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AUTHOR	Ruskus, Joan A.; Matson, Barbara S.; Perakis, Steven J.
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ABSTRACT

This report contains the summative evaluation of the Collaborative for Excellence in Teacher Preparation (CETP). The evaluation emphasizes program impacts in keeping with the Government Performance and Results Act (GPRA) requirements which drive evaluation and monitoring systems at the National Science Foundation (NSF) and other federal agencies. The summative evaluation includes the first five NSF CETP-funded collaboratives--the Louisiana Collaborative for Excellence in the Preparation of Teachers (LaCEPT), the Maryland Collaborative for Teacher Preparation (MCTP), the Systemic Teacher Excellence Preparation (STEP) project in Montana; Colorado's Rocky Mountain Teacher Education Collaborative (RMTEC), and Philadelphia's Collaborative for Excellence in Teacher Preparation (Temple). The rationale for including the most mature projects was that they were the most likely to have developed and implemented reformed courses, taken steps toward institutionalization, and graduated teachers. These five CETP projects involved 47 institutions of higher education. The report is divided into two sections, one each for qualitative and quantitative findings. Subsections of the quantitative findings include: (1) "Implementation of Reform"; (2) "Outcomes for Students"; (3) "Faculty Involvement and Collaboration"; (4) "Impact on the Learning Infrastructure and Institutionalization of Reform"; and (5) "Dissemination and Model Generation." (MM)

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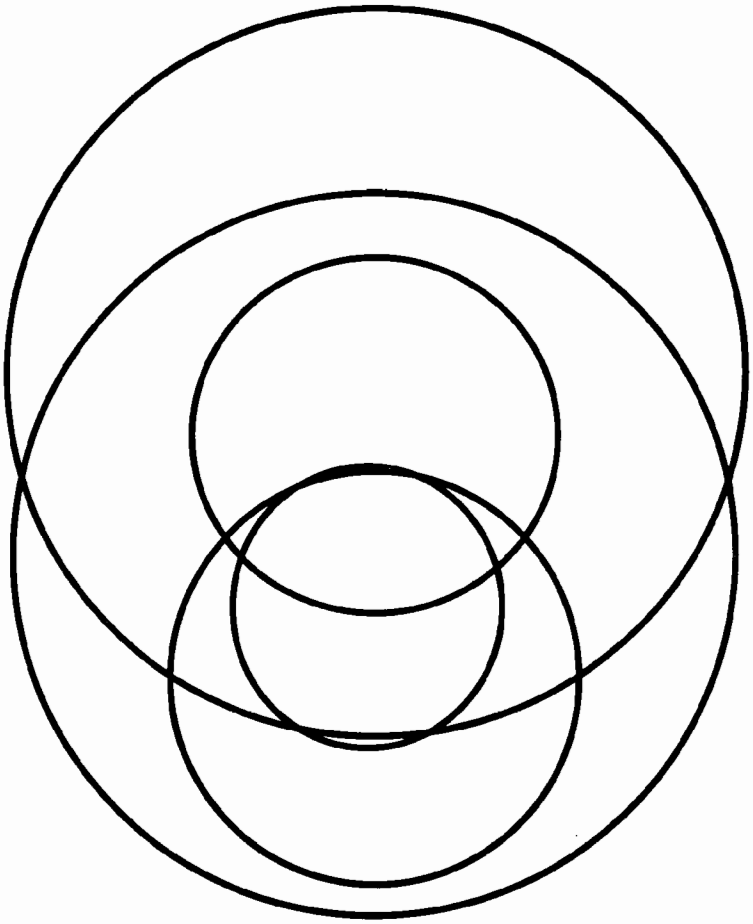

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March 2001

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SUMMATIVE EVALUATION of the COLLABORATIVES for EXCELLENCE in TEACHER PREPARATION

Reference: Contract No. RED 9452963
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March 2001

Prepared for:

The National Science Foundation
Directorate for Education and Human Resources
Division of Research, Evaluation and Communication
4201 Wilson Boulevard
Arlington, Virginia 22230

Prepared by:

Joan A. Ruskus
Barbara S. Matson
Steven J. Perakis
SRI International
Higher Education Policy and Evaluation
Center for Science, Technology and Educational Development
1611 North Kent Street
Arlington, Virginia 22209
(703) 524-2053

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Any opinions, findings, conclusions, or recommendations expressed in this report are those of SRI International. They do not necessarily represent the official views, opinions, or policy of the National Science Foundation.

EXECUTIVE SUMMARY

Background and Overview of the Collaboratives for Excellence in Teacher Preparation Program

Improving the quality of K-12 education, a goal in the United States for decades, came into its own in the early 1980s with publication of *A Nation at Risk*, issued by the National Commission on Excellence in Education.[1] By the mid-1990s, reform of teacher preparation was seen as an essential strategy for reforming K-12 education. Reports such as *What Matters Most: Teaching for America's Future*,[2] served as an impetus for faculty from schools of education and from schools of arts and sciences to work together to develop and implement teacher preparation reforms.

To foster collaborations among education and mathematics and science faculty to create more effective teacher preparation programs, NSF put into place a program called "Collaboratives for Excellence in Teacher Preparation" (CETP). In 1993, NSF began funding American colleges and universities under the CETP program. The purpose of the CETP program is "to improve significantly the science, mathematics, and technology preparation of future K-12 teachers and their effectiveness as educators in these areas." A principal objective of the CETP program is "to engage fully the departments of science, mathematics, engineering, technology, and education and their faculties in the preparation of teachers."[3] The CETP program supports large-scale systemic projects designed to significantly change teacher preparation programs on a state or regional basis and to serve as national comprehensive models of excellence in the preparation of K-12 teachers. Between 1993 and 2000, a total of 17 collaboratives were funded for up to $1 million per year for 5 years. In addition, some of the projects that received the earliest awards received $600,000 supplements for evaluation studies to determine the impact of the program on their graduates.

Evaluation Design

Because the CETP program had been operational for some time, a summative evaluation design was employed that emphasized program impacts. This emphasis on impact is in keeping with the requirements of GPRA, which are driving evaluation and monitoring systems at NSF and other federal agencies. The summative evaluation includes the first five NSF CETP-funded collaboratives (Cohorts 1 and 2): (1) the Louisiana Collaborative for Excellence in the Preparation of Teachers (LaCEPT), (2) the Maryland Collaborative for Teacher Preparation

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[1] National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform.* Washington, DC: U.S. Government Printing Office.
[2] National Commission on Teaching and America's Future. (1996). *What matters most: Teaching for America's future.* New York: Author.

(MCTP), (3) the Systemic Teacher Excellence Preparation (STEP) project in Montana, (4) Colorado's Rocky Mountain Teacher Education Collaborative (RMTEC), and (5) Philadelphia's Collaborative for Excellence in Teacher Preparation (Temple).[4] The rationale for including the most mature projects was that they were the most likely to have developed and implemented reformed courses, taken steps toward institutionalization, and graduated teachers. These five CETP projects involved 47 institutions of higher education.

The summative evaluation includes a similar group of institutions that also were undergoing teacher education reform of some type. Until the U.S. Department of Education began funding "Partnership Grants" for the purpose of reforming preservice teacher education (summer of 2000), there were unfortunately few, if any, formal collaboratives or partnerships of institutions of higher education focused on the reform of teacher preparation to use as comparison units for the CETP collaboratives. Thus, it was necessary to create a more general comparison group.

SRI subcontracted with an outside firm with a national reputation for selecting peer institutions for colleges and universities.[5] Comparison institutions (which, for the purposes of this study can be thought of as "peer institutions" for the CETP institutions) were selected on the basis of data included in the most recent Integrated Postsecondary Education Data System (IPEDS), using calculations that most closely matched U.S. institutions to CETP institutions.

The calculations were based on four primary criteria: (1) general institutional data (e.g., Carnegie classification, public/private control), (2) enrollment data (full-time student equivalency), (3) financial data (e.g., educational and general expenditures), and (4) the extent of institutional involvement in teacher preparation. The first three criteria have been shown empirically to generate a set of closely matched institutions. Using these criteria, the subcontractor identified 10 close matches for each CETP institution, from which the subcontractor selected a final sample. Because we anticipated low response rates from comparison institutions, we oversampled these institutions, sending out 50 questionnaires rather than 35, which was the size of the final CETP sample.[6]

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[3] *Undergraduate Education Program Announcement and Guidelines*, NSF 97-29.

[4] The Teacher Education Addressing Mathematics and Science in Boston and Cambridge (TEAMS-BC) project was funded in Cohort 2, but because it was in operation for just 2 years, it is not included in the summative evaluation.

[5] SRI subcontracted with JPL Associates, an independent consulting firm widely known in the field of higher education research and policy. JPL works extensively with U.S. Department of Education databases and frequently consults for institutions of higher education nationally.

[6] Twelve of the 47 CETP institutions in Cohorts 1 and 2 indicated that they had no PI or campus lead to fill out the SRI CETP PI/Campus Lead Survey. Thus, the CETP sample size was reduced to 35.

Limitations of a Comparison Group Design

The use of control groups or comparison groups has been discussed in the evaluation literature since the late 1960s.[7] The argument against their use centers on the fact that evaluations of programs in the natural community differ markedly from experiments in the laboratory, where scientists typically use control groups. Nevertheless, the "experimental paradigm" of evaluation, as it is sometimes called, has enjoyed a resurgence in the past few years because of the demand for clear-cut outcomes that can be attributed to the program rather than to intervening factors, of which there are many in the natural community. Appropriate comparison groups are very difficult to identify for evaluative purposes. The context of programs, including institutional setting, motivation for and characteristics of the intervention, and characteristics of participants and program administrators—to name a few aspects—is often very different from that of the program being evaluated. Thus, in interpreting any findings that compare CETPs with the comparison group, the reader should bear in mind that the comparison sites were not organized as collaboratives; they did not necessarily share the same reform philosophy as the CETP program; and they were not always comparable in scope or maturity. In addition, CETP institutions received NSF funding on the basis of a demonstrated need to improve teacher preparation, a distinction that sets them apart from the comparison institutions, where such need may or may not have existed. The comparison group that was used for the CETP summative evaluation was carefully selected and was a reasonable approximation to the CETP institutions in many respects. However, the limitations discussed above should be kept in mind when reading this report.

Also note that a comparative design such as this, which is summative in nature, does not directly capture the changes that occurred at CETP sites over the duration of the funding period, although those indicators intended to measure growth (i.e., increases in faculty involvement and increases in disciplines involved) are analyzed and reported.

Evaluation Methods

Although the focus of the summative evaluation was on the first two cohorts of CETPs as they stood in the 1998-99 academic year, qualitative evaluation data collection spanned 5 years, from 1994 to 1999. Annual 2- to 4-day site visits were made to two or more institutions at each of the five CETPs. The site teams included content experts as well as SRI researchers. Site visits included interviews, focus groups, and observations of classrooms and key CETP

[7] See, for example, Campbell, D. T. & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Chicago: Rand McNally; Boruch, R. F. (1975). On common contentions about randomized experiments for evaluating social programs, in R. F. Boruch and H. W. Riecken (Eds.), *Experimental testing of public policy*. Boulder: Westview; and Weiss, R. S., & Rein, M. (1972). The evaluation of broad-aim programs: Difficulties in experimental

activities. In addition to conducting site visits to the NSF collaboratives, SRI visited a small sample of comparison institutions to collect contextual data and more detailed impact data from these sites.

At the end of the summative evaluation (late spring-early fall 1999), surveys were administered to CETP PIs and campus leads of each participating institution, CETP faculty, and directors of teacher preparation programs at comparison sites. The final set of surveys was reviewed, edited, and approved by NSF and OMB. Each survey focused on reform efforts and outcomes for students, faculty, and the teacher preparation program. We achieved a 94% response to the PI/Campus Lead Survey, a 75% response to the CETP Faculty Survey, and a 54% response to the Directors of Teacher Preparation Program (or comparison) Survey. Although most of the survey items were closed-ended, some were open-ended, allowing respondents to provide comments and express their perceptions of CETP issues.

