE MAJOR ENVIRONMENTAL	COURSE.=	NONSCIE	N 082
OR CHARACTER OF SCIENCE	COURSE.=	NONSCIENCE MAJ	N 087
METHODS AND STATISTICS	COURSE.=	SOCIAL SCIENCE	N 139
NCED ECOSYSTEMS BIOLOGY	COURSE.=	ADVA	N 003
AKING IN MODERN SOCIETY	COURSE.=	DECISION M	N 108
ENTED GENERAL CHEMISTRY	COURSE.=	COMPUTER ORI	N 044
BIO-ORGANIC LABORATORY	COURSE.=		C 061
CAL SCIENCE AND SOCIETY	COURSE.=	PHYSI	N 067
Y ENVIRONMENTAL SCIENCE	COURSE.=	INTERDISCIPLINAR	C 081
CABULARY FOR SCIENTISTS	COURSE.=	AUDIO-TUTORIAL VO	N 110
SOCIAL SCIENCE METHODS	COURSE.=	INTERDEPARTMENTAL	C 136
ALS FOR CHINESE SOCIETY	COURSE.=	AUDIO-VISUAL MATERI	C 039

BON COMPOUNDS CHEMISTRY	COURSE.=	MASS SPECTROMETER CAR	N 095
TTERNS NUTRITION/HEALTH	COURSE.=	NUTRITION/CULTURAL-PA	N 069
OR CONTEMPORARY SOCIETY	COURSE.=	MULTIMEDIA MATERIALS F	C 089
ITION INTERDISCIPLINARY	COURSE.=	PHYSICS ENGLISH COMPOS	C 180
CTORY BIOLOGY-CHEMISTRY	COURSE.=	INDERDEPARTMENTAL INTRODU	N 153
G THROUGH HALF-SEMESTER	COURSE.=	INTERDISCIPLINARY TEACHIN	C 080
ARY COASTAL ENVIRONMENT	COURSE.=	NONSCIENCE INTERDISCIPLIN	N 179
AL CHEMISTRY LABORATORY	COURSE.=	ENGINEERING ORIENTED GENER	C 127
TERDISCIPLINARY NUCLEAR	COURSE.=	RADIOISOTOPE LABORATORY/IN	C 067
NG FRESHMAN ENGINEERING	COURSE.=	USE OF TELEVISION IN TEACHI	C 050
MINI-	COURSES	(HALF-SEMESTER COURSES).=	C 080
ES.= BIOLOGY MINI	COURSES	AND INVESTIGATION LABORATORI	C 112
STATISTICS	COURSES	AND LABORATORY.=	C 077
ED SPECTROPHOTOMETER IN	COURSES	AND RESEARCH.= NMR/INFRAR	N 053
OCEANOGRAPHY	COURSES	AND RESEARCH.=	N 089
ES.= COMPUTER	COURSES	AND USE OF COMPUTER FACILITI	N 069
ELECTRICAL ENGINEERING	COURSES	AT SMALL SCHOOLS.=	C 188
TS.=	COURSES	BY UNITS INSTEAD OF BY CREDI	N 118
INCREASED PHYSICS	COURSES	ENROLLMENTS.=	N 101
S.= GEOG-GEOL SHORT	COURSES	FOR CREDIT BY OUTSIDE EXPERT	C 008
T OF INSERVICE COMPUTER	COURSES	FOR FACULTY.= DEVELOPMEN	C 035
ENGINEERING	COURSES	FOR NONENGINEERS.=	N 016
ALTERNATIVE SCIENCE	COURSES	FOR NONMAJORS.=	C 057
BIOLOGY	COURSES	FOR NONSCIENCE MAJORS.=	C 164
BIOLOGY TOPICS	COURSES	FOR NONSCIENCE MAJORS.=	C 184
	COURSES	FOR NONSCIENCE MAJORS.=	C 030
	COURSES	FOR NONSCIENCE MAJORS.=	C 076
NEW PHYSICS	COURSES	FOR NONSCIENCE MAJORS.=	N 136
	COURSES	FOR NONSCIENTISTS.=	C 027
SCIENCE	COURSES	FOR NONSCIENTISTS.=	N 134
MATHEMATICS	COURSES	FOR NONSPECIALISTS.=	C 034
PHYSICS	COURSES	FOR NONSPECIALISTS.=	C 034
SCIENCE	COURSES	FOR THE NONSCIENTIST.=	N 020
.=	COURSES	IN AFRICAN POLITICAL SCIENCE	C 144
CELL BIOLOGY.=	COURSES	IN BIOLOGICAL PRINCIPLES AND	C 116
INTERDISCIPLINARY	COURSES	IN BIOLOGY AND CHEMISTRY.=	N 118
FOR INTERINSTITUTIONAL	COURSES	IN CHEMISTRY.= MODELS	C 185
E CREDIT FOR LABORATORY	COURSES	IN CHEMISTRY.= FLEXIBL	N 118
PHYSIOLOGY.=	COURSES	IN COMPARATIVE AND CELLULAR	C 159
PROJECT	COURSES	IN ENGINEERING.=	N 136
MENT.= INTEGRATED CORE	COURSES	IN GENERAL EDUCATION REQUIRE	N 083
REVISED	COURSES	IN GEOGRAPHY.=	C 099
ENCES.= MODULAR	COURSES	IN HUMANITIES/BEHAVIORAL SCI	N 017
SELF-PACED LABORATORY	COURSES	IN PHYSICS.=	N 174
INTERDISCIPLINARY	COURSES	IN SCIENCES AND HUMANITIES.=	N 017
INTEGRATIVE	COURSES	IN SOCIAL SCIENCES.=	C 073
INTRODUCTION OF TWO	COURSES	IN TECHNOLOGY.=	N 068
NONMAJOR	COURSES	INTRODUCED.=	C 037
.= INTERDISCIPLINARY	COURSES	INVOLVING CHEMISTRY/BUSINESS	N 116
SCIENCE SEMINAR	COURSES	NONSCIENCE HONORS STUDENTS.=	N 134
CHEMISTRY	COURSES	NONSCIENCE MAJORS.=	C 074
SCIENCE	COURSES	RELATED TO SOCIETAL NEEDS.=	N 019
NONMAJORS	COURSES	USE INSTRUMENTS.=	N 133
TEAM-TAUGHT	COURSES	WITH PHYSICISTS.=	N 034
INSTRUCTION FOR BIOLOGY	COURSES.=	AUDIO-TUTORIAL	C 021
OF COMPUTER IN SCIENCE	COURSES.=	INTRODUCTION	C 058
ADVANCED CHEMISTRY	COURSES.=		C 176
SELF-PACED LEARNING	COURSES.=		C 002
CEPT-CENTERED CHEMISTRY	COURSES.=	CON	C 118
VANCED COMPUTER SCIENCE	COURSES.=	AD	C 034
ND ADVANCED MATHEMATICS	COURSES.=	NONMAJOR A	C 140
MATERIALS FOR CHEMISTRY	COURSES.=	AUDIO-VISUAL	C 104
CHNIQUES IN MATHEMATICS	COURSES.=	COMPUTER TE	C 040
REVISION OF	COURSES.=		C 081
ECOLOGICALLY ORIENTED	COURSES.=		C 109
ITUDES IN NONSPECIALIST	COURSES.=	FACULTY ATT	C 034
BEGINNING PHYSICS	COURSES.=		C 079
COMPUTER AND STATISTICS	COURSES.=		C 087
INARY CHEMISTRY PHYSICS	COURSES.=	INTERDISCIPL	C 101
ETHNOLOGY	COURSES.=		C 157
ONMENTAL SUMMER SESSION	COURSES.=	ENVIR	C 181
FIELD RESEARCH AND	COURSES.=		C 057
ED CHEMISTRY LABORATORY	COURSES.=	INTEGRAT	C 101
OF EXPERIMENTAL PHYSICS	COURSES.=	REVISION	C 116
ENVIRONMENTAL SHORT	COURSES.=		C 181

SEMINAR ON A	DEVELOPING COUNTRY.=	C 169
AND STUDENT RESEARCH.=	DEVELOPING INSTITUTIONS - PSYCHOLOGY	N 078
FACULTY	DEVELOPMENT AND EVALUATION.=	C 166
CURRICULUM	DEVELOPMENT AND LABORATORY MANUALS.=	C 027
MODULAR SCIENCE COURSE	DEVELOPMENT AND TESTING.=	C 017
	DEVELOPMENT AUDIO-VISUAL CENTER.=	C 039
EQUIPMENT CURRICULUM	DEVELOPMENT CHEMISTRY PHYSICS.=	C 074
ENTS.= LIBRARY SKILL	DEVELOPMENT FOR BIOLOGY/GEOLOGY STUD	C 041
DISCUSSION SKILL	DEVELOPMENT FOR BIOLOGY STUDENTS.=	C 041
FACULTY	DEVELOPMENT GRANT PROGRAM.=	N 074
CURRICULAR	DEVELOPMENT IN BIOLOGY.=	C 137
CORE CURRICULUM	DEVELOPMENT IN BIOLOGY.=	C 129
CURRICULAR	DEVELOPMENT IN CHEMISTRY.=	C 137
AL SCIENCE.= FACULTY	DEVELOPMENT IN ECONOMICS AND POLITIC	C 111
MPUTERIZED DATA BANK.=	DEVELOPMENT OF BEHAVIORAL SCIENCE CO	N 123
NG CIVIL ENGINEERING.=	DEVELOPMENT OF CASE METHOD OF TEACHI	C 147
TRUCTION.=	DEVELOPMENT OF COMPUTER ASSISTED INS	N 021
INSTITUTE.=	DEVELOPMENT OF ENVIRONMENTAL STUDIES	N 008
PROFESSIONAL	DEVELOPMENT OF FACULTY.=	C 057
URSES FOR FACULTY.=	DEVELOPMENT OF INSERVICE COMPUTER CO	C 035
RNING AIDS.=	DEVELOPMENT OF INSTRUCTIONAL AND LEA	N 021
IPLINARY SCHEMA.=	DEVELOPMENT OF INTERACTIVE/INTERDISC	C 148
SHMAN SCIENCE COURSES.=	DEVELOPMENT OF INTERDISCIPLINARY FRE	C 025
STUDENT ASSISTED	DEVELOPMENT OF LABORATORIES.=	C 129
PROGRAM.=	DEVELOPMENT OF POLITICAL PSYCHOLOGY	C 116
H PROGRAMS.=	DEVELOPMENT OF UNDERGRADUATE RESEARC	C 159
GINEERING.=	DEVELOPMENT OF WORK IN BIOMEDICAL EN	N 136
FACULTY CAREER	DEVELOPMENT PERSONNEL PROGRAM.=	N 007
FACULTY	DEVELOPMENT PROGRAM ECONOMICS.=	C 072
COMPENSATORY SKILLS	DEVELOPMENT PROGRAM.=	C 093
ECONOMIC	DEVELOPMENT STUDIES.=	C 170
FACULTY	DEVELOPMENT THROUGH RESEARCH.=	C 036
PHYSICS CURRICULUM	DEVELOPMENT.=	C 097
PROFESSIONAL	DEVELOPMENT.=	C 102
NTAL SCIENCE CURRICULUM	DEVELOPMENT.= ENVIRONME	C 155
CURRICULUM	DEVELOPMENT.=	C 029
	DEVELOPMENT.=	C 048
ENGINEERING LAB	DEVELOPMENT.=	C 054
NTERDEPARTMENTAL COURSE	DEVELOPMENT.= I	C 061
CURRICULUM	DEVELOPMENT.=	C 103
NTERDISCIPLINARY COURSE	DEVELOPMENT.= I	C 005
LABORATORY	DEVELOPMENT.=	C 026
SCIENCE LAB	DEVELOPMENT.=	C 054
OCEANOGRAPHIC COURSE	DEVELOPMENT.=	C [illegible]
CURRICULUM	DEVELOPMENT.=	C [illegible]
ASE TIME FOR CURRICULUM	DEVELOPMENT.= FACULTY RELE	C 093
COURSE AND CURRICULUM	DEVELOPMENT.=	C 107
ANALYTICAL CHEMISTRY	DEVELOPMENT.=	C 171
FACULTY	DEVELOPMENT.=	C 026
GENERAL PHYSICS COURSE	DEVELOPMENT.=	C 054
DISCIPLINARY CURRICULUM	DEVELOPMENT.= INTER	C 108
CURRICULUM	DEVELOPMENT.=	C 123
SEARCH AND PROFESSIONAL	DEVELOPMENT.= FACULTY RE	C 002
NTERDISCIPLINARY COURSE	DEVELOPMENT.= I	C 076
RINE BIOLOGY LABORATORY	DEVELOPMENT.= MA	C 106
STUDENT-TEACHER	DEVELOPMENT.=	C 107
SCIENCE CURRICULUM	DEVELOPMENT.=	C 002
CURRICULUM REVISION AND	DEVELOPMENT.= SCIENCE	C 030
LEASED TIME FOR FACULTY	DEVELOPMENT.= RE	C 035
ORY AND FIELD EQUIPMENT	DEVELOPMENT.= LABORAT	C 181
N SOCIO-ECONOMIC COURSE	DEVELOPMENT.= URBA	N 108
CONTINUING EDUCATION	DEVELOPMENT.=	N 086
SED TIME FOR CURRICULUM	DEVELOPMENT.= RELEA	N 020
SCIENCE SHOP	DEVELOPMENT.=	N 062
OLLEGE COMPUTER SCIENCE	DEVELOPMENT.= C	N 148
DUCATIONAL RESEARCH AND	DEVELOPMENT.= OFFICE OF E	N 007
CADEMIC COMPUTER CENTER	DEVELOPMENT.= A	N 098
FRO-AMERICAN CURRICULUM	DEVELOPMENT.= A	N 116
RICULUM ORIGINATION AND	DEVELOPMENT.= BIOCHEMISTRY CUR	C 018
FOR ENGINEERING PROGRAM	DEVELOPMENT.= EXCESS PROPERTY	C 155
ONOMIC/POLITICAL/SOCIAL	DEVELOPMENT.= BLACK COMMUNITY EC	N 139
INDIVIDUAL INSTRUCTION	DEVELOPMENT.= FACULTY CURRICULUM	C 094
TUDENT ASSISTANT COURSE	DEVELOPMENT.= MULTIDISCIPLINARY S	C 113
UM.=	DEVELOPMENT-ADOPTION OF NEW CURRICUL	N 005
T.= HUMAN	DEVELOPMENT/FAMILY STUDIES DEPARTMEN	N 108

```
      INCREASED SCIENCE ENROLLMENT.=                                C 033
DMISSIONS AND YEARROUND ENROLLMENT/OPERATION.=        OPEN A      N 059
      PHYSICAL SCIENCE ENROLLMENTS.=                                C 076
CREASED PHYSICS COURSES ENROLLMENTS.=                     IN      N 101
       COLLEGE CALCULUS ENTRY.=                                     C 121