In addition to the surveys, quantitative data were drawn from the extensive NSF CETP Monitoring System. This database includes data reported directly by the CETPs in calendar year 1999.

Highlights of Findings

The comparative analyses that we performed yielded very few statistically significant differences between the CETPs as a group and the comparison sites, in part because of the limited number of CETP and comparison institutions in the study. In the text we point out the significance/nonsignificance of findings whenever discussing findings based on comparisons. In selected cases, we discuss nonsignificant comparative findings, but only when there is a clear pattern in the direction of the differences, and the nonsignificance of the findings is always noted.

Implementation of Reform

Implementation of reform involves a myriad of factors, including funding for reform, administrative support for reform, reform strategies, and the number and quality of reformed courses. In addition to funding from NSF, all the CETPs sought both internal and external funding to support their reform efforts. Individual CETP institutions received nearly four times as much total funding as comparison sites (approximately $1 million versus $300,000 per institution, a statistically significant difference). The CETPs reported that relatively large proportions of funding for teacher preparation reform were contributed by their own institutions, which is a strong indicator of administrative support. Another sign of administrative support for reform was the provision of tangible as well as intangible incentives for faculty participation.

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design and an alternative, in C. H. Weiss (Ed.), *Evaluating action programs: Readings in social action and education.* Boston: Allyn and Bacon.

The CETPs provided significantly more incentives than comparison sites, one of the few statistically significant findings of the study. In terms of reform strategies, CETP projects and comparison projects both reported high use of innovative pedagogy; the comparison projects reported using innovative curricular reform strategies at higher levels than did the CETP projects, although these differences were not significant overall.

Course reform was at the heart of the CETP program. The first two cohorts of CETP projects revised an impressive number of courses—just under 300, according to the NSF CETP Monitoring System. Survey data indicate that CETPs reported approximately seven new or revised courses per institution, as did comparison projects. However, course counts should not be the only measure of outcome with respect to reformed courses. Our site visits also examined course reform. These qualitative data indicated variation in the quality and implementation of reformed courses. Some of these courses were new or revised in substantial ways and reflected best practice in terms of both curricula and pedagogy. Others were courses that had been modified only slightly or did not meet standards of best practice, according to our content expert site visitors. Overall, course reform instigated by the CETPs can be described as uneven and generally not well coordinated across institutions within a CETP project.

Outcomes for Students

As indicated above, the central purpose of the CETP initiative was "to improve significantly the science, mathematics, and technology preparation of future K-12 teachers and their effectiveness as educators in these areas." According to the NSF CETP Monitoring System, the number of students involved in CETP courses in 1999 ranged, on average, from 170 per institution in one CETP to 10 times as many per institution in another CETP. The number of students involved in CETP-reformed courses was statistically greater than the number of students in reform projects in the comparison sites, by a factor of approximately seven. Clearly, the higher level of CETP funding enabled CETP projects to reach many more students than comparison sites did.

Several of the survey items collected data on the perceptions of CETP PIs and campus leads, CETP faculty, and directors of teacher preparation programs with respect to student outcomes. On closed-ended items, CETP faculty reported positive outcomes for students along a number of dimensions. About two-thirds of faculty indicated mastery of science, mathematics, engineering, and technology (SMET) and related skills (especially with respect to non-CETP students), confidence in applying SMET skills, understanding of SMET concepts, and mastery of SMET knowledge relative to that of preservice students prior to the CETP project. In response to open-ended questions, directors of teacher preparation programs at comparison

sites tended to provide more positive comments regarding preservice students' positive attitudes, comfort level with material, and confidence in their own ability to teach than did CETP PIs. They also reported more positive comments than CETP PIs indicating that students were better prepared to teach and "very hirable," although these differences were not significant.

Qualitative data on individual CETP projects indicate that more positive student outcomes tend to be associated with collaboratives that have fewer participating institutions and more cohesive, coordinated programs. Having a smaller number of partner institutions seems to facilitate more regular collaboration, a common vision of reform, development of parallel courses, and articulation agreements, all of which make for a stronger teacher preparation experience for students.

Many CETP administrators and faculty argue that it is "just too early to tell" what student outcomes will be because students are just now graduating from the first two cohorts. Until a cohort of CETP students are in the field for 2 to 3 years (presuming that they can be tracked and remain in teaching), good outcome data will not be possible to obtain.

Faculty Involvement and Collaboration

A principal objective of the CETP program is "to engage fully the departments of science, mathematics, engineering, technology, and education and their faculties in the preparation of teachers." More than 450 faculty were involved in the reform efforts of the five CETP projects in 1999, or approximately 15 per institution, a figure nearly identical to the number of faculty reported to be involved at comparison sites. The number of disciplines involved in teacher preparation reform was approximately five per CETP institution and four per comparison project institution. On average, the CETPs had equal proportions of education faculty, biological/agricultural sciences faculty, and mathematics/statistics faculty involved in teacher preparation reform. Reform efforts of comparison projects tended to involve proportionately more education faculty than disciplinary faculty, relative to the CETPs.

Another primary objective of the CETP program was the promotion of collaboration among education and SMET faculty in revising/teaching courses, among faculty across disciplines and institutions in revising/teaching courses, and among college/university faculty and K-12 staff in field placements and in revising/teaching courses. There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group.

Although CETP respondents reported engaging in collaborative activities across disciplines and across institutions to a relatively high degree on the surveys, the reality of disciplinary autonomy, departmental turf, and cultural as well as academic differences between

partner institutions impeded collaborative efforts, according to our site visit data. Collaboration within disciplines and across disciplines within institutions was generally stronger than interinstitutional collaboration. CETPs that managed to coordinate course reform and other program elements across partners were those that had long-standing relationships between the institutions and had fewer, rather than more, institutions involved.

Impact on the Learning Infrastructure and Institutionalization of Reform

For the purposes of this report, we looked at growth in the "critical mass" of participating faculty, increases in the number of disciplines involved, the number of courses that were actually developed or reformed and their disciplinary focus, and funding for continuation as indicators of impact on the learning infrastructure and potential institutionalization. We found that CETP faculty involvement increased annually at the rate of approximately 4 faculty per year per institution, about double that of comparison sites (not a significant difference). The annual rate of disciplines coming on board was less than 1 for both CETP and comparison sites. However, more disciplines were involved in CETP-reformed courses than in comparison projects.

With respect to the potential for institutionalization, the proportion of internal institutional funding contributing to CETPs was quite high, indicating strong administrative support. CETPs reported more external sources of funding, in addition to NSF funding, to draw on than did comparison sites, which may also be a predictor of continuation.

Dissemination and Model Generation

CETPs were expected to disseminate their successful practices and serve as models for other institutions seeking to reform teacher preparation. Most PIs/campus leads reported that they were involved in disseminating the CETP to the national community. The most frequently reported types of dissemination were responding to requests from individuals from other institutions for CETP curricula or products and disseminating the project via CETP symposia/workshops or conferences. Overall, CETP projects were more actively involved in dissemination activities than were comparison projects, although not significantly so. The one exception was that CETPs documented more hits to their Web sites. Both CETP respondents and comparison group respondents answered open-ended questions about replicable model components by citing their "approaches to teaching courses." Nearly half of the CETP respondents also listed course materials and specific programs as replicable for other institutions.

Although the CETP projects were quite distinct from one another in many ways, as indicated in the qualitative descriptions of the projects we prepared, quantitative analyses of

their "approaches to reform" do not indicate significant differences. In fact, there was more variation from institution to institution within a CETP in terms of curricular, pedagogical, and program reform than there was from CETP to CETP. Teacher preparation reform reflects the character, needs, and faculty proclivities of individual institutions to a greater degree than it does the clustering of institutions as "CETP projects."

Overall Summary

The CETP program met many of its goals with respect to providing students with improved SMET curricula, more relevant and innovative pedagogy, and stronger teacher preparation programs. It was highly successful in exposing large numbers of potential teachers to these courses. It was also very successful in involving faculty, particularly disciplinary faculty, and the numbers keep growing each year. The potential for institutionalization looks positive at this point, especially because of the relatively large financial contributions of CETP institutions themselves. For each of the outcomes reviewed, CETPs with fewer partners reported more positive findings, even with respect to the number of students involved.

In comparing the CETP program with a set of comparison group institutions undergoing reform, it appears that CETP has some distinct advantages, particularly in the number of students reached and the level of resources available to reward faculty. However, the two groups attained similar results for a number of other outcomes.

Finally, dissemination of CETP approaches to reform is taking place, but the CETPs do not represent distinct models of reform. Rather, institutions within CETPs appear to use reform strategies that work best for their students and in the unique context of their own institutional cultures.

INTRODUCTION

Teacher Preparation Reform in Context

Improving the quality of K-12 education, a goal in the United States for decades, came into its own in the early 1980s with publication of *A Nation at Risk,* issued by the National Commission on Excellence in Education.[8] At that time, most reform focused on K-12 schools and classrooms (e.g., increasing graduation requirements). However, one of the five sets of recommendations made by the authors of this landmark report was addressed to the teaching profession. Among other recommendations for inservice teachers, the report stipulated that persons preparing to teach be required to meet high educational standards and that master teachers be involved in designing teacher preparation programs and supervising preservice teachers. Although these recommendations were precursors of reforms to come, the early 80s remained focused on K-12 education.

Later in the 1980s, the focus of reform had broadened to include improving the preparation of preservice teachers. Teacher education programs were often criticized for their watered-down content courses and weak pedagogy courses that did not address the real needs of beginning teachers, such as classroom management and teaching disadvantaged students in the urban classroom. Field experiences for preservice teachers were recognized as critical but were criticized for not being aligned with the students' teacher preparation curricula. Relatively low admission standards for education students fueled the criticism that teacher preparation programs were not rigorous enough to prepare the kind of teaching workforce needed to carry out the educational reform initiatives being developed for K-12 students. The higher education community responded with initiatives such as the Holmes Group (now the Holmes Partnership), a collaborative effort of education deans from 100 major research universities, who each committed to making teacher preparation a priority on their own campuses. Their 1986 report, *Tomorrow's Teachers,* brought attention to the important role of preservice teacher education.[9]

By the mid-1990s, reform of teacher preparation was seen as an essential strategy for reforming K-12 education. The nation's teacher professional accreditation body, the National Council for Accreditation of Teacher Education (NCATE), began revising its program review standards to align them with curriculum standards developed by K-12 content area professional associations (e.g., the National Council of Teachers of Mathematics). New organizations, including the National Board for Professional Teaching Standards (NBPTS) and an alternative accreditation agency, the Teacher Education Accreditation Council (TEAC), emerged and grew

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[8] National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform.* Washington, DC: U.S. Government Printing Office.
[9] The Holmes Group. (1986). *Tomorrow's teachers.* East Lansing, MI: Author.

in significance. Reform of teacher preparation took further shape with publication of the 1996 report from the National Commission on Teaching and America's Future (NCTAF), *What Matters Most: Teaching for America's Future.*[10] This report provided concrete guidance for policy-makers and educators to begin improving teacher education.

At the same time, research increasingly alerted the field to the critical need to design teacher education and to facilitate inter- and intrainstitutional collaborative efforts to redesign teacher preparation programs. Universities heeded the call. As guided by educational research, central features of the reformed programs were[11],[12]:

- Increased use of a basic skills test (typically Praxis I) for admission to programs.
- More rigorous, yet accessible, content courses (particularly in mathematics and science) and use of an exit exam (typically Praxis II) to test subject area knowledge of graduating students.
- Alignment of teacher preparation requirements with NCATE or TEAC standards and with the state's K-12 content and performance standards.
- Facilitation of the transition between teacher preparation and the K-12 classroom through improved pedagogical courses and increased classroom experiences.

Faculty from schools of education and from schools of arts and sciences were urged to work together to develop and implement reforms. To foster collaborations between education and mathematics and science faculty to create more effective teacher preparation programs, NSF put into place a program called "Collaboratives for Excellence in Teacher Preparation" (CETP).

Overview of the Collaboratives for Excellence in Teacher Preparation Program

In 1993, NSF began funding American colleges and universities under the CETP program. The purpose of the CETP program is "to improve significantly the science, mathematics, and technology preparation of future K-12 teachers and their effectiveness as educators in these areas. Since attention to both introductory and advanced courses in mathematics and the sciences is essential, a principal objective of the CETP program is to engage fully the departments of science, mathematics, engineering, technology, and education and their faculties in the preparation of teachers."[13] Although the program guidelines have naturally changed over the years, we have selected the purpose of the program from the guidelines for 1997 because those were the guidelines in place at the beginning of the summative evaluation.

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[10] National Commission on Teaching and America's Future. (1996). *What matters most: Teaching for America's future*. New York: Author.
[11] Ehrenberg, R., & Brewer, D. (1995). Did teachers' verbal ability and race matter in the 1960s? Coleman revisited. *Economics of Education Review 14*(1), 1-21.
[12] Ferguson, R. (1998). Can schools narrow the Back-White test score gap? In C. Jencks & M. Phillips (Eds.), *The Black-White test score gap*. Washington DC: The Brookings Institution.
[13] *Undergraduate Education Program Announcement and Guidelines*, NSF 97-29.

The CETP program supports large-scale systemic projects designed to significantly change teacher preparation programs on a state or regional basis and to serve as national comprehensive models of excellence in the preparation of K-12 teachers. CETP projects involve cooperative efforts among science, mathematics, engineering, technology, and education faculty, within and across institutions. A primary focus of all CETP projects is the revision and development of science and mathematics content and methods courses.

The first awards (Cohort 1) were made to three statewide projects: the Louisiana Collaborative for Excellence in the Preparation of Teachers (LaCEPT), the Maryland Collaborative for Teacher Preparation (MCTP), and the Systemic Teacher Excellence Preparation (STEP) project in Montana. In 1994, awards were made to three more collaboratives (Cohort 2), one regional in scope and the others urban: Colorado's Rocky Mountain Teacher Education Collaborative (RMTEC), Philadelphia's Collaborative for Excellence in Teacher Preparation (Temple), and Teacher Education Addressing Mathematics and Science in Boston and Cambridge (TEAMS-BC). Because TEAMS-BC was in operation for just 2 years, it is not included in this summative evaluation.

Between 1993 and 2000, a total of 17 collaboratives were funded for up to $1 million per year for 5 years. In addition, some of the projects that received the earliest awards received $600,000 supplements to determine the impact of the program on their graduates.

The Summative Evaluation

Evaluation Design

At the time this summative evaluation was undertaken in 1997, the Assistant Director of the Education and Human Resources (EHR) Directorate specified that a control group design be used to evaluate the effect of the CETP program. This decision was based primarily on the requirements of GPRA, which were driving evaluation and monitoring systems at NSF and other federal agencies, but it was also consistent with congressional interest in rigorous impact evaluations. In response to EHR, a comparison group of matched institutions was identified and approved by the Office of Management and Budget (OMB).

The summative evaluation includes the first five NSF CETP-funded collaboratives (Cohorts 1 and 2), along with a comparison group. The summative evaluation was limited to the first two cohorts of awardees because they were the institutions most likely to have developed reformed courses, taken steps toward institutionalization, and graduated teachers. The five Cohort 1 and 2 collaboratives involved 47 institutions of higher education nested within collaboratives, ranging from tribal and community colleges to Research I universities. Of the 47

CETP institutions eligible for the summative evaluation, 12 reported that they had "no campus lead" qualified to fill out the SRI survey. Thus, the sample of CETPs was reduced to 35.

Until the Department of Education began funding "Partnership Grants" for the purpose of reforming preservice teacher education (summer of 2000), there were unfortunately few, if any, formal collaboratives or partnerships of institutions of higher education focused on the reform of teacher preparation to use as comparison units for the CETP collaboratives. Thus, it was necessary to create a more general comparison sample. An outside firm with specialized experience in the use of higher education databases and a national reputation for selecting peer institutions for colleges and universities selected the comparison group for the CETP evaluation.[14] Comparison institutions (which can be thought of as "peer institutions" for the CETP institutions) were selected on the basis of data provided in the most recent Integrated Postsecondary Education Data System (IPEDS), using calculations that most closely matched U.S. institutions to CETP institutions.

The calculations were based on four primary criteria: (1) general institutional data (e.g., Carnegie classification, public/private control), (2) enrollment data (full-time student equivalency), (3) financial data (e.g., educational and general expenditures), and (4) the extent of institutional involvement in teacher preparation. The first three criteria have been shown empirically to generate a set of closely matched institutions. Using these criteria, the subcontractor identified 10 potential matches for each CETP institution, yielding a set of 447 institutions. Any CETP institution that was selected by the analytic program as a peer institution for another CETP institution was removed (the fact that the program generated such matches provided a good validity check on the selection procedure).

SRI employed standard weighting procedures used in social science research to equate the two groups for comparative analyses. We first grouped CETP and comparison institutions in four categories based on institutional type: (1) M-1, M-2, and BAC-2 institutions (19 CETPs, 13 comparison institutions); (2) community colleges (3 CETPs, 3 comparison institutions); (3) Research and Doctoral institutions (11 CETPs, 5 comparison institutions), and (4) tribal colleges (2 CETPs, 6 comparison colleges). We assigned a weight of 1 to each CETP institution. Weights for the comparison institutions were based on the number of CETPs in each institutional grouping. For example, a comparison tribal college received a weight of 1/3 while a comparison community college received a weight of 1. This weighting scheme allowed maximum use of all CETP data collected, while accommodating for the effects of uneven comparison group response. All cross-group analyses in this report utilize the weighting

[14] SRI subcontracted with JPL Associates, an independent consulting firm widely known in the field of higher education research and policy.

scheme described above. Within-group analyses are not weighted. The specifics of the selection algorithm for the computer-generated comparison group and procedures involved in the weighting of data are described in Appendix A.

Limitations of a Comparison Group Design

The use of control groups or comparison groups has been discussed in the evaluation literature since the late 1960s.[15] The argument against their use centers on the fact that evaluations of programs in the natural community differ markedly from experiments in the laboratory, where scientists typically use control groups. Nevertheless, the "experimental paradigm" of evaluation, as it is sometimes called, has enjoyed a resurgence in the past few years because of the demand for clear-cut outcomes that can be attributed to the program rather than to intervening factors. Appropriate comparison groups are very difficult to identify in the field for evaluative purposes. The context of comparison programs, including the institutional setting, motivation for and characteristics of the intervention, and characteristics of participants and program administrators—to name a few aspects—is often very different from that of the program being evaluated. Thus, in interpreting any findings that compare CETPs with the comparison group, the reader should bear in mind that the comparison sites were not organized as collaboratives; they did not necessarily share the same reform philosophy as the CETP program; and they were not always comparable in scope or maturity. However, the comparison group that was used for the CETP summative evaluation was carefully selected and was a reasonable approximation to the CETP institutions, given the limitations discussed above.

Evaluation Methods

Qualitative Data Collection. Although the focus of the summative evaluation was on the first two cohorts of CETPs as they stood in the 1998-99 academic year, data collection spanned 5 years. Annual 2- to 4-day site visits were made to two or more institutions at each of the five CETPs. In addition to SRI researchers, the site visit teams included an external content expert who had been approved by NSF, whose primary function was to assess the quality of new and reformed courses. During the site visits, SRI had lengthy discussions with the PIs and campus leads. We interviewed faculty from each discipline involved, along with administrators of those colleges/schools/departments. We held private focus groups with CETP students, with graduated teachers (when possible), and with K-12 teachers involved in the reform effort. All

[15] See, for example, Campbell, D. T. & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research.* Chicago: Rand McNally; Boruch, R. F. (1975). On common contentions about randomized experiments for evaluating social programs, in R. F. Boruch and H. W. Riecken (Eds.), *Experimental testing of public policy.* Boulder: Westview; and Weiss, R. S., & Rein, M. (1972). The evaluation of broad-aim programs: Difficulties in experimental design and an alternative, in C. H. Weiss (Ed.), *Evaluating action programs: Readings in social action and education.* Boston: Allyn and Bacon.

interviews and focus groups were guided by protocols developed for each type of respondent. The descriptive summaries of the CETPs in Part I of this report are based on this qualitative data collection.

In addition to conducting site visits to the NSF collaboratives, SRI visited a small sample of comparison institutions to collect contextual data and more detailed impact data from these sites.

Quantitative Data Collection. Three surveys were administered as part of the summative evaluation: the CETP Principal Investigator and Campus Lead Survey, the CETP Faculty Survey, and the Director of Teacher Preparation Survey (the comparison group survey). The final set of surveys was reviewed, edited, and approved by NSF and OMB. At the time of survey development, SRI was working with NSF program and evaluation staff in identifying a set of GPRA-like outcomes and indicators for the CETP program to guide the summative evaluation (see Appendix B). Thus, items on the three surveys were linked to a corresponding set of GPRA-like indicators. In addition to GPRA-like indicators, explanatory variables (e.g., level of funding, faculty counts) were also included. Each survey focused on reform efforts and outcomes for students, faculty, and the teacher preparation program. The three surveys can be found in Appendix C. We have summarized quantitative evaluation procedures at the beginning of Part II. For more statistical details of the quantitative analyses, please see Appendix D.

Additional quantitative data were drawn from the extensive NSF CETP Monitoring System. SRI worked closely with Quantum Research Corporation in drawing data from the system. This database includes data reported directly by the CETPs in calendar year 1999.

Table I-1 presents the populations, selected samples, responding samples, and response rates for each of the three surveys. The reader is referred to the footnotes of this table for further explanation of sampling procedures.

Table I-1
Survey Populations, Samples, and Response Rates

Survey	Number of Collaboratives Surveyed	Population	Sample	Number of Respondents	Response Rate
CETP Principal Investigator and Campus Lead Survey	5	47	35[16]	33	94%
CETP Faculty Survey	5	451[17]	146[18]	109	75%
Director of Teacher Preparation Survey (Comparison Group)	NA	442[19]	50[20]	27	54%

Organization of the Report

We organize the report in two sections: Part I, Qualitative Findings, and Part II, Quantitative Findings. The reader will note that a minimal amount of quantitative data from the NSF CETP Monitoring System (e.g., counts of faculty and courses) has been included in the descriptive summaries of CETPs to ensure data accuracy. Some qualitative data (vignettes based on site visits) have been interspersed with the quantitative data when they add valuable context to the survey findings.

Part I. Qualitative Findings

Part I begins the report with descriptive overviews of the first five CETPs that were funded, a summary of key issues facing the CETPs, and brief descriptions of five comparison projects. The summaries in Part I are based on site visits and case studies of the five CETPs and site visits to a small random sample of comparison projects.

Part II. Quantitative Findings

Part II of the report discusses and displays SRI survey findings and relevant data from the NSF CETP Monitoring System. The comparative analyses that we performed yielded very few statistically significant differences between the CETPs as a group and the comparison sites, in part because of the limited number of CETP and comparison institutions in the study. In the text we point out the significance/nonsignificance of findings whenever discussing findings based on comparisons. In selected cases, we discuss nonsignificant comparative findings, but only when

[16] The sample excluded 12 institutions, which reported that they had no "Campus Lead."
[17] The N for faculty was taken from the NSF CETP Monitoring System.
[18] The sample was limited to 3-6 faculty per institution, who were identified by the CETP Principal Investigator.
[19] The population included 10 peer institutions per CETP institution; however, some were eliminated because they were CETP institutions.
[20] Comparison projects were oversampled because of anticipated low response rates (50 questionnaires were sent rather than 35).

there is a clear pattern in the direction of the differences, and the nonsignificance of the findings is always noted.