TERDISCIPLINARY COASTAL ENVIRONMENT COURSE.=   NONSCIENCE IN       N 179
                        ENVIRONMENT EDUCATION CENTER.=              N 086
                   OPEN ENVIRONMENT GEOLOGY.=                       C 121
                        ENVIRONMENT RESOURCES PROGRAM.=             N 043
            CONTROLLED- ENVIRONMENT ROOM.=                          C 086
        CHEMISTRY OF THE ENVIRONMENT.=                              C 120
ENT EXPOSURE TO FOREIGN ENVIRONMENT.=             DIRECT STUD       C 169
F PROFESSIONAL RESEARCH ENVIRONMENT.=              CREATION O       C 033
     BIOLOGY OF MAN AND ENVIRONMENT.=                               C 183
          URBAN-COASTAL ENVIRONMENT.=                               C 109
          OPEN LEARNING ENVIRONMENT.=                               N 121
 IN SCIENCE HISTORY AND ENVIRONMENT.-       LIBRARY ADDITIONS       C 069
 EXPOSURE TO SCIENTIFIC ENVIRONMENT.=     FACULTY AND STUDENT       C 127
 STUDENTS.=             ENVIRONMENTAL BIOLOGY FOR NONSCIENCE        C 053
S FOR BIOLOGY MAJORS.=  ENVIRONMENTAL BIOLOGY AND FIELD TRIP        C 053
            LOWER LEVEL ENVIRONMENTAL BIOLOGY COURSE.=              C 046
                        ENVIRONMENTAL BIOLOGY FOR SOCIETY.=         N 053
=                       ENVIRONMENTAL BIOLOGY FOR NONMAJORS.        N 088
                CONTROL ENVIRONMENTAL CHAMBER.=                     C 109
                        ENVIRONMENTAL CHEMISTRY LABORATORY.=        C 091
=         COLLOQUIUM IN ENVIRONMENTAL CHEMISTRY AND PHYSICS.        C 003
CE MAJORS.=             ENVIRONMENTAL CHEMISTRY FOR NONSCIEN        N 089
                        ENVIRONMENTAL CONCERNS SEMINAR.=            N 004
       NONSCIENCE MAJOR ENVIRONMENTAL COURSE.=                      N 082
IDISCIPLINARY URBAN AND ENVIRONMENTAL CURRICULUM.=       MULT       C 140
               REGIONAL ENVIRONMENTAL DATA CENTER.=                 N 002
                        ENVIRONMENTAL EDUCATION.=                   C 122
.=                      ENVIRONMENTAL ENGINEERING LABORATORY        C 085
.=                      ENVIRONMENTAL ENGINEERING CURRICULUM        N 071
                        ENVIRONMENTAL FIELD PROGRAM.=               N 004
UM.=             MALHEUR ENVIRONMENTAL FIELD STATION CONSORTI       C 181
ST-SESSION, TEAM-TAUGHT ENVIRONMENTAL FIELD STUDIES.=      PO       N 156
UM MEMBER.=      MALHEUR ENVIRONMENTAL FIELD STATION CONSORTI       N 156
               BASE FOR ENVIRONMENTAL FIELD TRIPS.=                 C 181
            )           ENVIRONMENTAL GEOLOGY.=                     C 162
     ACCOMMODATIONS FOR ENVIRONMENTAL GROUPS.=                      N 181
          TELEMETRY AND ENVIRONMENTAL MONITORING EQUIPMENT.=        C 122
                        ENVIRONMENTAL NOISE STUDY FRESHMEN.=        C 117
               REGIONAL ENVIRONMENTAL PLANNING ELEMENT.=            C 135
CIST.=         COURSE IN ENVIRONMENTAL PROBLEMS BY A GEOPHYSI       C 080
NSCIENCE STUDENTS.=      ENVIRONMENTAL PROBLEMS COURSE FOR NO       C 080
                AQUATIC ENVIRONMENTAL QUALITY RESEARCH.=            C 004
                        ENVIRONMENTAL QUALITY PROGRAM.=             N 009
ELOPMENT.=              ENVIRONMENTAL SCIENCE CURRICULUM DEV        C 155
          BACCALAUREATE ENVIRONMENTAL SCIENCE.=                     C 050
      INTERDISCIPLINARY ENVIRONMENTAL SCIENCE COURSE.=              C 081
JOR.=                   ENVIRONMENTAL SCIENCE PROGRAM AND MA        N 099
HELOR DEGREE PROGRAM IN ENVIRONMENTAL SCIENCE.=           BAC       N 155
                        ENVIRONMENTAL SHORT COURSES.=               C 181
ARCH.=                  ENVIRONMENTAL STUDIES MAJOR AND RESE        C 084
                 MOBILE ENVIRONMENTAL STUDIES LABORATORY.=          C 130
                        ENVIRONMENTAL STUDIES CURRICULUM.=          C 135
LOGY.=                  ENVIRONMENTAL STUDIES PROGRAM IN GEO        C 055
      INTERDISCIPLINARY ENVIRONMENTAL STUDIES PROGRAM.=             C 030
                        ENVIRONMENTAL STUDIES PROGRAM.=             C 035
        CORE CURRICULUM ENVIRONMENTAL STUDIES MAJOR.=               C 115
    COORDINATE MAJOR IN ENVIRONMENTAL STUDIES.=                     C 137
LEGE LOCALITY.=         ENVIRONMENTAL STUDIES FOCUSED ON-COL        C 137
   REGIONAL PROGRAMS IN ENVIRONMENTAL STUDIES ON TV.=               N 172
         DEVELOPMENT OF ENVIRONMENTAL STUDIES INSTITUTE.=           N 008
    GRADUATE PROGRAM IN ENVIRONMENTAL STUDIES.=                     N 012
                        ENVIRONMENTAL STUDIES MAJOR.=               N 062
     HUMANITIES ROLE IN ENVIRONMENTAL STUDIES.=                     N 137
                        ENVIRONMENTAL STUDIES CENTER.=              N 158
E PROJECT.=             ENVIRONMENTAL STUDIES AS INTERCOLLEG        N 137
MUNITY PROJECT.=        ENVIRONMENTAL STUDIES AS COLLEGE COM        N 137
                        ENVIRONMENTAL STUDIES PROGRAM.=             N 033
.=                      ENVIRONMENTAL SUMMER SESSION COURSES        C 181
      INTERDISCIPLINARY ENVIRONMENTAL SUMMER PROJECT.=              C 137
LITY.=       STREAM-POND ENVIRONMENTAL TEACHING-RESEARCH FACI       N 002
```

	ENVIRONMENTAL TECHNICIAN PROGRAM.=	N 012
CES.=	ENVIRONMENTAL WORKSHOPS AND CONFEREN	C 084
	ENVIRONMENTAL WORKSHOP CONFERENCES.=	N 181
COMMUNITY	ENVIRONMENTALLY AWARE SOCIETY.=	N 155
INTERDISCIPLINARY	ENVIRONMENTALLY ORIENTED COURSES.=	C 109
STUDENT	ENVIRONMENTALLY ORIENTED GROUP.=	N 155
AQUATIC	ENVIRONMENTS MAJOR.=	N 002
ITA8LE SCIENCE LEARNING	ENVIRONMENTS.= CREATING SU	C 094
CULTY-STUDENT RESEARCH/	ENZYMOLOGY/BACTERIOPHAGE.= FA	N 139
L/QUANTITATIVE ANALYSIS	EQUIPMENT ACQUISITION.= COMPUTATIONA	C 062
INSTRUCTIONAL	EQUIPMENT ACQUISITIONS.=	C 093
	EQUIPMENT ACQUISITIONS.=	C 010
ENGINEERING LABORATORY	EQUIPMENT ACQUISITION.=	C 146
INSTRUCTIONAL	EQUIPMENT ACQUISITIONS.=	C 171
	EQUIPMENT ACQUISITION.=	C 158
	EQUIPMENT ACQUISITION.=	C 102
SCIENCE AND ENGINEERING	EQUIPMENT ACQUISITIONS.=	C 107
AND RESEARCH.=	EQUIPMENT ACQUISITIONS FOR TEACHING	N 093
GEOLOGY	EQUIPMENT AND LIBRARY MATERIALS.=	C 070
IMPROVED INSTRUCTION.=	EQUIPMENT AND SUPPLY REQUIREMENT FOR	C 110
PHYSICS SEMIRESEARCH	EQUIPMENT AND TEACHING AIDS.=	C 143
SCIENCE	EQUIPMENT AND WORKSHOP TECHNICIAN.=	C 108
	EQUIPMENT AQUISITION.=	C 145
INSTRUCTIONAL RESEARCH	EQUIPMENT BUDGETS.= COLLEGE	N 094
MISTRY PHYSICS.=	EQUIPMENT CURRICULUM DEVELOPMENT CHE	C 074
LABORATORY	EQUIPMENT DESIGN CONSTRUCTION.=	C 016
LABORATORY AND FIELD	EQUIPMENT DEVELOPMENT.=	C 181
PROGRAM.= EXPERIMENTAL	EQUIPMENT FOR BEHAVIOR MODIFICATION	C 072
GY.= FIELD RECORDING	EQUIPMENT FOR ETHOLOGY/AQUATIC 8IOLO	C 088
= LABORATORY	EQUIPMENT FOR EXPERIMENTAL SCIENCES.	C 163
	EQUIPMENT FOR FACULTY RESEARCH.=	C 152
.= INSTRUCTIONAL	EQUIPMENT FOR NEW LABORATORY COURSES	C 025
	EQUIPMENT FOR PHYSICAL GEOGRAPHY.=	C 160
	EQUIPMENT IN ANALYTICAL CHEMISTRY.=	N 155
LABORATORY	EQUIPMENT IN CHEMISTRY.=	C 024
RESISTIVITY AND SEISMIC	EQUIPMENT IN GEOLOGY.=	C 092
AUTO-TUTORIAL	EQUIPMENT IN INTRODUCTORY BIOLOGY.=	C 122
TECHNICIAN PROGRAM FOR	EQUIPMENT MAINTENANCE.=	C 061
CURRICULUM AND	EQUIPMENT MODERNIZATION.=	C 082
EENHOUSE RENOVATION AND	EQUIPMENT PURCHASE.= GR	C 021
SCIENCE MATHEMATICS	EQUIPMENT PURCHASE.=	C 019
LABORATORY	EQUIPMENT PURCHASED.=	C 103
INTERINSTITUTIONAL	EQUIPMENT PURCHASES.=	C 185
SURPLUS	EQUIPMENT PURCHASES.=	C 076
SCIENTIFIC	EQUIPMENT PURCHASES.=	C 003
BIOLOGY BUILDING AND	EQUIPMENT RENOVATION.=	C 095
INTERDEPARTMENTAL	EQUIPMENT SHARING.=	N 062
SCIENCE	EQUIPMENT TECHNICIANS.=	C 076
INTERFACING LABORATORY	EQUIPMENT WITH MINICOMPUTERS.=	C 020
VIOR FACULTY LABORATORY	EQUIPMENT.= ANIMAL BEHA	C 111
S LECTURE DEMONSTRATION	EQUIPMENT.= PHYSIC	C 134
RATURE PHYSICS RESEARCH	EQUIPMENT.= LOW TEMPE	C 164
INSTRUCTIONAL	EQUIPMENT.=	C 032
EXPERIMENTAL PSYCHOLOGY	EQUIPMENT.=	C 070
RESEARCH	EQUIPMENT.=	C 077
RESEARCH	EQUIPMENT.=	C 100
GEOLOGY LABORATORY	EQUIPMENT.=	C 164
SCIENTIFIC	EQUIPMENT.=	C 182
LOGICAL THIN-SECTIONING	EQUIPMENT.= GEO	C 092
ANALYTICAL CHEMISTRY	EQUIPMENT.=	C 155
NSTRUCTIONAL SCIENTIFIC	EQUIPMENT.= PURCHASE OF I	C 021
S LABORATORY/DESIGN AND	EQUIPMENT.= GROUP DYNAMIC	C 073
RESEARCH	EQUIPMENT.=	C 076
AL CHEMISTRY LABORATORY	EQUIPMENT.= METALLURGIC	C 044
MOLECULAR 8IOLOGY	EQUIPMENT.=	C 070
IC CHEMISTRY LABORATORY	EQUIPMENT.= ORGAN	C 082
INTRODUCTORY LABORATORY	EQUIPMENT.= PHYSICS	C 024
LABORATORY	EQUIPMENT.=	C 026
YSICS OPTICS LABORATORY	EQUIPMENT.= PH	C 044