Chapter 1, ***Implementation of Reform,*** we review key quantitative data related to the process of reform: funding for reform, administrative support for reform, the reform "climate," preparation of faculty to teach reformed courses, and course reform strategies.

Chapter 2, ***Outcomes for Students***, addresses NSF's primary goal: to improve significantly the science, mathematics, and technology preparation of future K-12 teachers and their effectiveness as educators in these areas. Chapter 2 includes student participation counts, student outcomes for all students exposed to CETP courses, and specific outcomes for underrepresented students. The latter section includes quantitative data from the NSF CETP Monitoring System on the collaboratives' use of scholarships. However, as is discussed in the chapter, there were no "hard" assessment data available at the time of this writing.

Chapter 3, ***Faculty Involvement and Collaboration***, addresses one of NSF's principal objectives for the collaboratives program: to engage fully the departments of science, mathematics, engineering, technology, and education and their faculties in the preparation of teachers. The chapter describes characteristics of involved faculty and provides faculty participation counts, presents a typology of faculty involvement and collaboration, and discusses the impact of involvement in reform projects for faculty themselves.

Chapter 4, ***Impact on the Learning Infrastructure and Institutionalization of Reform,*** takes a broader view of the findings in terms of the sustainability of reform. This includes data on the growth rate of the faculty reform workforce, the disciplines involved, the extent to which courses were reformed and became part of the curriculum, and the extent to which the teacher preparation program itself was improved. These are changes that will be in place after the current cohort of CETP students graduate. Chapter 4 concludes with the likelihood of continuation funding.

Chapter 5, ***Dissemination and Model Generation,*** addresses the issue of dissemination, what components of the various CETPs can be replicated, and whether or not individual CETPs can be considered as independent "models" of teacher preparation.

The ***Conclusion*** chapter summarizes both qualitative themes and quantitative comparative findings, discusses implications of the summative evaluation design for our findings, and provides recommendations for further evaluation work.

PART I
QUALITATIVE FINDINGS

Organization of Part I

In Part I, we provide descriptive summaries of the five collaboratives included in the summative evaluation. We review each CETP's project goals, project scope, project components, student outcomes and support for reform. We then summarize the major issues facing collaboratives: course reform, collaboration, student outcomes, and sustainability. We conclude Part I with brief descriptions of a small sample of comparison sites to provide the reader with information about the nature and context of these projects, which are included in the quantitative analyses in Part II of the report.

Overview of the CETP Approaches to Reform

In an effort to better align teacher preparation with K-12 mathematics and science education reform, all the CETPs implemented multi-component projects that were designed to provide significantly improved science and mathematics preparation for elementary, middle, and/or secondary preservice education students. Through joint efforts of colleges of education and colleges of arts and sciences faculty, targeted mathematics and science content and methods courses were revised and developed. Student participants, particularly those who traditionally were underrepresented in mathematics and science teaching, were actively recruited by the CETPs, and a number of students were awarded scholarships. Aside from these commonalties, the CETPs' overall approaches to reform varied, as did the individual participating institutions. CETP project design considerations included a variety of factors, such as local cultural and political traditions, human and material resources, types of participating institutions and the needs of their student populations, and local, regional, and state education needs. A CETP's decision to direct reform efforts primarily at improved K-8 or 9-12 teacher preparation likewise influenced design of the overall strategy.

A great deal of work was done by dedicated faculty and K-12 teachers at all the CETPs, and many new, reformed courses were developed. Many other courses that are counted as "CETP courses" underwent moderate revisions, and still others underwent only minor revisions. These differences occurred for a variety of reasons, including differences in resources, faculty curricular and pedagogical preferences, institutional and departmental support, faculty rewards for participation, and type and extent of professional development.

Louisiana Collaborative for Excellence in the Preparation of Teachers (LaCEPT)

Project Goals

- Improve the preparation of K-8 teachers of mathematics and science.
- Increase the participation of individuals from underrepresented groups in reform of preservice teacher education.
- Improve statewide policy regarding both teacher preparation and the process for review of new and ongoing academic programs at Louisiana's higher education institutions.

Project Scope

The following 14 institutions of higher education (IHEs) received LaCEPT grants to reform disciplinary and/or methods courses for K-8 teachers:

- Centenary College
- Louisiana State University-Baton Rouge
- Louisiana State University-Shreveport
- Louisiana Tech University
- Loyola University of the South
- McNeese State University
- Nicholls State University
- Northeast Louisiana University
- Northwestern State University
- Southeastern Louisiana University
- Southern University-Baton Rouge
- University of New Orleans
- University of Southwestern Louisiana
- Xavier University of Louisiana

LaCEPT estimated that the initiative affected hundreds of faculty and more than 25,000 students. In 1998-99, 115 faculty were involved in LaCEPT activities: 35 from mathematics departments, 61 from science departments, and 19 from schools or colleges of education. Twenty-one K-12 teachers were also involved, 18 of them from elementary schools. An estimated 11,725 students were enrolled in reformed courses in 1997-98.

In addition to its presence at multiple institutions across the state, the project had a broader scope through its focus on statewide policy issues. When Louisiana received the LaCEPT award, it had a Statewide Systemic Initiative, LaSIP, already in place. Although LaSIP focused exclusively on inservice teachers, it provided the philosophical basis and structure to facilitate the development of LaCEPT as a preservice initiative. In fact, it was the statewide body that administered LaSIP that applied for and received the LaCEPT grant.

The statewide LaCEPT administration awarded "Campus Renewal Grants" to IHEs across the state via a competitive process (campuses receiving such awards are termed "Campus Renewal Projects"). An external review panel reviewed applications and selected the Campus

Renewal Projects, thus removing funding decisions from the political arena and adding credence to the selection process. This strategy was unique among CETPs; in all other states, CETPs consisted of a smaller set of IHEs that formed a collaborative and jointly applied for a CETP award.

Project Components

Course Reform. Universities and colleges were awarded grants from LaCEPT to reform courses. These Campus Renewal Projects focused on developing and/or revising mathematics and science content courses taken by education students and/or science and mathematics education methods courses. Although the process of course reform varied across institutions, typically, introductory courses were revised with education faculty members more involved than disciplinary faculty in the initial course reforms. Faculty participation was dependent on (1) the individual Campus Renewal Project and the activities that were implemented, and (2) the campus PIs—for example, their personalities, charisma, creativity, profiles within the campus and professional communities, and levels of effort. K-12 involvement varied across institutions, ranging from minimal on some campuses to direct involvement in reforming courses on others.

In all, approximately 80 courses were reformed on the 14 campuses: 32 in science, 24 in mathematics, 12 in teaching methods, and 12 combining multiple disciplines or one or more disciplines and teaching methods.

Most revisions were made to introductory courses. Several of the projects developed "developmental mathematics" courses for the many students who wished to pursue education majors but who lacked adequate preparation for college mathematics.

Field Experiences. The field experience component of LaCEPT varied from institution to institution. LaCEPT's central administration encouraged the placement of students for their practica with teachers trained under the Statewide Systemic Initiative program, LaSIP. Unfortunately, this was not always possible because of the scarcity of LaSIP-trained teachers with master's degrees[21] or because of geographic mismatches between teachers and students.

Support for Teacher Graduates. LaCEPT began implementing a mentoring program for novice teachers during the 1998-99 academic year, but no data were available on its effectiveness at the time of the final site visit. Several evaluation plans are in place that would involve novice teachers exposed to reformed courses. These plans include a survey of graduated LaCEPT preservice mathematics, science, and elementary school teachers; comparison studies of graduates exposed to reformed courses versus those not exposed to reformed courses; and a tracking project based on statewide public school data, which would

[21] Louisiana requires that all teachers receiving students for practica have master's degrees.

identify placements, primary teaching assignments, retention in teaching, and use of reform teaching methods.

Professional Development. For the most part, each Campus Renewal Project addressed the professional development of its own faculty. However, two statewide professional development programs were developed with the goal of involving more disciplinary faculty. In the first program, interested disciplinary faculty were paid a stipend to sit in a revised course for one semester and observe the teaching methods used by the instructor(s). The goal of this "mentor" program was to groom other faculty to teach additional sections of the same course or to take initial steps toward reform of their own course(s). A second strategy was an internship program in which interested faculty were paid a stipend to attend a summer LaSIP workshop as interns and observe the instructors or presenters and help where appropriate. This program was run from 1993 through 1997. The project also sponsored several statewide conferences, including an annual "teaching conference," and presentations/seminars/workshops at individual campuses.

Dissemination. LaCEPT produced five videos to be used for professional development purposes, two reports for the public, and two promotional booklets. Individual Campus Renewal Projects' products included books, course materials, and newsletters. To increase awareness of national efforts to reform mathematics and science teaching and learning, LaCEPT, LaSIP, and the state Board of Regents cosponsored an annual teaching conference for K-12 participants. During the final phase of the project, LaCEPT sponsored workshops to share ideas and strategies concerning education reform.

Student Outcomes

There was no systematic information regarding student outcomes. However, a study conducted by one LaCEPT campus in 1997 compared students in a LaCEPT-revised course with students in a traditionally taught course and found "positive initial student outcomes, including lower attrition rates, higher success rates in later courses, and higher student scores compared with student scores in traditional courses."

LaCEPT conducted a survey of students who had taken LaCEPT courses. Results from the survey suggested that students held more positive attitudes (than non-LaCEPT students) and that a "high proportion of preservice teachers valued and planned to utilize reform methodology and principles in their classrooms."

In our interviews, faculty indicated that students who complete the revised courses typically have a much deeper understanding of mathematics and science concepts than students who complete traditional courses.

Our student interviewees at Louisiana Tech indicated that they felt well prepared to teach science and mathematics to elementary and middle school students. This small sample reported having positive learning experiences not only in disciplinary courses but via workshops designed for K-12 LaSIP teacher inservice.

Support for Reform

Statewide support for LaCEPT was strong, as evidenced by the following actions:

- The Board of Regents changed academic review and funding policies to reward colleges that valued teaching excellence and worked to improve undergraduate education and teacher preparation programs.
- The Board of Elementary and Secondary Education changed elementary teacher certification requirements to include a minimum of 12 credit hours of mathematics and 15 of science.
- The state legislature appropriated $1 million to support the combined effort of the Board of Regents and LaCEPT to develop a statewide Center for Innovative Teaching and Learning.
- The Board of Regents pledged $50,000 per year to augment NSF funds and support scholarships at the three historically black colleges and universities (HBCUs) that had LaCEPT campus projects.

Administrative support for LaCEPT was institution specific. Examples of ways administrators showed their support were the following: reducing class size of reform sections, providing additional laboratory and/or classroom space, hiring and/or promoting faculty who supported reform efforts, providing release time for faculty to develop new courses, and permitting teaching of pilot sections and experimental classes.

Maryland Collaborative for Teacher Preparation (MCTP)

Project Goals

- Develop a teacher preparation program that would prepare middle school mathematics and science specialists.
- Provide professional development for postsecondary faculty.

Project Scope

Twelve IHEs and three public school systems throughout the state participated in MCTP. The IHEs included institutions in the University of Maryland system, HBCUs, and community colleges, as follows:

Four-year institutions:

- Coppin State College (HBCU)
- Frostburg State University
- Salisbury State University
- Towson University
- University of Maryland-College Park
- University of Maryland-Eastern Shore
- Bowie State University (HBCU)
- University of Maryland- Baltimore County

Community colleges:

- Baltimore City Community College
- Anne Arundel Community College
- Prince George's Community College
- Catonsville Community College

In all, in 1998-99, 53 faculty were involved in the project: 20 from mathematics, 23 from sciences, 9 from education, and 1 from a non-SMET (science, mathematics, engineering, and technology) department. Forty-five staff from K-12 schools were also involved; these included 7 administrators, 20 elementary school teachers, 16 middle school teachers, and 2 high school teachers.

Project Components

Course Reform. MCTP developed or revised content, methods, and capstone courses. Course reform did not begin with the project's inception, however. The project used the first year for faculty and a group of middle school teachers to work to develop a common vision of the knowledge, attitudes, and beliefs about science and mathematics that would provide a strong foundation for middle school teachers. The second summer of the project, 80 participants (including postsecondary faculty from each institution and 20 K-8 teachers) worked on actual course revisions and development of materials (e.g., teaching modules) for 32 courses. During the academic year, faculty participants piloted the materials for the new MCTP courses and began the revision process.

In the project's third year, participants refined introductory content courses and developed intermediate-level content courses and preliminary materials for capstone and methods courses (including integrated methods courses). Thirty-nine new or revised courses were offered that year. In the remaining years, work on methods courses and capstone courses continued. Throughout the project, course developers paid particular attention to making sure that content courses and methods courses were aligned.

Typically, the bulk of course development was done during the several weeks following summer professional development activities (see below). Later in the summer, the curriculum development work groups met to share insights and accomplishments as well as the newly developed curriculum materials.

Capstone courses were developed and offered on two of the participating campuses (College Park and Towson). These were interdisciplinary courses that attempted to provide hands-on learning experiences but involved a higher level of mathematics or science than students typically got in introductory courses.

In all, 59 courses were developed or revised. These included 21 science courses, 18 mathematics courses, 10 teaching methods courses, and 10 courses that combined various content areas or content and methods.

Field Experiences. MCTP's goal was to place all students in practica with mentor teachers who had participated in summer training for mentor teachers (see Professional Development below). Approximately 30 students, primarily from College Park, were placed with such teachers and had very positive experiences. Other institutions were not so successful at placing their students with mentor teachers.

Towson and College Park's MCTP projects included a summer research internship program. Taking advantage of Maryland students' easy access to scientific and research facilities, federally funded laboratories, museums, and parks, these programs offered students intensive 8- to 10-week immersion experiences and the opportunity to work and learn in local scientific research institutions, museums, businesses, and industry. Between 1995 and 1998, 53 MCTP students participated in this program.

Support for Teacher Graduates. An *Introduction to Teaching* handbook was provided to new graduates. All-day workshops, funded by the Maryland Higher Education Commission, were held to bring together novice teachers and mentor teachers to discuss issues related to mathematics and science teaching. (MCTP teacher candidates also attended these workshops.)

Professional Development. Faculty inservice began with the first summer's activities when participants gathered to learn about and discuss what constructivist teaching means, and to develop the knowledge and skills needed to implement effective teaching strategies. The feeling had been that there was no way that participants could proceed with a coordinated approach to reform if they did not have the same vision or the knowledge necessary to develop appropriate curricula—thus the thrust for intensive professional development. Each summer, when participants gathered to continue the course reform efforts, there was more professional

development. And during the academic year, there were monthly programs at different locations that addressed topics such as assessment.

MCTP provided intensive professional development for mentor teachers via workshops that were held in the summers of 1995 through 1998. Seventy-five teachers across the state attended these workshops. Starting in 1997, the MCTP worked with the Maryland Governor's Academy for Mathematics, Science, and Technology to ensure sustainability of the mentor workshop program in future years. Finally, a 1-day workshop was given for mentor teachers, MCTP graduates who were in their first year of teaching, and MCTP preservice teachers to address classroom issues.

Dissemination. Much informal dissemination was provided by well-trained mentor teachers and by students who took revised courses. Formal dissemination took place through MCTP's Web site; presentations at regional and national conferences; journal articles; a published document, *Journeys of Transformation*, which includes a collection of case reports written by MCTP faculty; annual conferences for participating faculty; and a statewide conference that was held in January 1998, which drew more than 175 participants from a variety of institutions and school systems. The conference featured MCTP and provided time for participants to discuss the state of teacher preparation in Maryland.

Student Outcomes

Faculty interviewees indicated that students who have been through the MCTP program have superior knowledge of content and pedagogy. According to one interviewee, "They are far better prepared in science and math by the time they get to the introductory methods block and to the science and math methods courses than non-MCTP students." Interviewees also indicated that public school recruiters are disappointed that not all graduates with an elementary certificate will have participated in MCTP.

Internal evaluation data suggest that participation in MCTP's summer research internship program had a positive impact on the knowledge, attitudes, and skills of the student participants. According to faculty, participation in the program contributed to students' reconceptualizing the nature and processes of mathematics and science, and influenced their beliefs about the teaching and learning of mathematics and science.

Support for Reform

Administrative support for MCTP depended on the participating institution and its thrust for education reform in general, and on the deans and chairs of colleges and departments and their foresight concerning a need for change. Overall, IHE administrators supported the mechanics of innovation, course development, team teaching, faculty development workshops, small

enrollments in initial offerings of reformed courses, and policy decisions such as the decision to transform an MCTP-revised course into a required offering for all elementary education majors.

At Coppin State, Frostburg, Salisbury State, Towson, and UM-College Park, science and mathematics is now a formal area of specialization within an elementary education major. At Towson, the Dean of the College of Education committed $52,000 over a 3-year period to MCTP scholarships. The Provost of Frostburg committed to fund five MCTP scholarships from the university's Capital Campaign funds.

Although there is no coordinated program at these institutions, students at UM-Baltimore County, UM-Eastern Shore, and Bowie State can participate in a variety of aspects of the MCTP program, and Baltimore City Community College has an approved option for the science and mathematics concentration in its education transfer program. A number of community colleges provide gateway MCTP courses to prepare their students to enter the MCTP program at the 4-year schools.

The summer research program became self-sustaining via financial support from the internship sites, the University of Maryland Graduate Fellows program, and the University System of Maryland.

Montana's Systemic Teacher Excellence Preparation (STEP) Program

Project Goals

- Improve preparation of elementary, middle, and secondary teachers through new disciplinary and methods courses at state colleges and universities.
- Enhance communication between Native American tribal colleges and state universities.
- Recruit Native Americans into teaching.
- Increase retention of rural teachers.

Project Scope

Montana's CETP, STEP, included five institutions in the University of Montana system and seven tribal colleges, as follows:

Universities in the Montana system:

- Montana State University-Bozeman
- Montana State University-Billings
- Western Montana College
- The University of Montana-Missoula

Tribal colleges:

- Blackfeet Community College
- Dull Knife Memorial College
- Ft. Belknap College
- Ft. Peck College

- Montana State University-Northern
- Little Big Horn College
- Salish Kootenai College
- Stone Child College

Six K-12 school-university partnership sites were also part of STEP.

In all, 93 faculty were involved, including 31 mathematics faculty, 27 science faculty, 15 education faculty, and 20 faculty from other departments. One hundred forty-one K-12 staff were involved, including 11 administrators, 61 elementary school teachers, 36 middle school math and/or science teachers, and 33 high school math and/or science teachers. More than 26,400 students had been enrolled in new or reformed courses by spring of 1998.

Project Components

Course Reform. The project supported revision of introductory mathematics and science content courses and mathematics and science methods courses at each of the five participating state institutions. Project leadership developed a list of 11 criteria as guidelines for course revisions. A "course revision team" at each institution then wrote mini-proposals for STEP funding to develop and implement a course using at least three or four criteria from the list. Teams typically consisted of one or two content faculty and sometimes (but not always) a math or science educator. Forty to 50 K-12 teachers were funded to be consultants to the course revision teams.

Typically, STEP-revised courses included the introduction of teaching methodologies that required a more hands-on approach and active participation on the part of students. Although lecture sections of courses generally were not the focus of STEP revisions, several faculty participants creatively changed the all-lecture format to involve students more effectively in participatory learning experiences. Many faculty inserted reform modules into traditional classes or reduced the amount of lecture to permit increased laboratory work and hands-on activities. Science labs and mathematics classes with smaller enrollments were revised to emphasize small-group assignments and hands-on and collaborative techniques.

In all, 52 courses were developed or revised: 19 science courses, 17 math courses, 11 teaching methods courses, and 5 courses combining teaching methods and math or science. Both MSU-Bozeman and UM-Missoula addressed the issue of the weak mathematics skills of the typical entering elementary education major by providing an introductory mathematics course that included a balance of content and pedagogy.[22] At UM-Missoula, the education methods courses were completely redone using a block format that coordinates methods in

[22] This write-up focuses primarily on activities at MSU-Bozeman and UM-Missoula. Other sites were not visited as part of the evaluation.

several disciplines, provides simultaneous field experience, and provides for joint planning between university faculty and teachers.

Although STEP helped two of the tribal colleges develop elementary education programs, the project was not able to support a focused effort to develop or revise courses at tribal colleges. However, once Native American students were admitted to a state college or university, STEP provided a summer "bridge" program to help students adjust to university life and improve their chances for academic success. Ongoing advising and mentoring were also available for Native American students.

Field Experiences. Initially, STEP established model K-12 sites for preservice teacher field practica. These were not successful because students declined placements in the small settings in which most of them were located. Consequently, STEP revised its strategy, implementing a series of university-school partnerships around the state. Although less intensive than the model sites, these partnerships resulted in improved student teacher placements and opportunities.

Support for Teacher Graduates. The Early Career Support program was implemented in partnership with the Montana Science Teachers Association and the Montana Council of Teachers of Mathematics. This program assigned small groups of beginning teachers to mentor teachers. Communication, which focused on specific topics and issues related to teaching, took place in dedicated chat rooms, using Montana's statewide telecommunications network for educators. Early-career teachers who applied to participate in the program received a "survival kit" of grade-specific ideas and materials, and mentors received a $600 stipend for attending a summer workshop and $1,000 for mentoring during the academic year.

Professional Development. Professional development for faculty was left mainly to the individual campuses, but was typically provided via workshops and seminars, via attendance at local and national conferences, and through external consultants who gave presentations on individual campuses. No systematic professional development in reformed teaching was provided for teaching assistants, who often took over reformed courses. Professional development for K-12 teachers included a series of inservice workshops for cooperating teachers at partnership public schools and training for Early Career Support mentor teachers.

STEP sponsored two conferences that brought together many of the presidents, chancellors, vice presidents, and deans and faculty of Montana's university system. These conferences served as platforms for introducing the STEP project and soliciting support for continued efforts to change the way that postsecondary science and mathematics were taught. In addition, they provided professional development for faculty and facilitated interaction between education faculty and faculty from mathematics and science departments. K-12

teachers from Montana's six K-12 school-university partnership sites were involved in planning, organizing, and implementing these workshops.

To facilitate communication among tribal college educators and between the universities and tribal colleges, STEP held a summer institute each year. Until those institutes, faculty from tribal colleges had never had a dedicated opportunity to network among themselves or with majority faculty at large institutions. The summer institutes were enthusiastically received and reported as helpful.

Dissemination. STEP held two writing conferences during which faculty, administrators, and NSF scholars came together to brainstorm and write STEP-related articles for publishing. Forty-three journal articles and chapters in books were written during the 5 years of STEP. Five videos were produced and are being used for public awareness. Numerous professional presentations were made at regional and national meetings and conferences. Additionally, campus coordinators at each institution organized and coordinated peer observations for the sake of interested faculty and administrators from other institutions.