NSTRUCTIONAL SCIENTIFIC	EQUIPMENT.= I	C 153
PSYCHOLOGY LABORATORY	EQUIPMENT.=	C 024
PHYSICS NUCLEAR SCIENCE	EQUIPMENT.=	C 082
INSTRUCTIONAL	EQUIPMENT.=	C 100
ANSPORTATION OF GEOLOGY	EQUIPMENT.= MOBILE FIELD TR	C 008
NVIRONMENTAL MONITORING	EQUIPMENT.= TELEMETRY AND E	C 122

S.=	FACULTY DEVELOPMENT PROGRAM-ECONOMIC	C 072
.=	FACULTY DEVELOPMENT THROUGH RESEARCH	C 036
	FACULTY DEVELOPMENT.=	C 026
RELEASED TIME FOR	FACULTY DEVELOPMENT.=	C 035
ARCH.=	FACULTY DIRECTION UNDERGRADUATE RESE	C 101
	FACULTY ECONOMETRICS.=	C 111
	FACULTY FELLOWSHIPS.=	N 124
MISTRY.= BIOCHEMISTRY	FACULTY FROM BIOLOGY RATHER THAN CHE	N 118
	FACULTY GRADUATE STUDY MATHEMATICS.=	C 165
ZOOLOGY	FACULTY IMPROVEMENT AND RESEARCH.=	N 079
TIES.=	FACULTY IMPROVEMENT BY SUMMER ACTIVI	C 127
	FACULTY IMPROVEMENT LEAVES.=	C 061
	FACULTY IMPROVEMENT LEAVE PROGRAM.=	C 019
	FACULTY IMPROVEMENT.=	C 043
TICAL LEAVES.=	FACULTY IMPROVEMENT-SUPPLEMENT SABBA	C 005
INVOLVEMENT OF SCIENCE	FACULTY IN GOVERNANCE.= GREATER	C 033
DOLOGY STRATIFICATION.=	FACULTY IN POLITICAL SOCIOLOGY METHO	C 111
	FACULTY IN RESEARCH.=	C 089
	FACULTY IN-SERVICE TRAINING.=	C 084
STUDENT	FACULTY INTERACTIONS.=	C 152
PROGRAM.= NONSCIENCE	FACULTY INTEREST IN VISITING SCHOLAR	C 069
ISCIPLINARY ENGINEERING	FACULTY INVOLVEMENT.= INTERD	C 161
ANIMAL BEHAVIOR	FACULTY LABORATORY EQUIPMENT.=	C 111
	FACULTY LEAVE PROGRAM.=	C 032
	FACULTY LEAVE PROGRAM.=	C 074
	FACULTY LEAVE.=	C 182
	FACULTY LEAVES.=	C 124
	FACULTY ON-CAMPUS RESEARCH LEAVES.=	C 019
	FACULTY ORGANIZED RESEARCH GRANTS.=	N 131
COMPUTERBASED	FACULTY PRODUCTIVITY MEASURES.=	C 059
IMPROVED ENGINEERING	FACULTY PROFESSIONAL EXPERTISE.=	C 161
	FACULTY PROFESSIONAL COMMITMENT.=	C 123
RELEASED TIME FOR	FACULTY PROJECTS.=	C 159
Y RESEARCH.=	FACULTY RELEASE IN TIME FOR SCHOLARL	C 044
IMPROVEMENT.=	FACULTY RELEASE TIME FOR CURRICULUM	C 101
DEVELOPMENT.=	FACULTY RELEASE TIME FOR CURRICULUM	C 093
	FACULTY RELEASE TIME FOR STUDY.=	C 129
UDY.=	FACULTY RELEASE TIME FOR ADVANCED ST	C 021
	FACULTY RELEASE TIME.=	C 078
.=	FACULTY RELEASED TIME RESEARCH STUDY	C 029
	FACULTY RELEASED TIME.=	C 075
	FACULTY RELEASED TIME.=	C 107
RAINING.=	FACULTY RELEASED TIME RESEARCH AND T	C 134
	FACULTY REPLACEMENTS.=	C 182
P.=	FACULTY RESEARCH AND STUDY FELLOWSHI	C 081
PS.=	FACULTY RESEARCH AND STUDY FELLOWSHI	C 108
VELOPMENT.=	FACULTY RESEARCH AND PROFESSIONAL DE	C 002
	FACULTY RESEARCH AND PUBLICATIONS.=	C 164
PS.=	FACULTY RESEARCH AND STUDY FELLOWSHI	N 140
RS.-	FACULTY RESEARCH AND TEACHING SEMINA	N 062
	FACULTY RESEARCH AT SMALL COLLEGES.=	C 184
STUDENT-	FACULTY RESEARCH COLLABORATION.=	C 170
	FACULTY RESEARCH ENHANCEMENT.=	C 033
	FACULTY RESEARCH FELLOWSHIPS.=	C 157
HOUT ASSISTANTS.=	FACULTY RESEARCH GRANTS WITH AND WIT	C 153
	FACULTY RESEARCH GRANTS.=	N 112
DISCIPLINES.=	FACULTY RESEARCH IN THE SEVEN COSIP	C 152
Y.=	FACULTY RESEARCH INITIATION CHEMISTR	C 165
LOADS.=	FACULTY RESEARCH LEAVES AND REDUCED	C 131
STUDENT-	FACULTY RESEARCH PARTICIPATION.=	C 102
	FACULTY RESEARCH PARTICIPATION.=	N 101
SUMMER STUDENT	FACULTY RESEARCH PROJECTS.=	C 077
	FACULTY RESEARCH PROJECTS.=	C 107
ATE ASSISTANTS.=	FACULTY RESEARCH PROJECTS UNDERGRADU	C 115
	FACULTY RESEARCH SUPPORT.=	C 101
NCE DEPARTMENTS.=	FACULTY RESEARCH SUPPORT IN ALL SCIE	N 093
ASSISTED	FACULTY RESEARCH.=	C 103
PHYSICS STUDENT	FACULTY RESEARCH.=	C 120
STUDENT-	FACULTY RESEARCH.=	C 075
STUDENT	FACULTY RESEARCH.=	C 031
CHEMICAL	FACULTY RESEARCH.=	C 139
SOCIAL SCIENCE	FACULTY RESEARCH.=	C 150
	FACULTY RESEARCH.=	C 009
TERDISCIPLINARY STUDENT	FACULTY RESEARCH.= IN	C 035
	FACULTY RESEARCH.=	C 176

138

```
                        FACULTY RESEARCH.=                          C 090
        SUMMER STUDENT/ FACULTY RESEARCH.=                          C 096
L REGRANTING AGENCY FOR FACULTY RESEARCH.=            INTERNA       C 030
                        FACULTY RESEARCH.=                          C 027
          EQUIPMENT FOR FACULTY RESEARCH.=                          C 152
                        FACULTY RESEARCH.=                          N 102
            FUND TO AID FACULTY RESEARCH.=                          N 111
R CHEMISTRY AND BIOLOGY FACULTY RESEARCH.=  RELEASED TIME FO        C 164
                        FACULTY RESEARCH/STUDY GRANTS.=             C 060
                        FACULTY SABBATICAL LEAVES.=                 C 025
            ENGINEERING FACULTY SABBATICAL PROGRAM.=                N 107
                SCIENCE FACULTY SABBATICAL PROGRAM.=                N 107
                        FACULTY SABBATICALS.=                       C 152
IENCE/NUTRITION.=       FACULTY SELF-IMPROVEMENT/COMPUTER SC        C 069
IETY.=                  FACULTY SEMINAR ON COMPUTERS AND SOC        C 058
     CROSS DISCIPLINARY FACULTY SEMINAR.=                           C 060
S.=                     FACULTY SHORT SUBJECT MATTER PROGRAM        C 107
 SMALL COLLEGES.=       FACULTY SPECIALIZATION IN BIOLOGY AT        C 184
ROGRAMS.=               FACULTY STUDENT DEVELOPED RESEARCH P        C 036
ESOURCE LABORATORIES.=  FACULTY STUDENT PLANNING IN SUMMER R        C 007
 ATTENDANCE.=           FACULTY STUDENT PROFESSIONAL MEETING        C 013
                        FACULTY STUDENT RESEARCH.=                  C 016
               ENRICHED FACULTY STUDENT RESEARCH PROGRAM.=          C 068
ECTS.=                  FACULTY STUDENT SUMMER RESEARCH PROJ        C 029
                        FACULTY STUDENT SUMMER RESEARCH.=           C 163
ECTS.=                  FACULTY STUDENT SUMMER RESEARCH PROJ        C 137
                        FACULTY STUDY AND RESEARCH.=                C 048
=                       FACULTY STUDY AND RESEARCH PROGRAMS.        C 074
=                       FACULTY SUMMER RESEARCH FELLOWSHIPS.        C 005
                        FACULTY SUMMER RESEARCH PROJECTS.=          C 088
                        FACULTY SUMMER RESEARCH.=                   C 093
ANTS.=                  FACULTY SUMMER RESEARCH AND STUDY GR        C 153
=                       FACULTY SUMMER RESEARCH FELLOWSHIPS.        C 174
                        FACULTY SUMMER RESEARCH GRANTS.=            C 164
S.=                     FACULTY TRAVEL TO SCIENTIFIC MEETING        C 093
                        FACULTY TRAVEL.=                            C 074
                        FACULTY UPDATING OF KNOWLEDGE.=             N 152
                        FACULTY UPGRADING.=                         C 145
 COMPUTER TERMINALS FOR FACULTY USE.=                PORTABLE       C 177
  GREATER PARTICIPATING FACULTY VISIBILITY.=                        N 094
          INTEGRATED    FACULTY WORKSHOP SYLLABUS.=                 N 178
                        FACULTY WORKSHOPS COMPUTER USAGE.=          C 115
ATION OLDER ENGINEERING FACULTY.=           CONTINUING EDUC         C 146
  COMPUTER TRAINING FOR FACULTY.=                                   C 177
-METHODOLOGIST ADDED TO FACULTY.=                 STATISTICIAN      C 006
  COMPUTER TRAINING FOR FACULTY.=                                   C 137
ATION YOUNG ENGINEERING FACULTY.=             RESEARCH INITI        C 146
ESSIONAL DEVELOPMENT OF FACULTY.=                         PROF      C 057
LARY FOR IMPROVEMENT OF FACULTY.=                   SUMMER SA       C 079
    SUMMER WORKSHOP FOR FACULTY.=                                   C 058
                UPGRADED FACULTY.=                                  C 103
D ADVANCED TRAINING FOR FACULTY.=               REFRESHER AN        C 040
 FACILITIES FOR COLLEGE FACULTY.=            INSTRUMENT SHOP        C 174
     RELEASED TIME FOR FACULTY.=                                    C 028
DUSTRIAL EXPERIENCE FOR FACULTY.=                         IN        C 040
CH PROJECTS FOR PHYSICS FACULTY.=                       RESEAR      C 067
 MATHEMATICS COURSE FOR FACULTY.=                                   C 104
ROJECTS FOR MATHEMATICS FACULTY.=             SUMMER STUDY P        C 164
DESIGNED BY STUDENT AND FACULTY.=         LIBERAL ARTS MAJOR        N 029
 CHEMISTRY STUDENTS AND FACULTY.=        RESEARCH SUPPORT FOR       C 130
CE COMPUTER COURSES FOR FACULTY.=      DEVELOPMENT OF INSERVI       C 035
EARCH.=                 FACULTY-STUDENT INSECT PHEROMONE RES        N 139
ENT.=                   FACULTY-STUDENT INTERACTION ENHANCEM        C 108
TS.=                    FACULTY-STUDENT JOINT RESEARCH POJEC        C 135
                        FACULTY-STUDENT RESEARCH PROJECTS.=         C 006
                        FACULTY-STUDENT RESEARCH ACTIVITY.=         C 076
 ALL COURSES.=          FACULTY-STUDENT RESEARCH INTEGRAL TO        C 162
                        FACULTY-STUDENT RESEARCH.=                  C 087
Y/PHYSICS/MATHEMATICS.= FACULTY-STUDENT RESEARCH IN CHEMISTR        C 140
BACTERIOPHAGE.=         FACULTY-STUDENT RESEARCH/ENZYMOLOGY/        N 139
RAM.=                   FACULTY-STUDENT SUMMER RESEARCH PROG        C 062
                        FACULTY-STUDENT SYMPOSIA.=                  N 114
AM.=                    FACULTY-UNDERGRADUATE RESEARCH PROGR        C 042
            STUDENTS AND FACULTY, RECRUITMENT AND RETENTION.=       C 158
.=                PASS/ FAIL ELECTIVES JUNIOR SENIOR COURSES        N 134
```

COMPUTER-BASEO	INSTRUCTION.=		C 006
IRY-ORIENTEO LABORATORY	INSTRUCTION.=	INQU	C 017
ATIVE COMPUTER ASSISTEO	INSTRUCTION.=	INTEGR	C 148
TICIPATION IN SHIPBOARO	INSTRUCTION.=	STUDENT PAR	C 179
R CAPABILITY IN SCIENCE	INSTRUCTION.=	COMPUTE	C 025
ORIENTEO UNOERGRAOUATE	INSTRUCTION.=	RESEARCH	C 071
KELLER PHYSICS	INSTRUCTION.=		C 110
MOVIES FOR LABORATORY	INSTRUCTION.=		C 142
ENT FEEOBACK IN SCIENCE	INSTRUCTION.=	STUO	C 023
ATHEMATICS COMPUTERIZEO	INSTRUCTION.=	M	C 094
SELF-PACEO MOOULAR	INSTRUCTION.=		C 143
VIOEO-TAPE IN SCIENCE	INSTRUCTION.=		C 011
COMPUTER ASSISTEO	INSTRUCTION.=		C 103
ATICS COMPUTER ASSISTEO	INSTRUCTION.=	MATHEM	C 013
MATHEMATICS PROGRAMMEO	INSTRUCTION.=		C 052
NT OF COMPUTER ASSISTEO	INSTRUCTION.=	OEVELOPME	N 021
INOEPENOENT PROGRESS	INSTRUCTION.=		N 100
RY APPROACH TO MEOIATEO	INSTRUCTION.=	MULTIOISCIPLINA	N 027
COMPUTER IN STATISTICS	INSTRUCTION.=		N 070
INOIVIOUALLY PRESCRIBEO	INSTRUCTION.=		N 166
NTATION WITH SELF-PACEO	INSTRUCTION.=	EXPERIME	N 033
COMPUTER ASSISTEO	INSTRUCTION.=		N 123
COSTS OF ALTERNATIVE	INSTRUCTION.=		N 023
PERSONALIZEO STUOENT	INSTRUCTION.=		N 082
COMPUTER BASEO	INSTRUCTION.=		N 082
SELF-PACEO	INSTRUCTION.=		N 158
NONMAJOR SCIENCE	INSTRUCTION.=		N 023
COMPUTER ASSISTEO	INSTRUCTION.=		N 023
LLER SELF-PACEO PHYSICS	INSTRUCTION.=	EVALUATION OF KE	C 110
GANIC CHEMISTRY PRE-LAB	INSTRUCTION.=	AUOIO-VISUAL INOR	C 141
EQUIREMENT FOR IMPROVEO	INSTRUCTION.=	EQUIPMENT ANO SUPPLY R	C 110
ORIAL SELF-PACEO KELLER	INSTRUCTION.=	PHYSICS BY STUOENT TUT	C 110
OEVELOPMENT OF	INSTRUCTIONAL	ANO LEARNING AIOS.=	N 021
.=	INSTRUCTIONAL	CAPABILITIES INCREASEO	C 152
	INSTRUCTIONAL	COMPUTER FACILITY.=	C 156
OF LEARNING CENTER FOR	INSTRUCTIONAL	OESIGN. REGIONAL USE	C 172
RATORY COURSES.=	INSTRUCTIONAL	EQUIPMENT FOR NEW LABO	C 025
	INSTRUCTIONAL	EQUIPMENT.=	C 032
.=	INSTRUCTIONAL	EQUIPMENT ACQUISITIONS	C 093
.=	INSTRUCTIONAL	EQUIPMENT ACQUISITIONS	C 171
	INSTRUCTIONAL	EQUIPMENT.=	C 100
	INSTRUCTIONAL	IMPROVEMENT PROGRAM.=	N 112
AUOIO-VISUAL	INSTRUCTIONAL	LABORATORY.=	C 100
EFFICIENCIES IN	INSTRUCTIONAL	PROGRAMS.=	C 109
GETS.= COLLEGE	INSTRUCTIONAL	RESEARCH EQUIPMENT-BUO	N 094
PURCHASE OF	INSTRUCTIONAL	SCIENTIFIC EQUIPMENT.=	C 021
	INSTRUCTIONAL	SCIENTIFIC EQUIPMENT.=	C 153
TIMEFREE	INSTRUCTIONAL	SYSTEM.=	C 059
ACEO ANO GUIOEO OESIGN	INSTRUCTIONAL	TECHNIQUES.= SELF-	C 026
S.=	INSTRUCTIONAL	USE OF TV ANO COMPUTER	C 011
LABORATORY	INSTRUMENT	COMPUTER INTERFACING.=	N 068
PERSONALITY PROFILE	INSTRUMENT	FOR ATTITUOINAL CHANGE.=	C 007
INTEROISCIPLINARY	INSTRUMENT	LABS.=	C 158
SERVICE PERSONNEL	INSTRUMENT	REPAIR SECRETARIAL.=	C 044
	INSTRUMENT	REPAIR SHOP.=	C 102
GE FACULTY.=	INSTRUMENT	SHOP FACILITIES FOR COLLE	C 174
CHEMISTRY	INSTRUMENT	TECHNICIAN.=	C 185
	INSTRUMENT	TECHNICIAN.=	N 102
= RESEARCH	INSTRUMENT	USAGE IN CELL PHYSIOLOGY.	C 046
OGRAM WAVEFORM ANALYSIS	INSTRUMENT.=	ELECTROENCEPHAL	C 123
PHYSICS OEPARTMENT	INSTRUMENT-MAKER ANO TECHNICIAN.=		N 101
	INSTRUMENTAL	ANALYSIS.=	C 182
EQUIPMENT/	INSTRUMENTAL	ANALYSIS LABORATORY.=	C 079
NEW COURSE IN	INSTRUMENTAL	ANALYSIS.=	C 047
CHEMICAL	INSTRUMENTAL	METHOOS.=	C 139
= ELECTRONIC	INSTRUMENTATION	FOR ALLIEO SCIENCES.	C 071
Y.=	INSTRUMENTATION	FOR ORGANIC CHEMISTR	C 091
AOVANCEO	INSTRUMENTATION	IN FRESHMAN LAB.=	C 012
URAL SCIENCE LAB.=	INSTRUMENTATION	IN UNOERGRAOUATE NAT	C 012
	INSTRUMENTATION	NOTES.=	C 049
ELECTRONIC	INSTRUMENTATION	PROGRAM PHYSICS.=	N 074
NS/CHEMISTRY TOPICS ANO	INSTRUMENTATION.=	TUTORIAL SESSIO	C 176
	INSTRUMENTATION.=		N 079
COURSE IN	INSTRUMENTS ANO METHOOS IN BIOLOGY.=		C 046
OIGITAL	INSTRUMENTS IN LABORATORY.=		C 142

146

BIOLOGICAL	PHYSICAL SCIENCE.=		C 139
MOODERNIZING OF	PHYSICAL SCIENCE.=		C 116
MINORITY STUDENTS	PHYSICAL SCIENCE.=		C 180
UALIZED PROJECTS IN THE	PHYSICAL SCIENCES.=	INDIVID	C 012
FIELD STUDIES IN	PHYSICAL SCIENCES.=		C 071
ENCE FOR NONSCIENTISTS/	PHYSICAL WORLD ENERGY PROBLEMS.=	SC	N 120
EAM-TAUGHT COURSES WITH	PHYSICISTS.=	T	N 034
OR HEALTH SCIENCES.=	PHYSICS AND CHEMISTRY MAJOR OPTION	F	C 120
IBRARY ACQUISITIONS FOR	PHYSICS AND CHEMISTRY.=	L	C 163
KELLER PLANS IN	PHYSICS AND CHEMISTRY.=		C 061
NO DIGITAL COMPUTERS IN	PHYSICS AND CHEMISTRY.=	ANALOG A	N 067
	PHYSICS AND LIFESCIENCE COURSE.=		C 143
JECTS.= HEALTH	PHYSICS AND RADIATION PROTECTION	PRO	N 035
	PHYSICS AUDIO-TUTORIAL MATERIALS.=		C 180
	PHYSICS BEHAVIORAL OBJECTIVES.=		C 180
ED KELLER INSTRUCTION.=	PHYSICS BY STUDENT TUTORIAL SELF-PAC		C 110
TION.= EXTENSION	PHYSICS CHEMISTRY CURRICULAR COOPERA		C 068
	PHYSICS COLLOQUIUM VIDEO TAPES.=		N 180
REGIONAL	PHYSICS CONFERENCES.=		N 180
GENERAL	PHYSICS COURSE DEVELOPMENT.=		C 054
ENTS.=	PHYSICS COURSE FOR LIFE SCIENCE	STUD	C 061
.=	PHYSICS COURSE FOR NONSCIENCE MAJORS		C 001
.=	PHYSICS COURSE FOR NONSCIENCE MAJORS		C 068
TOPICAL	PHYSICS COURSE ON ENERGY.=		C 057
REVISED MODERN	PHYSICS COURSE.=		C 183
-PACED, OPEN LABORATORY	PHYSICS COURSE.=	SELF	C 055
INCREASED	PHYSICS COURSES ENROLLMENTS.=		N 101
	PHYSICS COURSES FOR NONSPECIALISTS.=		C 034
S.=	PHYSICS COURSES FOR NONSCIENCE MAJOR		N 136
BEGINNING	PHYSICS COURSES.=		C 079
ROISCIPLINARY CHEMISTRY	PHYSICS COURSES.=	INTE	C 101
EVISION OF EXPERIMENTAL	PHYSICS COURSES.=	R	C 116
USE OF APL IN	PHYSICS COURSES.=		N 097
	PHYSICS CURRICULUM DEVELOPMENT.=		C 097
	PHYSICS CURRICULUM MODIFICATION.=		C 062
UNDERGRADUATE	PHYSICS CURRICULUM REVISION.=		C 052
AND TECHNICIAN.=	PHYSICS DEPARTMENT INSTRUMENT-MAKER		N 101
CIPLINARY COURSE.=	PHYSICS ENGLISH COMPOSITION INTERDIS		C 180
S.= MODULAR	PHYSICS EXPERIENCE FOR SCIENCE MAJOR		C 045
BIOLOGY AND	PHYSICS FACILITIES RENOVATION.=		C 082
RESEARCH PROJECTS FOR	PHYSICS FACULTY.=		C 067
OVEMENT OF INTRODUCTORY	PHYSICS FOR ENGINEERS.=	IMPR	C 127
ASTRONOMY COURSE IN	PHYSICS FOR NONSCIENCE MAJOR.=		N 027
	PHYSICS IN COLLEGE HONORS PROGRAM.=		N 034
KELLER	PHYSICS INSTRUCTION.=		C 110
ON OF KELLER SELF-PACED	PHYSICS INSTRUCTION.=	EVALUATI	C 110
GEOLOGY-	PHYSICS INTERDISCIPLINARY MAJORS.=		N 071
OCEANOGRAPHY/	PHYSICS INTERDISCIPLINARY MAJORS.=		N 071
PMENT.=	PHYSICS INTRODUCTORY LABORATORY	EQUI	C 024
MODERNIZATION OF	PHYSICS LABORATORIES.=		N 116
INTRODUCTORY	PHYSICS LABORATORY MANUALS.=		C 002
	PHYSICS LABORATORY PROGRAM.=		C 099
ADVANCED	PHYSICS LABORATORY.=		C 089
TRODUCTORY AND ADVANCED	PHYSICS LABORATORY.=	IN	C 140
INTRODUCTORY	PHYSICS LABORATORY.=		C 165
TEMPERATURE SOLID STATE	PHYSICS LABORATORY.=	LOW	C 066
GENERAL	PHYSICS LABORATORY.=		C 079
ELECTRONICS AND MODERN	PHYSICS LABORATORY.=		C 098
.=	PHYSICS LABORATORY/EXTERN SCIENTISTS		C 136
ENT.=	PHYSICS LECTURE DEMONSTRATION EQUIPM		C 134
ISTS.=	PHYSICS MAJOR PROGRAM FOR NONSPECIAL		C 034
APPLIED	PHYSICS MAJOR.=		N 030
LABORATORY SEQUENCE FOR	PHYSICS MAJORS.=		C 097
INTRODUCTORY	PHYSICS MATERIALS AND TECHNIQUES.=		C 180
TECHNICAL	PHYSICS MODULES.=		C 180
REGIONAL	PHYSICS NEWSLETTER.=		N 180
	PHYSICS NUCLEAR SCIENCE EQUIPMENT.=		C 082
	PHYSICS OF THE ECOSYSTEM SEQUENCE.=		C 150
=	PHYSICS OPTICS LABORATORY EQUIPMENT.		C 044
OOL SCIENCE.=	PHYSICS OPTION FOR TEACHING HIGH SCH		N 120
REGIONAL	PHYSICS ORGANIZATION.=		N 180
FOUR-YEAR	PHYSICS PROGRAM.=		C 121
EGE COMBINED CHEMISTRY-	PHYSICS PROGRAM.=	PRECOLL	C 171
POSTDOCTORAL	PHYSICS PROGRAM.=		C 151
MENTS BIOLOGY CHEMISTRY	PHYSICS PSYCHOLOGY.=	LAB EXPERI	C 074

```
      INTEROISCIPLINARY PROGRAMS ANO SYMPOSIA.=                    N 109
 NYQUIST,'ROUTH-HURWITZ PROGRAMS BASIC.=                BOOE,     C 117
               TUTORIAL PROGRAMS FOR ALL SCIENCE STUOENTS.=       N 171
               TUTORIAL PROGRAMS FOR ALL SCIENCE STUOENTS.=       N 093
               COMPUTER PROGRAMS FOR CHEMISTRY ANO GEOLOGY.=      C 011
Y.=            COMPUTER PROGRAMS FOR ECONOMICS ANO PSYCHOLOG      C 011