Student Outcomes

Teachers in whose classes STEP students did their student teaching reported that STEP student teachers were better prepared than other student teachers to teach science and mathematics using an active approach. In interviews conducted by an internal evaluator, approximately two-thirds of 25 K-12 principals who had hired STEP students indicated that they found STEP teachers to be generally well prepared in mathematics and science. Among other findings, the principals involved in this study reported that STEP teacher graduates had solid knowledge of mathematics and/or science content; that they demonstrated greater confidence and experience than the typical first-year teacher; and that they appeared to have had good preparation in teaching methods, classroom management, and lesson planning.

Support for Reform

At both MSU-Bozeman and UM-Missoula, the program for teacher certification now includes a substantial number of courses affected by STEP reform. University policy at MSU-Bozeman is now that students must earn a grade of "C" or better in the second semester of the two introductory mathematics courses developed by STEP before they can be admitted to the Department of Education. The Dean of Letters and Sciences has contributed to the financial support of reformed courses.

At UM-Missoula, mathematics education is an important program in the Department of Mathematics, with a large number of students, and this fact gives education reform significant power. Elementary education students must take a minimum of 14 credit hours of mathematics,

including the mathematics methods course. This university also requires 12 credit hours of science for the elementary education certification. UM-Missoula showed support for reformed mathematics by renovating and equipping one classroom for reformed math and another for general science. In addition to a physical layout that supports hands-on, collaborative learning, the classroom is rich in technology.

With the exception of a core group of reformers at each institution, most faculty were fairly neutral about reforms. They were not resistant, but neither did they buy in.

Philadelphia's Collaborative for Excellence in Teacher Preparation

Project Goals

- Address deficits in content knowledge of matriculating students.
- Improve faculty's teaching methods by modeling best practices.
- Provide continuity in instructional focus and methods between Community College of Philadelphia (CCP) and the university classrooms, and between Temple University and the field placement classrooms in professional development schools in the Philadelphia School District.
- Revise Temple's curriculum requirements for elementary and middle school teacher certification.

Project Scope

In contrast to the other CETPs, which were statewide or regional, the Temple CETP included only one university (Temple University), one community college (Community College of Philadelphia, or CCP), and one school district (the Philadelphia School District). The focus was on the preparation of elementary and middle school teachers. In all, 69 faculty were involved: 6 from math, 24 from sciences, 11 from engineering, 13 from education, and 15 from other departments. Sixty-two K-12 staff were involved: among these were 12 administrators, 38 elementary school teachers, 6 middle school teachers of mathematics and/or science, and 6 high school teachers of mathematics and/or science.

The Temple CETP fulfilled its goal of putting into place articulation agreements between CCP and Temple. Under these agreements, Temple accepts CCP graduates who have grade point averages of at least 2.0, and CETP courses taught at CCP are transferable to Temple.

Project Components

Course Reform. During the first 2 years of the project, core mathematics and science courses were developed and a two-semester integrated science/mathematics methods course was developed. Curriculum development committees included science, mathematics, and education faculty from Temple and CCP, several master teachers from the public school system, and administrators from each constituent institution. Release time for instructors to

work on courses was funded by the Temple CETP. The master teachers "coached" instructors in the classroom and contributed ideas for course content and methodology. During the last 2 years of the grant, new or revised courses were refined.

In recognition of the fact that many entering students are not ready for college-level math, the Temple CETP also developed an arithmetic skills exam that students had to pass before they could take higher-level mathematics courses and complete their teacher certification requirements. For students who could not pass the test, the project developed an introductory mathematics "methods" course, which provides precollege, basic mathematics. All elementary education preservice students must either take this introductory mathematics course or pass the course-exit competency arithmetic skills test before taking the two other mathematics classes required for elementary education majors. All three of these math courses were revised in collaboration with K-8 master teachers to integrate hands-on activities, cooperative group learning exercises, and peer teaching, and include an emphasis on conceptual understanding.

Additionally, the Temple CETP supported the development of a Math/Science Resource Center, whose purpose was tutoring and advising CETP students, housing resources for students and field placement teachers, and holding meetings, seminars, and colloquia regarding mathematics and science. The center was well used; in 1997 alone, 20,000 separate tutoring sessions took place.

In 1999, 21 courses were developed or revised. At Temple, 1 mathematics "methods" course, 2 science "methods" courses, 1 math/science "methods" course, 4 mathematics courses, 3 biology courses, 2 chemistry courses, and 3 courses that were interdisciplinary were prepared. At CCP, 1 mathematics course, 3 science courses, and a two-semester interdisciplinary science and math course (physics, geology, and chemistry) were available. All course revisions at CCP paralleled changes in corollary courses at Temple to facilitate transfer of education majors from CCP to Temple.

Field Experiences. The integrated methods course was enhanced to include practice in elementary and middle school classrooms in a cluster of collaborating professional development schools (PDSs). These practica and the semester-long student teaching experience were coordinated by a master teacher who had played a key role in developing the integrated methods course. As field experience coordinator, she ensured successful integration of academe into the K-8 classroom and helped provide professional development for the K-8 supervising teachers.

Professional Development. A Supervising/Mentoring course was provided to all public school teachers who served as mentors to both CETP students and CETP graduates in their first year of teaching. The course was team-taught by faculty members from Temple and

master teachers from the Philadelphia School District and was intended to ensure that teacher mentors and practicum supervisors used new and revised pedagogy.

Professional development in new teaching methods was provided to faculty and teaching assistants via seminar presentations, work with K-8 master teachers, critiques resulting from peer classroom observations and discussions at advisory meetings and retreats.

In 1998, a video focusing on best practices was developed, which was used for staff development and dissemination purposes.

Dissemination. CCP took the lead in increasing the numbers of regional institutions adopting CETP-like courses. CCP obtained articulation agreements with 18 other institutions, including local community colleges, for the redesigned courses. Expansion of the Temple CETP courses to other institutions could increase the numbers of institutions overall that are affected directly by the project. CCP also held workshops for nonparticipating institutions.

Other dissemination activities included publication of articles based on CETP activities; presentations at local, regional, and national meetings; and development and dissemination of products such as workbooks, lab manuals, and a video.

Student Outcomes

The internal evaluation's preliminary analysis of effects that CETP courses had on students, and students' subsequent performance in non-CETP "next" courses, revealed that students typically achieved higher grades in CETP courses and that performance in a subsequent, traditionally taught course was not adversely affected. Student surveys administered by the internal evaluator indicated that new courses captured students' interest, and, compared with traditionally taught courses of the same genre and level, students indicated that CETP courses overall provided more practical examples and were more interesting and more useful.

In focus groups run by SRI, students who had not been in science or mathematics sections for education majors (CETP-revised course sections) felt that they "did not come out with the same kind of learning" that their peers had experienced in the special sections. Students also felt that they had learned quite a bit of content in their methods courses and the physics course (if they were in the section for education majors). They indicated that the opportunity to construct meaning in these classes via experiences—experiments and activities—contributed to their increased comprehension.

Students indicated that they had learned "a lot of teaching methods such as cooperative learning" in the special CETP sections of mathematics and physics and in their CETP methods courses. It was the activities and experiments—seeing how to teach a concept—that they did in

these classes that stuck with the students. They felt that they had something tangible to take into the K-8 classrooms when they were asked to teach a science or mathematics lesson. Faculty indicated that they had observed practicum students and student teachers use or adapt the experiments or activities successfully in the K-8 classrooms. And K-8 cooperating teachers indicated that "student teachers who are coming out [of Temple] now are more aware of standards based education, up-to-date texts and materials that meet standards."

Support for Reform

In support of the project, Temple University changed its curriculum requirements for elementary education majors. In addition to requiring that these students take and pass the Temple CETP-developed arithmetic skills exam, the university also increased the number of required courses in mathematics from three to four and in science content from two to three. With these additional requirements, the 4-year education program was expanded to 5 years.

Temple's College of Arts and Sciences officially revised its promotion and tenure policy in 1996 so that good teaching was given considerable weight for promotion and tenure. During 1997-98, for the first time, the Provost at Temple issued universitywide guidelines for allocating 30% of the points for teaching excellence. The new Provost is continuing to support these guidelines. Although these changes cannot be attributed to CETP, they worked in support of the program.

Notwithstanding these lasting changes, faculty participants at Temple were not sanguine about the institutionalization of reforms. Buy-in varied from department to department, depending on the faculty's professional interests and beliefs. For example, in the mathematics department, 4 of 6 tenured professors were actively engaged in CETP course revision and teaching, whereas in chemistry, 1 of 17 total faculty was a major player.

Rocky Mountain Teacher Education Collaborative (RMTEC)—Colorado

Project Goals

- Reform courses in mathematics, science, and educational methods for preservice teachers of secondary school mathematics and/or science.
- Build collaborative relations among the postsecondary institutions in the region.
- Build connections between universities, feeder community colleges, and local school districts.

Project Scope

RMTEC involved the following three universities and respective feeder community colleges:

Universities:

- Colorado State University (CSU)
- Metropolitan State College of Denver (MSCD)
- University of Northern Colorado (UNC)

Community colleges:

- Aims Community College
- Community College of Denver
- Front Range Community College—Larimer campus

The project also involved the public school systems in which the IHEs were located.

A total of 121 faculty and 130 K-12 teachers participated in the project. Thirty-five faculty were from mathematics departments, 55 from science departments, 23 from education departments, and 8 from other types of departments. Teachers were divided almost evenly among high school and middle school mathematics and science teachers. A small number (4) of elementary school teachers participated in the project.

Project Components

Course Reform. RMTEC supported course revisions in mathematics and the sciences that used strategies such as team teaching, modeling of best practices, and integrated field experiences. At the three 4-year institutions, introductory science content courses were revised to be lecture/lab/discussion combinations. The revisions were stepped, starting with chemistry the first year, followed by physics the second year, earth science the third year, and biology the fourth year. University courses were typically worked on for one year, then piloted the following year. Development/revisions of mathematics courses proceeded in parallel with science courses.

Content area teams from all institutions met monthly to develop courses. Education faculty tended not to be involved in the development of content courses; however, they developed a new two-semester methods course that integrated mathematics and science methods.

Secondary public school master teachers provided input for both content courses and methods courses. Once courses were being implemented, they also provided assistance with pedagogical issues via team teaching in content courses.

Community college faculty revised courses in mathematics, chemistry, biology, and physics. Science and mathematics content course revisions of a similar nature occurred at the community colleges and were implemented in 1998-99, thus generally improving the articulation between each pair of institutions.

As of 1998-99, 33 science courses, 15 mathematics courses, 16 teaching methods courses, and 1 other education course had been developed, for a total of 65 courses.

All teacher education students at CSU took the revised and unified math/science methods course. However, many did not take the revised content courses. In general, traditional lecture-based courses contained as many as 400 students in a class. Funding constraints allowed for only one section of approximately 25 students to be taught in a workshop-type lecture/lab format. The remaining students continued to take traditional lecture-based courses. The goal was that secondary teacher education students would be in the revised sections, but that was not always accomplished. In some cases, secondary education students elected to take the traditional versions of the courses; in other cases, the students had already taken their introductory science courses by the time they declared their intent to pursue teaching.

Field Experiences. CSU's Dean of the College of Applied Human Sciences (who is also a co-PI) met every 6 weeks with the superintendents in the area to maintain the university's link to the K-12 community. RMTEC worked with Partnership Schools in the area, placing student teachers as much as possible in classrooms of master mathematics and science teachers. Disciplinary and education faculty from CSU, MSCD, and UNC teamed to conduct classroom observations of students during their field experience courses and student teaching experience.

Support for Teacher Graduates. RMTEC's initial efforts to continue cohort group activities met with little success because many novice teachers had no access to electronic communication and because they were overwhelmed with the time demands and rigors of new responsibilities. As of early 1999, the program was making the following supports available to graduates:

- A one-page self-report of teaching strategies.
- Three RMTEC professionals available on each of the primary campuses to work with induction-year teachers.
- A MacArthur grant (in cooperation with RMTEC) to provide services and information to novice teachers.