STUOENTS.=       OEGREE PROGRAMS FOR NONENGINEERING SCIENCE       N 146
EXTERNAL STUOIES OEGREE PROGRAMS IN ARTS ANO SCIENCES.=           N 159
             INTERNSHIP PROGRAMS IN ARTS ANO SCIENCES.=           N 159
OLOGY.=        EXPANOEO PROGRAMS IN ASTRONOMY/METEOROLOGY/GE      N 071
= COOPERATIVE EOUCATION PROGRAMS IN BIOLOGY ANO ENGINEERING.      C 112
 TV.=          REGIONAL PROGRAMS IN ENVIRONMENTAL STUOIES ON      N 172
   QUANTITATIVE MAPPING PROGRAMS IN GEOGRAPHY.=                   C 087
INTEROISCIPLINARY MAJOR PROGRAMS IN SCIENCE.=                     N 025
  AUOIO-VISUAL TUTORIAL PROGRAMS IN SEVERAL OISCIPLINES.=         C 006
 SHARING FACILITIES ANO PROGRAMS WITH KNOX COLLEGE.=              N 092
OENT OEVELOPEO RESEARCH PROGRAMS.=                FACULTY STU     C 036
ENGINEERING ANO SCIENCE PROGRAMS.=                INTEGRATEO      C 054
TY SHORT SUBJECT MATTER PROGRAMS.=                       FACUL    C 107
ULTY STUOY ANO RESEARCH PROGRAMS.=                         FAC    C 074
TECHNICIAN ANO TEACHING PROGRAMS.=             UNOERGRAOUATE       C 156
ENCIES IN INSTRUCTIONAL PROGRAMS.=                     EFFICI      C 109
      INTEROISCIPLINARY PROGRAMS.=                                 C 087
 UNOERGRAOUATE RESEARCH PROGRAMS.=             OEVELOPMENT OF      C 159
O-ON-SLIOE AUOIO-VISUAL PROGRAMS.=                          SOUN   C 029
TRY PSYCHOLOGY RESEARCH PROGRAMS.=             STUOENT CHEMIS      C 094
 EVALUATION OF ACAOEMIC PROGRAMS.=                                 C 166
BARRIERS TO COOPERATIVE PROGRAMS.=             INSTITUTIONAL       C 185
CS ANO PHYSICS TUTORING PROGRAMS.=                  MATHEMATI      C 034
      INTEROISCIPLINARY PROGRAMS.=                                 C 115
      INTEROISCIPLINARY PROGRAMS.=                                 N 049
ABORATORY ASSISTANTSHIP PROGRAMS.=                            L    N 171
          JOINT OEGREE PROGRAMS.=                                  N 186
        LIVING-LEARNING PROGRAMS.=                                 N 157
         ASSOCIATE ARTS PROGRAMS.=                                 N 043
            INTERNSHIP PROGRAMS.=                                  N 151
OERGRAOUATE ENGINEERING PROGRAMS.=     EXPERIMENTATION IN UN       C 161
RY.=      OATA REOUCTION PROGRAMS/PHYSICAL CHEMISTRY LABORATO      C 147
          SUMMER STUOY PROJECTS FOR MATHEMATICS FACULTY.=          C 164
               RESEARCH PROJECTS FOR PHYSICS FACULTY.=             C 067
 INOEPENOENT LABORATORY PROJECTS IN CHEMISTRY.=                    C 136
 WATER QUALITY RESEARCH PROJECTS IN GENERAL BIOLOGY.=              N 067
 UNOERGRAOUATE RESEARCH PROJECTS IN MATHEMATICS.=                  C 118
         INOIVIOUALIZEO PROJECTS IN THE PHYSICAL SCIENCES.=        C 012
       FACULTY RESEARCH PROJECTS UNOERGRAOUATE ASSISTANTS.=        C 115
NTIAL.=                 PROJECTS WITH INTEROISCIPLINARY POTE      N 137
ACULTY-STUOENT RESEARCH PROJECTS.=                            F    C 006
TUOENT SCIENCE RESEARCH PROJECTS.=             UNOERGRAOUATE S     C 008
TUOENT FACULTY RESEARCH PROJECTS.=                     SUMMER S    C 077
FACULTY SUMMER RESEARCH PROJECTS.=                                 C 088
RAOUATE SUMMER RESEARCH PROJECTS.=                       UNOERG    C 088
       FACULTY RESEARCH PROJECTS.=                                 C 107
        BIOLOGY HONORS PROJECTS.=                                  C 147
    RESEARCH INITIATION PROJECTS.=                                 C 149
STUOENT SUMMER RESEARCH PROJECTS.=                     FACULTY     C 029
       STUOENT RESEARCH PROJECTS.=                                 C 107
STUOENT SUMMER RESEARCH PROJECTS.=                     FACULTY     C 137
      INOEPENOENT STUOY PROJECTS.=                                 C 164
      INOEPENOENT STUOY PROJECTS.=                                 C 158
 UNOERGRAOUATE RESEARCH PROJECTS.=                                 C 040
LEASEO TIME FOR FACULTY PROJECTS.=                           RE    C 159
TY ANO STUOENT RESEARCH PROJECTS.=                       FACUL     N 020
          OISMAL SWAMP PROJECTS.=                                  N 109
     ENGINEERING SENIOR PROJECTS.=                                 N 112
   COOPERATIVE RESEARCH PROJECTS.=                                 N 186
L GROUP PROBLEMCENTEREO PROJECTS.=                         SMAL    N 059
RANSFERABILITY OF COSIP PROJECTS.=                             T   N 137
ER ANALYSIS OF RESEARCH PROJECTS.=                       COMPUT    N 152
OENT ORIGINATEO STUOIES PROJECTS.=                           STU   N 067
NO RAOIATION PROTECTION PROJECTS.=             HEALTH PHYSICS A    N 035
OENT STUOY ANO RESEARCH PROJECTS.=     UNOERGRAOUATE INOEPEN       N 085
FOR LONGER TERM BIOLOGY PROJECTS.=     PHYSIOLOGY LABORATORY       C 118
 UNOERGRAOUATE RESEARCH PROMOTEO.=                                 C 103
H PHYSICS ANO RAOIATION PROTECTION PROJECTS.=                HEALT N 035
                        PROTOLANGUAGE LINGUISTICS RESEARCH.=      C 039
```

```
FACULTY AND INSTITUTION RESEARCH CAPABILITY IMPROVEMENT.=          C 148
          UNDERGRADUATE RESEARCH CAPABILITY.=                      C 082
      STUDENT-FACULTY RESEARCH COLLABORATION.=                     C 170
                      RESEARCH CONSULTATION.=                      C 029
ITY AGENCIES.=        RESEARCH COOPERATION WITH NONUNIVERS         N 101
     MULTIDISCIPLINARY RESEARCH EFFORTS.=                          C 012
   ATMOSPHERIC PHYSICS RESEARCH EMPHASIS.=                         N 101
              FACULTY RESEARCH ENHANCEMENT.=                       C 033
REATION OF PROFESSIONAL RESEARCH ENVIRONMENT.=              C      C 033
  COLLEGE INSTRUCTIONAL RESEARCH EQUIPMENT BUDGETS.=               N 094
LOW TEMPERATURE PHYSICS RESEARCH EQUIPMENT.=                       C 164
                      RESEARCH EQUIPMENT.=                         C 077
                      RESEARCH EQUIPMENT.=                         C 100
                      RESEARCH EQUIPMENT.=                         C 076
NSIVE ONE-ON-ONE SUMMER RESEARCH EXPERIENCE.=            INTE      C 033
RIENTATED UNDERGRADUATE RESEARCH EXPERIENCE.=      STUDENT O       N 012
          UNDERGRADUATE RESEARCH FACILITIES IN BIOLOGY.=           C 055
         IMPROVEMENT IN RESEARCH FACILITIES IN CHEMISTRY.=         N 079
ENVIRONMENTAL TEACHING- RESEARCH FACILITY.=      STREAM-POND       N 002
         FACULTY SUMMER RESEARCH FELLOWSHIPS.=                     C 005
    FACULTY AND STUDENT RESEARCH FELLOWSHIPS.=                     C 030
          JUNIOR SUMMER RESEARCH FELLOWSHIPS.=                     C 174
              FACULTY RESEARCH FELLOWSHIPS.=                       C 157
       FACULTY SUMMER RESEARCH FELLOWSHIPS.=                       C 174
/COMMUNITY.=      SURVEY RESEARCH FINDINGS FOR SOCIAL SCIENCE      C 148
 AMERICA.=         FIELD RESEARCH FOR UNDERGRADUATES IN LATIN      C 170
    FACULTY AND STUDENT RESEARCH FORUM.=                           N 006
DENT ORIGINATED STUDIES RESEARCH GRANT.=                   STU     N 009
ISTANTS.=         FACULTY RESEARCH GRANTS WITH AND WITHOUT ASS     C 153
                  STUDENT RESEARCH GRANTS.=                        C 153
       FACULTY SUMMER RESEARCH GRANTS.=                            C 164
              FACULTY RESEARCH GRANTS.=                            N 112
     FACULTY ORGANIZED RESEARCH GRANTS.=                           N 131
SOCIALIZATION.=       RESEARCH IN AFRO-AMERICAN POLITICAL          C 148
              STUDENT RESEARCH IN ALL COSIP DISCIPLINES.=          C 152
          UNDERGRADUATE RESEARCH IN CHEMISTRY.=                    C 189
ATICS.= FACULTY-STUDENT RESEARCH IN CHEMISTRY/PHYSICS/MATHEM       C 140
       REQUIRED SENIOR RESEARCH IN ECONOMICS.=                     C 147
OGY.=     UNDERGRADUATE RESEARCH IN MATHEMATICS/BIOLOGY/GEOL.      C 106
       STUDY OF RECENT RESEARCH IN MATHEMATICS EDUCATION.=         N 035
CIOLOGY.= UNDERGRADUATE RESEARCH IN POLITICAL SCIENCE AND SO       C 111
          UNDERGRADUATE RESEARCH IN PRIMATE BEHAVIOR.=             N 162
NES.=             FACULTY RESEARCH IN THE SEVEN COSIP DISCIPLI     C 152
           INDEPENDENT RESEARCH IN ZOOLOGY.=                       C 038
ENTS ABILITY TO CONDUCT RESEARCH INCREASED BY COSIP.=    STUD      C 152
                  FACULTY RESEARCH INITIATION CHEMISTRY.=          C 165