Professional Development. Formal professional development consisted primarily of annual faculty development workshops in May for all RMTEC participants, biweekly seminars at CSU, and a brown-bag series at MSCD. Typically, the presenters at the seminars were faculty members who shared their successful teaching strategies, tips for revising courses, and assessment results of student performance in revised courses. Faculty development provided prior to course development and instruction reportedly focused on providing and reinforcing the kind of pedagogy supported by RMTEC—a constructivist approach.

A "teaching checklist" was provided by the RMTEC evaluation team to help faculty to use pedagogy consistent with the RMTEC vision of reform (e.g., cooperative learning groups, provision of a supportive learning environment, hands-on activities).

A great deal of informal professional development was provided through the Teachers in Residence (TIR) program. This program provided support for one or two public school teachers (usually one mathematics teacher and one science teacher) from local secondary schools who were released by their districts for 1 year to serve as adjunct faculty on participating campuses. These teachers worked with faculty to develop and team-teach targeted undergraduate courses, provide one-on-one professional development for the postsecondary faculty, and bring preservice teachers a better understanding of the public school classroom. The TIRs reportedly helped higher education faculty to provide student-centered, inquiry-based, experiential instruction that is reality based.

Dissemination. RMTEC published a newsletter twice yearly and produced a variety of pamphlets to introduce the RMTEC organizational structure and community to others. The project also presented information at a series of conferences and symposia (e.g., Calculus Reform Conference). In addition, the project produced numerous products and publications. The annual 2-day faculty development workshop/conference and MSCD's brown-bag lunch also were vehicles for dissemination.

Student Outcomes

RMTEC had a strong internal evaluation component, and reports were issued on a regular basis. The evaluators encouraged faculty to conduct appropriate course impact assessment studies. Then, using a "preponderance of evidence" approach, they used meta-analysis to assess the overall impact on student achievement. Results indicated that students in RMTEC courses equaled or exceeded the academic performance of other undergraduates taking traditionally taught courses in the same subject.

A small sample of first-year teachers responded to an internal evaluation survey of RMTEC impact. Results revealed that beginning teachers felt the RMTEC courses they took and their student teaching experiences were helpful in their teaching. They reported using "RMTEC teaching strategies" at least occasionally (e.g., cooperative groups, technology, real-world problems/applications).

In addition to internal evaluation findings, cooperating teachers reportedly commented on the strong subject matter knowledge and strong pedagogical skills of recent graduates, compared with student teachers 5 years ago.

Anecdotal and quantitative evidence from the internal evaluations indicated that the new integrated science/mathematics methods course made a positive difference in the overall preparation of RMTEC teacher graduates. Graduates' feelings of preparedness, combined with positive reports from the field, indicate that RMTEC students graduated with many pedagogical skills, including instructional approaches that reflect national standards.

Support for Reform

Administrative support depended on institutional goals. In general, however, the deans of the colleges of arts and sciences were strongly supportive of all RMTEC goals, as were many departmental chairs.

New positions were created at CSU and MSCD in mathematics and in mathematics education. In addition, one permanent TIR position was created at MSCD.

Departmental buy-in and administrative support are evident from the fact that all current RMTEC course offerings at CSU, MSCD, UNC, Community College of Denver, and Front Range Community College are being institutionalized. A special geometry course is offered only as an RMTEC course across the three lead institutions.

Summary of the Major Issues Facing Collaboratives

Course Reform

As indicated in the introduction to Part I, course reform was at the heart of the CETP program. Just under 300 courses were either developed or revised by the five collaboratives included in the summative evaluation over a 4- to 5-year period.[23] Some of the collaboratives set forth standards or checklists of criteria to follow, or made a concerted effort to develop a common vision of reform. These were thoughtful, systematic approaches to coordinating reform. However, there were no quality control mechanisms or other formal means to ensure that the quality of new/revised courses met standards of best practice as envisioned by a particular collaborative.

Because the CETP leadership could not control course quality, site visitors, particularly content experts who accompanied the SRI site visit teams, almost always noted unevenness across reformed courses. As we saw time after time, revisions did not necessarily guarantee quality of content or pedagogy in the reformed courses. There was a great deal of variation in the course reform, not only within CETPs as collaboratives but within participating institutions. Quality really came down to the faculty or faculty team designing and/or implementing the reformed course. Faculty's interpretation of best practices varied, and those variations were evident in the way a course was taught.

[23] Note: Course counts include all new/revised courses, regardless of their quality.

Thus, some of the new courses included rigorous content presented in accessible ways, using state-of-the-art pedagogy, whereas others either presented less rigorous content in less accessible ways or simply presented less rigorous content in traditional ways. Some courses were substantially changed or developed anew to reflect best practice; others underwent only modest revisions. Sometimes, we would read about an innovative new/revised course or hear a new/revised course described by faculty or a PI as innovative and then observe a fairly traditional course.

Collaboration

A core assumption of the CETP program was that teacher preparation could best be reformed through the collaborative efforts of education and disciplinary faculty, both within and across higher education institutions and K-12 partners. Initially, serious attempts were made to develop common visions of reform, to align course content, and to form interinstitutional as well as intrainstitutional course development teams. Over time, however, some of the interinstitutional collaborative efforts proved largely ineffective. Not only were faculty finding it very difficult to find the time to meet across campuses, their student populations were often very different, as were the institutional cultures and political environments of the individual institutions. More often than not, course development teams from each institution would develop their courses and projects to meet their institution's needs. A common philosophy of reform undergirded the best of these efforts across campuses. But in most cases, reformed courses at different institutions within a collaborative were disconnected from one another and could not be called "parallel" reforms. This should not necessarily be considered an undesirable outcome; it makes sense that courses should be tailored to individual institutions' student populations and programs.

CETPs that managed to coordinate course reform efforts and other program elements typically were those that had long-standing relationships between the institutions involved and had fewer, rather than more, institutions involved. Articulation agreements were an effective way to ensure coordinated courses and programs between colleges/universities and community colleges.

Student Outcomes

Student outcome data collected by the CETP projects ranged from no systematic information (purely anecdotal data from faculty or administrators) to methodologically sound sample surveys of principals, faculty, and students. In a few cases, individual institutions conducted good comparative evaluations, but they generally were limited to one or two courses and did not generalize to the collaborative as a whole. Professional internal evaluators that

compared CETP student findings with some relevant comparison group (often students in parallel courses, taught in a traditional manner, or students who had taken the course previously) conducted the best studies. Convincing evidence also came from systematic studies involving third parties, especially principals who had experience with CETP graduates and cooperating teachers who had experience with CETP student teachers. Among the findings from the more rigorous of the evaluations were the following:

- A survey conducted by an internal evaluator indicated that two-thirds of principals who had hired CETP graduates said they were well prepared in mathematics and science, had greater confidence and experience than typical student teachers.
- An internal evaluator's meta-analysis of individual faculty studies revealed that CETP students equaled or exceeded the academic performance of non-CETP students who took traditional courses.
- An internal evaluator's survey of first-year teachers indicated that they felt their CETP experience had been helpful in getting them through their first year of teaching, and they reported using teaching strategies that they had learned through CETP.

Most of the data reported as "evaluative" were not as rigorous or as conclusive as the above. There are several factors that make it difficult for the CETPs to collect good evaluation data. First, in most cases, it is unclear who a CETP student is. Most collaboratives have defined a CETP student as any student who takes a course that has been developed or revised as part of the CETP program. It is often unknown, however, which of these students or what proportion plan to be teachers.

Another major problem is that "similar" courses vary within institutions and across institutions. Courses with the same name often vary according to the faculty member who teaches it. Thus, the "treatment" or innovation is a moving target. Further, there are no standardized means to assess knowledge and/or skills that should be generated from similar courses. Thus, faculty and evaluators end up measuring different outcomes for "similar" courses. Grading policies fluctuate considerably across institutions, so they do not offer a viable alternative. Course-taking patterns (especially of advanced mathematics or science courses) are a good alternative and an indicator of positive student outcomes, but such tracking is time-consuming, and the data cannot be easily aggregated across institutions, let alone between collaboratives.

Many CETP administrators and faculty argue that it is "just too early to tell" what student outcomes will be because students are just now graduating. Until a cohort of CETP students are in the field for 2 to 3 years (presuming that they can be tracked and remain in teaching), good outcome data will not be available

Sustainability

Another serious issue facing the collaboratives was sustainability, not just of a course but of the innovative nature of the course. Over the years, many of the original faculty members involved in course development/revision retired, burned out, or went on to other work. New faculty or teaching assistants who took over at a later point often lacked sufficient knowledge and skills to teach the courses in the way intended. These instructors taught the courses according to their own experiences as teachers/students and beliefs about teaching, which were sometimes inconsistent with the collaboratives' vision or philosophy of reform. This was especially true for CETPs that did not implement ongoing professional development. Thus, as new/reformed courses were handed to the next generation of faculty/teaching assistants, the best-practice elements of the courses sometimes dissipated.

Overview of Reform Efforts at Five Comparison Institutions

To gain an understanding of the kinds of teacher preparation reform programs that are being implemented at institutions having no CETP funding and to provide a basis for comparison with the CETPs, SRI identified a sample of non-CETP teacher preparation institutions and collected data via questionnaires and site visits. Below are profiles of five reform projects that support improved preparation of K-12 teachers to teach mathematics and science. The set includes three comprehensive Masters I universities, a Research I land grant university, and a Research II land grant university.

Comprehensive Masters I University 1[24]

Teacher education reform at this comprehensive university is driven by three main contextual forces: (1) state testing programs for K-12 students, (2) state testing programs for entry to and exit from teacher preparation programs, and (3) the state's commitment to certification of master teachers via the National Board of Professional Teaching Standards (NBPTS). The overall reform effort is broad and deep, engaging faculty from both education and arts and sciences. The effort includes initiatives such as the new Advanced Masters Program, a Mathematics and Science Center, and the Second Academic Concentration program.

The focus of the teacher education reform initiative is the Advanced Masters Program, which is integrated with the NBPTS certification. This program focuses on knowledge of subject matter, diversity, teacher research, and teacher leadership. The Mathematics and Science Center in the College of Arts and Sciences has programs for K-12 schools and inservice

[24] Comparison sites were promised confidentiality, so the names of recognizable reform programs have been changed.

teachers. Involvement with the College of Education is through the Advanced Masters Program.

The Mathematics and Science Center is supported by a U.S. Department of Education (ED) grant of $1.2 million. This ED initiative is designed to provide funding for projects that pair a university with at least one middle school in a low-income community to help ensure that students are well prepared for college entrance. At this university, the Center is piloting a professional development school model with local schools. The overall objective is to move the middle school teacher preparation program at the university to a performance-based plan with collaboration of the professional development school. A practitioner-in-residence provides the link between campus and the school via a closed Internet network.

The Second Academic Concentration program is a 24-semester-hour program that was developed in response to the K-12 state testing program. The program's overall objective is to produce teachers who are well prepared to teach elementary or middle school mathematics, reading, and/or writing. The program has helped change mathematics course requirements for elementary and middle school teacher education students from a single 4-hour course and 2 hours of general methods experience to a total of 11 to 12 hours of mathematics. This change has required increased interaction and collaboration between education and mathematics faculty.

Comprehensive Masters I University 2

This comprehensive university recently developed a Center for Mathematics and the Natural Sciences (CMNS) under the state's "Programs for Distinction" higher education initiative. Dedicated to improving preservice education and serving as a staff development resource for local educators, CMNS is supported by a $1.5-million grant from the state, with a matching amount from the university. The Center's strategy for promoting reform is to award funding to faculty members whose mini-proposals for innovative curriculum projects or outreach programs for K-12 and the community have been determined to be worthy of funding.