                          RESEARCH INITIATION PROJECTS.=           C 149
G FACULTY.=               RESEARCH INITIATION YOUNG ENGINEERIN     C 146
     BEHAVIORAL SCIENCE RESEARCH INSTITUTE.=                       C 164
      EMPLOYED DIRECTOR RESEARCH INSTITUTE.=                       N 006
YSIOLOGY.=                RESEARCH INSTRUMENT USAGE IN CELL PH     C 046
       FACULTY-STUDENT RESEARCH INTEGRAL TO ALL COURSES.=          C 162
=                         RESEARCH LABORATORY FOR MATHEMATICS.     N 160
TE GEOLOGY MOBILE FIELD RESEARCH LABORATORY.=    UNDERGRADUA      C 141
                  FACULTY RESEARCH LEAVES AND REDUCED LOADS.=      C 131
              SABBATICAL RESEARCH LEAVES.=                         C 163
      FACULTY ON-CAMPUS RESEARCH LEAVES.=                          C 019
COURSES.=          URBAN RESEARCH METHODS AND SOVIET STUDIES       C 111
WATERS.=  OCEANOGRAPHIC RESEARCH MONITORING PACIFIC COASTAL        N 179
      INTERDISCIPLINARY RESEARCH ON COMMON PROBLEMS.=              C 169
                  STUDENT RESEARCH ON VISUAL FORM PERCEPTION.=     C 004
     EXPANDED TEACHING- RESEARCH OPPORTUNITIES.=                   C 066
   OFF-CAMPUS STUDY AND RESEARCH OPPORTUNITIES.=                   C 057
RUCTION.=                 RESEARCH ORIENTED UNDERGRADUATE INST     C 071
R BIOLOGY UNDERGRADUATE RESEARCH PARTICIPATION.=     FOUR YEA      C 044
R SENIORS.=               RESEARCH PARTICIPATION EXPERIENCE FO     C 071
          UNDERGRADUATE RESEARCH PARTICIPATION.=                   C 043
          UNDERGRADUATE RESEARCH PARTICIPATION.=                   C 158
          UNDERGRADUATE RESEARCH PARTICIPATION.=                   C 025
          UNDERGRADUATE RESEARCH PARTICIPATION.=                   C 100
          UNDERGRADUATE RESEARCH PARTICIPATION.=                   C 131
US SUMMER UNDERGRADUATE RESEARCH PARTICIPATION.=     OFF-CAMP      C 069
CAREERS.= UNDERGRADUATE RESEARCH PARTICIPATION INFLUENCE ON        C 069
       STUDENT-FACULTY RESEARCH PARTICIPATION.=                    C 102
                       RESEARCH PARTICIPATION.=                    N 060
```

```
          UNDERGRADUATE RESEARCH PARTICIPATION.=                N 036
                FACULTY RESEARCH PARTICIPATION.=                N 101
          UNDERGRADUATE RESEARCH PARTICIPATION PROGRAM.=        N 153
      NSF UNDERGRADUATE RESEARCH PARTICIPATION.=                N 158
  FACULTY-STUDENT JOINT RESEARCH POJECTS.=                      C 135
               TEACHING RESEARCH POST-DOCTORAL POSITION.=       N 057
 IN BIOLOGY.=           RESEARCH PROBLEMS FOR UNDERGRADUATES   N 046
PHYSICS.=               RESEARCH PROFESSOR OF CHEMISTRY AND    C 057
          UNDERGRADUATE RESEARCH PROGRAM EXPANSION.=            C 070
          UNDERGRADUATE RESEARCH PROGRAM.=                      C 002
  FACULTY-UNDERGRADUATE RESEARCH PROGRAM.=                      C 042
 FACULTY-STUDENT SUMMER RESEARCH PROGRAM.=                      C 062
    STUDENT INDEPENDENT RESEARCH PROGRAM.=                      C 083
NRICHED FACULTY STUDENT RESEARCH PROGRAM.=                  E   C 068
RGED STUDENT TRAVEL FOR RESEARCH PROGRAM.=                ENLA  C 068
                 SUMMER RESEARCH PROGRAM.=                      N 185
CULTY STUDENT DEVELOPED RESEARCH PROGRAMS.=                 FA  C 036
      FACULTY STUDY AND RESEARCH PROGRAMS.=                     C 074
OPMENT OF UNDERGRADUATE RESEARCH PROGRAMS.=             DEVEL   C 159
NT CHEMISTRY PSYCHOLOGY RESEARCH PROGRAMS.=             STUDE   C 094
  COMPREHENSIVE ECOLOGY RESEARCH PROJECT.=                      N 187
Y.=                     RESEARCH PROJECTS FOR PHYSICS FACULT    C 067
          UNDERGRADUATE RESEARCH PROJECTS IN MATHEMATICS.=      C 118
.=        WATER QUALITY RESEARCH PROJECTS IN GENERAL BIOLOGY    N 067
STANTS.=        FACULTY RESEARCH PROJECTS UNDERGRADUATE ASSI    C 115
        FACULTY-STUDENT RESEARCH PROJECTS.=                     C 006
RADUATE STUDENT SCIENCE RESEARCH PROJECTS.=             UNDERG  C 008
 SUMMER STUDENT FACULTY RESEARCH PROJECTS.=                     C 077
         FACULTY SUMMER RESEARCH PROJECTS.=                     C 088
   UNDERGRADUATE SUMMER RESEARCH PROJECTS.=                     C 088
                FACULTY RESEARCH PROJECTS.=                     C 107
 FACULTY STUDENT SUMMER RESEARCH PROJECTS.=                     C 029
                STUDENT RESEARCH PROJECTS.=                     C 107
 FACULTY STUDENT SUMMER RESEARCH PROJECTS.=                     C 137
          UNDERGRADUATE RESEARCH PROJECTS.=                     C 040
E INDEPENDENT STUDY AND RESEARCH PROJECTS.=         UNDERGRADUAT N 085
    FACULTY AND STUDENT RESEARCH PROJECTS.=                     N 020
            COOPERATIVE RESEARCH PROJECTS.=                     N 186
   COMPUTER ANALYSIS OF RESEARCH PROJECTS.=                     N 152
          UNDERGRADUATE RESEARCH PROMOTED.=                     C 103
                        RESEARCH REPORTS SEMINAR.=              N 004
              SCIENTIFIC RESEARCH REVITALIZATION.=              C 013
ES.=             STUDENT RESEARCH SPONSORED BY OUTSIDE AGENCI   N 152
             ECOLOGICAL RESEARCH STATION.=                      N 076
                STUDENT RESEARCH STIPENDS.=                     C 134
                 SUMMER RESEARCH STIPENDS.=                     C 076
  FACULTY RELEASED TIME RESEARCH STUDY.=                        C 029
NTS AND FACULTY.=       RESEARCH SUPPORT FOR CHEMISTRY STUDE    C 130
RTMENTS.=        FACULTY RESEARCH SUPPORT IN ALL SCIENCE DEPA   N 093
                 FACULTY RESEARCH SUPPORT.=                     C 101
                         RESEARCH SUPPORTING INSTRUMENTS.=      C 149
=         UNDERGRADUATE RESEARCH TEAM DESIGN COMPUTER USAGE.    C 141
                         RESEARCH TRAINING FIRST YEAR LEVEL.=   N 062
          UNDERGRADUATE RESEARCH TUTORIAL.=                     C 155
P.ACTIVITY.=      POLICY RESEARCH WITH PEER TEACHING AND GROU   C 007
C ENVIRONMENTAL QUALITY RESEARCH.=                      AQUATI  C 004
            ENGINEERING RESEARCH.=                              C 026
      FACULTY STUDY AND RESEARCH.=                              C 048
ENTAL STUDIES MAJOR AND RESEARCH.=                      ENVIRONM C 084
UDENT MULTIDISCIPLINARY RESEARCH.=                          ST  C 090
        FACULTY SUMMER RESEARCH.=                               C 093
 RELEASED TIME ONCAMPUS RESEARCH.=                              C 100
       ASSISTED FACULTY RESEARCH.=                              C 103
N BIOLOGY UNDERGRADUATE RESEARCH.=                      AVIA    C 106
PHYSICS STUDENT FACULTY RESEARCH.=                              C 120
        RADIO ASTRONOMY RESEARCH.=                              C 175
        MARINE ALGALOGY RESEARCH.=                              C 004
        FACULTY STUDENT RESEARCH.=                              C 016
  UNDERGRADUATE STUDENT RESEARCH.=                              C 021
OMETER TEACHING STUDENT RESEARCH.=                  NMR SPECTR  C 053
        COMPUTER USE IN RESEARCH.=                              C 058
        STUDENT-FACULTY RESEARCH.=                              C 075
  UNDERGRADUATE STUDENT RESEARCH.=                              C 123
         SUMMER STUDENT RESEARCH.=                              C 145
POSSUM RHYTHMIC PATTERN RESEARCH.=                              C 004
```

SUMMER STUOENT	RESEARCH.=		C 009
ENOVATION FOR CHEMISTRY	RESEARCH.=	SPACE R	C 014
STUOENT FACULTY	RESEARCH.=		C 031
LTY OEVELOPMENT THROUGH	RESEARCH.=	FACU	C 036
E IN TIME FOR SCHOLARLY	RESEARCH.=	FACULTY RELEAS	C 044
O UNOERGRAOUATE STUOENT	RESEARCH.=	FACULTY AN	C 072
FACULTY-STUOENT	RESEARCH.=		C 087
NEW FACULTY IN	RESEARCH.=		C 089
CHEMICAL FACULTY	RESEARCH.=		C 139
SOCIAL SCIENCE FACULTY	RESEARCH.=		C 150
FACULTY STUOENT SUMMER	RESEARCH.=		C 163
HONORS	RESEARCH.=		C 174
UNOERGRAOUATE	RESEARCH.=		C 176
INSECT HEARING	RESEARCH.=		C 004
FACULTY	RESEARCH.=		C 009
ASEO TIME FOR STUOY ANO	RESEARCH.=	RELE	C 031
PLINARY STUOENT FACULTY	RESEARCH.=	INTEROISCI	C 035
STUOENT INVOLVEMENT IN	RESEARCH.=		C 057
INFORMATION THEORY	RESEARCH.=		C 066
OFFCAMPUS	RESEARCH.=		C 100
OIRECTION UNOERGRAOUATE	RESEARCH.=	FACULTY	C 101
TUOENT PARTICIPATION IN	RESEARCH.=	S	C 149
FACULTY	RESEARCH.=		C 176
PORPHINE	RESEARCH.=		C 004
COMPUTER SIMULATION	RESEARCH.=		C 066
FACULTY	RESEARCH.=		C 090
SUMMER STUOENT/FACULTY	RESEARCH.=		C 096
E BIOLOGY UNOERGRAOUATE	RESEARCH.=	MARIN	C 106
UNOERGRAOUATE ASSISTEO	RESEARCH.=		C 129
STUOENT	RESEARCH.=		C 175
SYSTEMS ENGINEERING	RESEARCH.=		C 066
OMETERS ENHANCE STUOENT	RESEARCH.=	SPECTR	C 086
STUOENT	RESEARCH.=		C 124
EO TIME FOR MATHEMATICS	RESEARCH.=	RELEAS	C 130
RY SUMMER UNOERGRAOUATE	RESEARCH.=	MULTIOISCIPLINA	C 151
TING AGENCY FOR FACULTY	RESEARCH.=	INTERNAL REGRAN	C 030
OTOLANGUAGE LINGUISTICS	RESEARCH.=	PR	C 039
ES PROVIOEO FOR STUOENT	RESEARCH.=	OPPORTUNITI	C 181
TIMULUS CAUSEO BEHAVIOR	RESEARCH.=	S	C 004
IMPROVEO UNOERGRAOUATE	RESEARCH.=		C 019
FACULTY	RESEARCH.=		C 027
ANTHROPOLOGICAL	RESEARCH.=		C 076
BEHAVIORIAL SCIENCE	RESEARCH.=		C 086
OUATE MULTIOISCIPLINARY	RESEARCH.=	UNOERGRA	C 101
EQUIPMENT FOR FACULTY	RESEARCH.=		C 152
TEACHING-ORIENTEO	RESEARCH.=		C 028
TER FOR COOROINATION OF	RESEARCH.=	ESTABLISHEO CEN	N 006
STUOENT ORIGINATEO	RESEARCH.=		N 086
ULTIOISCIPLINARY SUMMER	RESEARCH.=	M	N 113
UOENT MULTIOISCIPLINARY	RESEARCH.=	ST	N 130
EMIC YEAR UNOERGRAOUATE	RESEARCH.=	ACAO	N 151
REQUIREO UNOERGRAOUATE	RESEARCH.=		N 155
NOERGRAOUATE PSYCHOLOGY	RESEARCH.=	COMPUTER USE U	N 056
FACULTY IMPROVEMENT ANO	RESEARCH.=	ZOOLOGY	N 079
STUOENT ECOLOGICAL	RESEARCH.=		N 080
UOENT INTEROISCIPLINARY	RESEARCH.=	ST	N 096
FACULTY	RESEARCH.=		N 102
UTER CENTER INSTRUCTION	RESEARCH.=	COMP	N 113
LIFE SCIENCES	RESEARCH.=		N 143
CONTINUEO UNOERGRAOUATE	RESEARCH.=		N 176
ELECTRON SPIN RESONANCE	RESEARCH.=		N 035
HODOLOGY FOR BIOLOGICAL	RESEARCH.=	RAOIOTRACER MET	N 098
FUNO TO AIO FACULTY	RESEARCH.=		N 111
ECONOMIC	RESEARCH.=		N 139
LLEGE COMMUNITY RELATEO	RESEARCH.=	CO	N 148
ONAL COOPERATIVE MARINE	RESEARCH.=	INTERINSTITUTI	N 179
HEO FACULTY ANO STUOENT	RESEARCH.=	PUBLIS	N 123
STUOENT OIRECTEO	RESEARCH.=		N 178
CIPLINARY UNOERGRAOUATE	RESEARCH.=	INTERDIS	N 023
CEANOGRAPHY COURSES ANO	RESEARCH.=	O	N 089
ORIGINATEO SEMINAR ANO	RESEARCH.=	STUOENT	N 093
INOEPENOENT BIOLOGICAL	RESEARCH.=	UNOERGRADUATE	N 095
TUOENT INSECT PHEROMONE	RESEARCH.=	FACULTY-S	N 139
PSYCHOLOGY BIOTELEMETRY	RESEARCH.=	ENGINEERING ANO	C 140
ITIONS FOR TEACHING ANO	RESEARCH.=	EQUIPMENT ACQUIS	N 093

```
          SUPPLEMENT TO SABBATICAL LEAVE PROGRAM.=                C 108
                FACULTY SABBATICAL LEAVES.=                       C 025
 IMPROVEMENT-SUPPLEMENT SABBATICAL LEAVES.=          FACULTY      C 005
    ENGINEERING FACULTY SABBATICAL PROGRAM.=                      N 107
        SCIENCE FACULTY SABBATICAL PROGRAM.=                      N 107
                        SABBATICAL RESEARCH LEAVES.=              C 163
                FACULTY SABBATICALS.=                             C 152
                 SUMMER SALARIES FOR COURSE REORGANIZATION.=      C 079
                 SUMMER SALARY FOR IMPROVEMENT OF FACULTY.=       C 079
ILURE.=                 SALVAGE OF STUDENTS FROM ACADEMIC FA      C 138
            STATISTICAL SAMPLING TECHNIQUES.=                     C 139
                  COST- SAVING SCIENCE INSTRUCTION.=              C 017
OCK ONE COURSE ACADEMIC SCHEDULE.=                  NINE BL       N 029
        OPEN LABORATORY SCHEDULE.=                                N 110
CTIVE/INTERDISCIPLINARY SCHEMA.=       DEVELOPMENT OF INTERA      C 148
TY INTEREST IN VISITING SCHOLAR PROGRAM.=   NONSCIENCE FACUL      C 069
LTY RELEASE IN TIME FOR SCHOLARLY RESEARCH.=            FACU      C 044
  INFLUENCE OF VISITING SCHOLARS AND PROFESSORS.=                 C 069
OOLS.=  DEPAUW VISITING SCHOLARS PROGRAM TO INDIANA HIGH SCH      N 035
          COLLEGE-HIGH SCHOOL COLLEAGUE RELATIONSHIPS.=           C 001
 GRADUATE-UNDERGRADUATE SCHOOL COOPERATIVE PROGRAM.=              C 002
              SECONDARY SCHOOL CURRICULUM ENRICHMENT.=            N 090
     COMPUTER CENTER IN SCHOOL OF ENGINEERING.=                   N 143
       PRE-MEDICAL HIGH SCHOOL PROGRAM.=                          N 125
     INSTITUTE FOR HIGH SCHOOL PSYCHOLOGY.=                       N 009
PTION FOR TEACHING HIGH SCHOOL SCIENCE.=            PHYSICS D     N 120
=               MINORITY SCHOOLS BIOMEDICAL SCIENCES PROGRAM.     N 143
TRY COOPERATION BETWEEN SCHOOLS.=                     CHEMIS      C 189
EERING FACULTY AT SMALL SCHOOLS.=                   PRE-ENGIN     C 188
TITUDES IN CEDAR RAPIDS SCHOOLS.=                   RACIST AT     C 028
ICAL PROBLEMS IN PUBLIC SCHOOLS.=                    SOCIOLOG     N 182
EERING COURSES AT SMALL SCHOOLS.=           ELECTRICAL ENGIN      C 188
ADUATE AND PROFESSIONAL SCHOOLS.=        ARTICULATION WITH GR     C 007
PROGRAM TO INDIANA HIGH SCHOOLS.=  DEPAUW VISITING SCHOLARS       N 035
                        SCIENCE ACTIVITIES CENTER.=               N 174
S.=           POLITICAL SCIENCE AND ECONOMICS LECTURER SERIE      C 111
                        SCIENCE AND ECONOMICS IN SOCIETY.=        N 035
CE STUDENT.=            SCIENCE AND ENGINEERING FOR NONSCIEN      C 146
QUISITIONS.=            SCIENCE AND ENGINEERING EQUIPMENT AC      C 107
REGIONAL CONFERENCES ON SCIENCE AND HUMAN AFFAIRS.=               C 112
NHANCED FLEXIBILITY FOR SCIENCE AND MATH MAJORS.=           E     N 118
VICE EXPERIENCES-FUTURE SCIENCE AND MATH TEACHERS.=   PRESER      N 159
                NATURAL SCIENCE AND MATHEMATICS CONFERENCE.=      C 186
OR ADDITIONAL TRAINING/ SCIENCE AND MATHEMATICS.=    LEAVES      C 159
       RESTRUCTURING OF SCIENCE AND MATHEMATICS CURRICULUM.=      N 021
    COMPUTER COURSE FOR SCIENCE AND NON-SCIENCE MAJORS.=          N 153
  ASTRONOMY PROGRAM FOR SCIENCE AND NONSCIENCE MAJORS.=           C 122
               PHYSICAL SCIENCE AND SOCIETY COURSE.=              N 067
ATION.=                 SCIENCE AND SOCIETY COURSE IMPLEMENT      N 070
E RESEARCH IN POLITICAL SCIENCE AND SOCIOLOGY.= UNDERGRADUAT      C 111
             HISTORY OF SCIENCE AND TECHNOLOGY COURSE.=           C 171
EST CENTERS.=   NATURAL SCIENCE AREA REORGANIZATION BY INTER      N 004
       GENERAL PHYSICAL SCIENCE AUDIO-TUTORIAL LABORATORY.=       C 022
                        SCIENCE BUILDING CONSTRUCTION.=           N 013
IDISCIPLINARY, FLEXIBLE SCIENCE BUILDING DESIGN.=         MULT    C 119
                        SCIENCE BUILDING RENOVATION.=             N 048
          RENOVATION OF SCIENCE BUILDING.=                        N 163
    AIR CONDITIONING OF SCIENCE BUILDING.=                        N 163
                        SCIENCE BUILDING.=                        N 185
                COMPUTER SCIENCE CAR POOLING.=                    N 131
TUDENT MOTIVATION.=     SCIENCE CAREERS DOCTORAL POTENTIAL S      C 094
 NON-COSIP PARTICIPANTS SCIENCE CAREERS MOTIVATION.=              N 094
                        SCIENCE CENTER - TALCOTT MOUNTAIN.=       C 065
SHING INTERDISCIPLINARY SCIENCE CENTER.=              ESTABLI     C 094
                        SCIENCE CENTER.=                          N 158
ORY ORIENTED BEHAVIORAL SCIENCE CENTER.=              LABORAT     N 094
      INTERDISCIPLINARY SCIENCE CENTER.=                          N 086
      CONSORTIUM MARINE SCIENCE COMMITTEE.=                       N 178
           OLIN HALL OF SCIENCE COMPLEX.=                         N 096
                 SOCIAL SCIENCE COMPUTER USE.=                    C 004
VELOPMENT OF BEHAVIORAL SCIENCE COMPUTERIZED DATA BANK.=  DE      N 123
  GEOLOGY FOR EXTENDING SCIENCE CONCEPTS.=                        N 087
                 SOCIAL SCIENCE CONFERENCE.=                      C 186
                        SCIENCE CONSULTANT.=                      C 124
ON.=                    SCIENCE CONSULTANTS FOR ADMINISTRATI      C 163
```

PHYSICAL	SCIENCE THROUGH MATHEMATICS.=	C 154
EERS.= MATERIAL	SCIENCE VERSATILITY MECHANICAL ENGIN	C 117
VEMENT OF UNDERGRADUATE	SCIENCE.= IMPRO	C 023
E BIOCHEMISTRY COMPUTER	SCIENCE.= BACCALAUREAT	C 050
BIOLOGICAL PHYSICAL	SCIENCE.=	C 139
RBAN SYSTEMS MANAGEMENT	SCIENCE.= BACCALAUREATE U	C 050
COMPUTER	SCIENCE.=	C 143
OPPORTUNITIES IN MARINE	SCIENCE.= UNDERGRADUATE	C 173
UCTION IN UNDERGRADUATE	SCIENCE.= COMPUTER INSTR	C 023
ALAUREATE ENVIRONMENTAL	SCIENCE.= BACC	C 050
ES IN AFRICAN POLITICAL	SCIENCE.= NEW COURS	C 144
IMPACT OF SOCIETY ON	SCIENCE.=	C 154
ON CORE ENGINEERING AND	SCIENCE.= COMM	C 054
MAN AND	SCIENCE.=	C 154
MODERNIZING OF PHYSICAL	SCIENCE.=	C 116
RTIUM PROGRAM/POLITICAL	SCIENCE.= CONSO	C 170
COMPUTER BASED SOCIAL	SCIENCE.=	C 104
ORITY STUDENTS PHYSICAL	SCIENCE.= MIN	C 180
INARY MAJOR PROGRAMS IN	SCIENCE.= INTERDISCIPL	N 025
PHYSICS/CHEMISTRY/EARTH	SCIENCE.= MERGER	N 142
NTERNSHIPS IN POLITICAL	SCIENCE.= I	N 131
UNDERGRADUATE COMPUTER	SCIENCE.=	N 023
CURRICULUM IN COMPUTER	SCIENCE.= EXPANDED	N 136
IN MODERN EXPERIMENTAL	SCIENCE.= COLLOQUIUM	N 003
HISTORY OF	SCIENCE.=	N 077
ER SIMULATION IN SOCIAL	SCIENCE.= COMPUT	N 121
Y HOLDINGS IN POLITICAL	SCIENCE.= INCREASED LIBRAR	C 144
OR TEACHING HIGH SCHOOL	SCIENCE.= PHYSICS OPTION F	N 120
ROGRAM IN ENVIRONMENTAL	SCIENCE.= BACHELOR DEGREE P	N 155
UTER SCIENCE MANAGEMENT	SCIENCE.= MASTER CURRICULA COMP	C 050
ECONOMICS AND POLITICAL	SCIENCE.= FACULTY DEVELOPMENT IN	C 111
COURSES.=	SCIENCE-HUMANITIES INTERDISCIPLINARY	N 019
	SCIENCE-TECHNOLOGY MODULES.=	N 154
RCH FINDINGS FOR SOCIAL	SCIENCE/COMMUNITY.= SURVEY RESEA	C 148
WPI PLAN FOR	SCIENCE/ENGINEERING EDUCATION.=	N 166
ITIES MAJORS.=	SCIENCE/ENGINEERING MINORS FOR HUMAN	C 166
Y MAJOR.= COMPUTER	SCIENCE/MATHEMATICS INTERDISCIPLINAR	N 057
ADVANTAGED STUDENTS.=	SCIENCE/MATHEMATICS WORKSHOP FOR DIS	N 004
CED INSTRUCTION NATURAL	SCIENCE/MATHEMATICS.= SELF-PA	C 017
LF-IMPROVEMENT/COMPUTER	SCIENCE/NUTRITION.= FACULTY SE	C 069
OCIETY.= COLLOQUIUM IN	SCIENCE/TECHNOLOGY IN CONTEMPORARY S	C 003
DISCIPLINARY COURSES IN	SCIENCES AND HUMANITIES.= INTER	N 017
RITY SCHOOLS BIOMEDICAL	SCIENCES PROGRAM.= MINO	N 143
LIFE	SCIENCES RESEARCH.=	N 143
EXPERIMENTAL	SCIENCES STUDY GROUP.=	N 163
ATIVE COURSES IN SOCIAL	SCIENCES.= INTEGR	C 073
E METHODS IN BEHAVIORAL	SCIENCES.= QUANTITATIV	C 137
IPMENT FOR EXPERIMENTAL	SCIENCES.= LABORATORY EQU	C 163
ELD STUDIES IN PHYSICAL	SCIENCES.= FI	C 071
LING OF SOCIAL AND LIFE	SCIENCES.= MODE	C 040
O-VISUAL TECHNICIAN FOR	SCIENCES.= AUDI	C 061
SED COMPUTING IN SOCIAL	SCIENCES.= INCREA	C 136
TERNSHIPS IN THE SOCIAL	SCIENCES.= IN	C 030
COMPUTERS IN THE SOCIAL	SCIENCES.=	C 060
TRUMENTATION FOR ALLIED	SCIENCES.= ELECTRONIC INS	C 071
ATIVE METHODS IN SOCIAL	SCIENCES.= QUANTIT	C 067
ATIVE ASPECTS OF SOCIAL	SCIENCES.= QUANTIT	C 077
RRICULUM CHANGES IN THE	SCIENCES.= CU	C 102
IDEO-RECORDER IN SOCIAL	SCIENCES.= V	C 086
TER PROGRAMMING FOR THE	SCIENCES.= COMPU	N 116
IP PROGRAMS IN ARTS AND	SCIENCES.= INTERNSH	N 159
ER TECHNIQUES IN SOCIAL	SCIENCES.= COMPUT	N 089
ROJECTS IN THE PHYSICAL	SCIENCES.= INDIVIDUALIZED P	C 012
LYSES IN SOCIAL-NATURAL	SCIENCES.= QUANTITATIVE ANA	C 087
N HUMANITIES/BEHAVIORAL	SCIENCES.= MODULAR COURSES I	N 017
MENTS IN THE BIOLOGICAL	SCIENCES.= OPEN ENDED EXPERI	C 012
EE PROGRAMS IN ARTS AND	SCIENCES.= EXTERNAL STUDIES DEGR	N 159
LABORATORY INSTRUCTION	SCIENCES.= IMPROVEMENT ELEMENTARY	C 131
MAJOR OPTION FOR HEALTH	SCIENCES.= PHYSICS AND CHEMISTRY	C 120
S OF MATHEMATICS/SOCIAL	SCIENCES.= SEMINARS ON APPLICATION	C 020
TION/NATURAL AND SOCIAL	SCIENCES.= COMPUTER SOFTWARE PRODUC	C 011
ATIONS COURSE IN SOCIAL	SCIENCES.= INTRODUCTION OF HUMAN REL	C 068
ISTIC STUDIES PROGRAM.=	SCIENCES-PART OF UNDERGRADUATE FUTUR	N 162
AND STUDENT EXPOSURE TO	SCIENTIFIC ENVIRONMENT.= FACULTY	C 127
	SCIENTIFIC EQUIPMENT PURCHASES.=	C 003

180

```
Y JOURNAL EXPANSION AND SUPPLEMENTATION.=                LIBRAR    C 019
ACULTY.=        RESEARCH SUPPORT FOR CHEMISTRY STUDENTS AND F     C 130
        FACULTY RESEARCH SUPPORT IN ALL SCIENCE DEPARTMENTS.=     N 093
    OMNIBUS GOVERNMENTAL SUPPORT MISSION.=                        N 148
        FACULTY RESEARCH SUPPORT.=                                C 101
            RELEASE TIME SUPPORT.=                                C 128
       INTERDISCIPLINARY SUPPORT.=                                N 103
                RESEARCH SUPPORTING INSTRUMENTS.=                 C 149
STUDENTS.=        ANIMAL SURGERY FOR BIOLOGY AND PRE-MEDICAL      C 091
                         SURPLUS EQUIPMENT PURCHASES.=            C 076
                         SURPLUS EQUIPMENT.=                      N 161
.=                       SURPLUS PROPERTY CLASSROOM EQUIPMENT     N 101
          WATER QUALITY SURVEY OF SOURIS (MOUSE) RIVER.=          N 091
SCIENCE/COMMUNITY.=      SURVEY RESEARCH FINDINGS FOR SOCIAL      C 148
.=              MAGNETIC SUSCEPTIBILITY IN PHYSICAL CHEMISTRY     C 133
 MULTILEVEL EVALUATION SUSTAINING IMPACT AND SELF-RENEWAL.=       C 007
                 DISMAL SWAMP PROJECTS.=                          N 109
GRATED FACULTY WORKSHOP SYLLABUS.=                        INTE    N 178
                 SCIENCE SYMPOSIA INITIATION.=                    N 013
         STUDENT TOPICAL SYMPOSIA.=                               C 174
SCIPLINARY PROGRAMS AND SYMPOSIA.=                       INTERDI  N 109
                 BIOLOGY SYMPOSIA.=                               N 122
        FACULTY-STUDENT SYMPOSIA.=                                N 114
        FEDERAL RESERVE SYSTEM FILM.=                             C 028
.=          PERSONALIZED SYSTEM INSTRUCTION CHEMISTRY PHYSICS     C 115
D TIME SHARING COMPUTER SYSTEM.=                    DISK FILES AN C 077
Y INFORMATION RETRIEVAL SYSTEM.=                          LIBRAR  C 016
 TIMEFREE INSTRUCTIONAL SYSTEM.=                                  C 059
            TELEVISION SYSTEM.=                                   C 138
I-COMPUTER TIME-SHARING SYSTEM.=                   SOFTWARE MIN   N 115
     STATEWIDE COMPUTER SYSTEM.=                                  N 103
ON OF IBM 1130 COMPUTER SYSTEM.=          PURCHASE AND EXPANSI    C 003
   TIME-SHARED COMPUTER SYSTEM/CLASSROOMS AND LABORATORIES.=      N 020
=       MASTER CURRICULA SYSTEMS BIOCHEMISTRY BIOENGINEERING.     C 050
                         SYSTEMS ENGINEERING RESEARCH.=           C 066
                DELIVERY SYSTEMS FOR LEARNING MODULES.=           C 049
EMENTS, PROPERTIES, AND SYSTEMS LABORATORIES.=            MEASUR  C 085
    BACCALAUREATE URBAN SYSTEMS MANAGEMENT SCIENCE.=              C 050
NCORPORATION OF GENERAL SYSTEMS THEORY INTO CURRICULUM.=    I     C 150
                ADVISING SYSTEMS.=                                C 166
M IN MACROENVIRONMENTAL SYSTEMS.=                     COLLOQUIU   N 003
                COMPUTER SYSTEMS.=                                N 053
       SCIENCE CENTER - TALCOTT MOUNTAIN.=                        C 065
                 VIDEO- TAPE IN SCIENCE INSTRUCTION.=             C 011
.=               VIDEO- TAPE INSTRUCTION FOR ANALOG COMPUTER      C 077
BRATE ZOOLOGY.=   VIDEO TAPE LABORATORY INSTRUCTION IN VERTE      C 106
                 VIDEO- TAPE OF NUMERICAL ANALYSIS.=              C 104
                 VIDEO- TAPED EXPERIMENTS.=                       C 109
=                       TAPES PRE-LAB INSTRUCTION CHEMISTRY.      N 010
HYSICS COLLOQUIUM VIDEO TAPES.=                               P   N 180
NOCOCCUS MULTILOCULARIS TAPEWORM STUDY.=                    ECHI  N 091
                  TEAM- TAUGHT COURSES WITH PHYSICISTS.=          N 034
    POST-SESSION, TEAM- TAUGHT ENVIRONMENTAL FIELD STUDIES.=      N 156
                 STUDENT TAUGHT INTRODUCTION TO PSYCHOLOGY.=      C 157
                STUDENT- TAUGHT MATHEMATICS COURSE.=              C 009
URSE.=            TEAM- TAUGHT UNIFIED FIRST-YEAR BIOLOGY CO      C 118
                STUDENT- TEACHER DEVELOPMENT.=                    C 107
                ENGINEER TEACHER INTERN PROGRAM.=                 C 016
RESERVICE EARTH SCIENCE TEACHER PREPARATION EXPERIMENT.=  PR      N 091
BASED SECONDARY SCIENCE TEACHER PROGRAM.=         COMPETENCY-     N 030
PROFESSIONAL SCIENTIFIC TEACHER TRAINING PROGRAM.=        PRE     C 043
 ELEMENTARY MATHEMATICS TEACHERS CURRICULUM.=                     C 024
                 SCIENCE TEACHERS PROGRAM.=                       C 040
     ELEMENTARY SCIENCE TEACHERS PROGRAM.=                        C 030
FUTURE SCIENCE AND MATH TEACHERS.=   PRESERVICE EXPERIENCES-      N 159
            AUDIO-VISUAL TEACHING AIDS CENTER.=                   C 107
IRESEARCH EQUIPMENT AND TEACHING AIDS.=           PHYSICS SEM     C 143
        DEPARTMENTAL TEACHING AIDS.=                              C 156
LICY RESEARCH WITH PEER TEACHING AND GROUP ACTIVITY.=     PO      C 007
SION OF COMPUTER USE IN TEACHING AND RESEARCH.=         EXPAN     N 068
IPMENT ACQUISITIONS FOR TEACHING AND RESEARCH.=           EQU     N 093
RY.=      UNDERGRADUATE TEACHING ASSISTANTS LECTURE/LABORATO      C 131
                 STUDENT TEACHING ASSISTANTS.=                    N 121
OGY.=     UNDERGRADUATE TEACHING ASSISTANTSHIPS IN ANTHROPOL      C 056
                 STUDENT TEACHING ASSISTANTSHIPS.=                C 153
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