The first project developed within the Center was an integrated science course for preservice teachers, implemented in fall 1999. A committee of seven instructors, including six from the sciences and one from mathematics, helped design the course. The overall goal was to provide science literacy skills for education majors and increase their comfort level with science. Eighteen freshmen, sophomores, and juniors were enrolled in the two-semester, 4-credit-hour course during 1999-2000. A workshop and lab format using an inquiry approach was augmented by electronic mail interaction with the three instructors.

The cost for the course was $130,000, primarily for equipment and the instructors. In subsequent years, it is expected that the course format will change to lecture and open lab to be more cost-effective.

Comprehensive Masters I University 3

This comprehensive university's reform project is at a local elementary professional development school (PDS) that serves as the internship site for a cohort of 20 elementary education students and a source of inservice for classroom teachers. The focus of the students' internship is the implementation of an inquiry-based thematic science program integrated across all grade levels, K-5.

The goals of the project include: (1) enhancing participants' knowledge of science content and instructional strategies; (2) establishing contexts for learning where preservice and inservice teachers work side by side; and (3) developing, implementing, and sharing inquiry-based science instruction through Web sites.

The science program is designed to provide developmentally appropriate science experiences around the theme of habitat. A summer professional development workshop for the K-5 teachers, funded by a $58,000, 3-year grant from ED's Eisenhower Program, is a key feature of the program. Three faculty from the university's College of Education and Human Services are involved in the project, along with all the teachers in the K-5 professional development school and the county's science coordinator. Sustaining the project is dependent on continued funding.

Research I Land Grant University

Teacher education reform at this research university involves a fundamental and complete reconceptualization of teacher preparation and redesign of the university's teacher education program. Totally funded by internal resources, the scope of the reform is deep, extensive, and ongoing. Five new programs have been developed to date, approved through formal academic processes, and implemented. More programs are under development.

The process by which this comprehensive reform effort was conceived and developed involved the School of Education's explicit recruitment of an appropriate leader; formation of a Teacher Education Steering Committee (TESC) to guide the overall effort; and accompanying on-site retreats, seminars, and numerous conversations among members of the committee. The TESC and its membership are indicative of the nature and degree of collaboration that occurred during the development and implementation of the reform effort. The 28 participants on the TESC included School of Education faculty and associate instructors, interested faculty from other units of the campus, graduate and undergraduate students, and public school

teachers and administrators. This group of individuals worked together as a committee to establish the aims of the effort and develop a set of principles to define the directions of the new School of Education programs. Faculty in science, social science, and language/literature participated in the overall reconceptualization process and are currently involved in the academic components of the new teacher education programs. SMET faculty have contributed to the redesign of elementary education courses.

Administrative support for this ambitious effort is evidenced by the conscious effort of university administrators to recruit and hire an appropriate leader expressly for the reconceptualization of the teacher education program. Funding for development of the overall project has been minimal, approximately $1,000. Buy-in by education faculty has been extensive, as evidenced by the five new programs already in place.

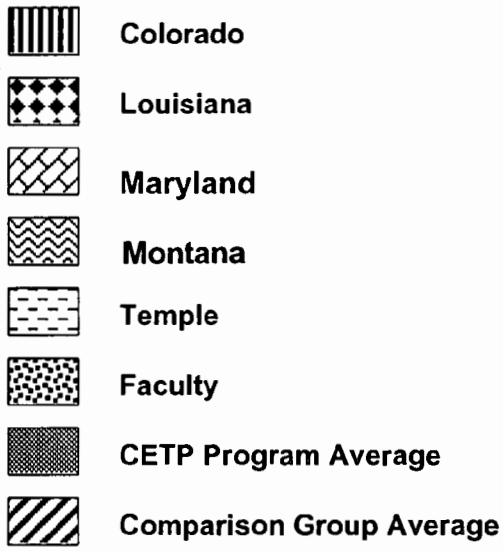
Research II Land Grant University

This research university has developed a new integrated content and science methods course with the goals of (1) better preparing preservice high school physical science teachers to use a hands-on approach to teaching, and (2) addressing the issue of the state's broad field certification requirement in science. Funded for $200,000 by NSF's Course and Curriculum Development program, the expected outcome of the reform project is the generation of print, video, and CD-ROM resource materials for dissemination. Use of these materials by K-12 schools is facilitated through the state's Science on the Move program, or SOM. SOM is a mobile educational program, established in 1994 by the state legislature, that provides the equipment, discipline training, and preparation support needed to run an effective secondary science laboratory program.

Two professors, one from secondary science education and one from engineering, designed the course using energy as a theme. Students are expected to work on team projects that provide realistic science experiences. Each project introduces a problem, provides demonstrations of key concepts, and then requires students to apply their own experiences in the quest for new solutions. A paper/video presentation is required to complete the project.

PREFACE TO PART II

To facilitate the reader's review of quantitative data presented in Part II of the report, we have adopted a standardized set of patterns to represent the five CETPs, CETP faculty responses, the CETP program overall, and the comparison group overall. Please refer to the legend below. Note that we refer to the collaboratives by the name of the state (with the exception of Temple), rather than the collaborative acronym.



The data generally appear in pattern-coded bar charts. Double bars are used to compare the CETP program and the comparison group. Multiple bars are used to compare the individual CETPs, the CETP program average, and the comparison group average. Each graphic notes the source or sources of the data (SRI survey or NSF CETP Monitoring System).

Weighting of Survey Data

An analytic plan that weighted the survey data was created to provide results that would not "overreport" one collaborative (because it had more institutions involved in its projects and therefore would have more survey respondents) at the expense of "underreporting" other collaboratives (that had smaller numbers of institutions involved). For the CETP PI/Campus Lead Survey, since there was only one respondent per institution, there was no need to weight each respondent and all responses were assigned a weight of 1.0 (see Appendix A for a more detailed discussion of weighting). For the CETP Faculty Survey, data first were weighted within institutions to account for the fact that the numbers of faculty respondents per institution differed in the calculations of the collaborative averages, and then were averaged across the five collaboratives to provide an overall faculty average. It was also necessary to weight the

Director of Teacher Preparation Survey results to statistically create a one-to-one match with the PI/Campus Leads Survey respondents.

Multiple-Response Items

Many of the survey questions were formatted as multiple-response items; that is, a respondent could logically select one or more responses. Thus, in many of the graphics and accompanying text, percentages of responses do not add to 100%.

Interpretation of Significance Tests

The comparative analyses that we performed yielded very few statistically significant differences between the CETPs as a group and the comparison sites, in part because of the limited number of CETP and comparison institutions in the study. In the text we point out the significance/nonsignificance of findings whenever discussing findings based on comparisons. In selected cases, we discuss nonsignificant comparative findings, but only when there is a clear pattern in the direction of the differences, and the nonsignificance of the findings is always noted.

Organization of Part II

In Part I, we provided qualitative descriptions of each of the five collaborative projects: Louisiana, Maryland, Montana, Temple, and Colorado. We also provided descriptions of five comparison site institutions that implemented teacher preparation reforms without CETP project funding. The chapters in Part II report on other aspects of the projects, including the implementation of the reforms (Chapter 1), outcomes for students (Chapter 2), faculty involvement and collaboration (Chapter 3), institutional outcomes (Chapter 4), and dissemination and model generation (Chapter 5). The final chapter summarizes both qualitative themes and quantitative comparative findings, discusses implications of the summative evaluation design for our findings, and provides recommendations for further evaluation work.

PART II
CHAPTER 1. IMPLEMENTATION OF REFORM

The findings in Chapter 1 are based on data from the NSF CETP Monitoring System and from SRI surveys. SRI survey data include the views of principal investigators and campus leads (CETP PI/Campus Lead Survey), faculty involved in the collaboratives (CETP Faculty Survey), and directors of teacher preparation programs in the comparison group (Director of Teacher Preparation Survey). We begin the chapter by reviewing the various types of support undergirding teacher preparation program reform: funding, administrative support, and the climate for reform. We then examine the role of professional development for faculty as

affecting the implementation of reform. Finally, we focus on the types of reform that the projects have implemented, looking at both curricular reform efforts and pedagogical reform.

Funding for Reform

One of the most important sources of support for teacher preparation reform on a large scale is a substantial funding base. NSF ensured that CETP-funded institutions were funded at adequate levels throughout the first 5 years of the program. Maryland, Louisiana, and Montana received additional CETP funding for their projects' fifth year to evaluate the impact of their projects on students. Total funding per collaborative (including funds from other sources) ranged from approximately $5 million (Temple) to nearly $11 million (Montana) (see Table 1-1).[25]

To put NSF project funding in perspective relative to the comparison group, the average amount per collaborative institution was calculated (see the row labeled "CETP Average" in Table 1-1). There was a wide range of funding averages per institution across collaboratives, from the $2.6 million received by each of Temple's two CETP institutions to less than $500,000 received by each of Maryland's 13 institutions. On average, CETP funds per institution were 3.7 times the mean funds reported by comparison institutions ($1,129,211 versus $301,426).[26]

It was reported that all the collaboratives received funding from multiple sources, as shown in Figure 1-1. Colorado's project had the most diversified funding base (eight sources besides the NSF CETP award); Montana's project received the most non-CETP funding overall, with 30% of the total coming from other NSF sources. Louisiana's project received its largest contribution from state sources, whereas Maryland's and Temple's projects received the greatest proportions of their non-CETP funding from their own institutions.

Comparison group institutions are not shown in Figure 1-1 because their survey did not ask for dollar amounts per source. However, they were asked whether they received *any* funding from each source shown in the figure. Comparison group respondents were most likely to indicate receiving funding from "the current institution" and "state funds," followed by Eisenhower education funds. Interestingly, more than one-fifth of comparison projects reported receiving funding for their reform efforts from NSF.

The importance of funding in supporting undergraduate reform varied across collaboratives. When asked to characterize the role that NSF CETP funding had in undergraduate reform at their institution, most PIs/campus leads indicated that NSF support

[25] Data reported by collaboratives in 1999 NSF CETP Monitoring System. These figures include NSF CETP funding as well as other sources of funding, but exclude in-kind contributions from institutions.
[26] This difference was statistically significant at the $p < .000001$ level.

was "one of several enabling factors."[27] CETP funds appear to have been relatively more important for reform in Montana; 40% of Montana PIs/campus leads claimed it was "***the enabling factor***." Notably, no PIs/campus leads from any collaborative indicated that the NSF funds simply "validated" reform efforts that were already under way.

Table 1-1
Funding for NSF CETP Projects,
by CETP Project, CETP Program, and Comparison Group
(1996-1999)

Collaborative	NSF Award Funds	Other Sources of Funds	Total	Average per Institution
Temple	$3,900,000	$1,327,957	$5,227,957	$2,613,979
Maryland	6,000,000	337,462	6,337,462	487,497
Colorado	5,000,000	1,713,304	6,713,304	1,118,884
Louisiana	4,000,000	3,143,729	7,143,729	510,266
Montana	6,000,000	4,985,176	10,985,176	915,431
CETP Average	4,980,000	2,301,526	7,281,525	1,129,211
Comparison Group Average				$301,426*

Sources: NSF CETP Monitoring System and Director of Teacher Preparation Survey.
Note: Funding data for comparison group were unavailable for "other sources." Data for "total" and "average per institution" are only for the year 1999 for the comparison group. All data are project/program/group averages.
* Significantly different at $p < .000001$.

Administrative Support for Reform

We saw from the case studies that there are many tangible and intangible ways that administrators—from provosts and presidents to department chairs—can support faculty reform efforts. It was also clear from the qualitative work that such support mattered greatly to participating faculty. We asked CETP PIs/campus leads and directors of teacher preparation in the comparison group institutions to indicate the extent to which three factors related to administrative support acted as barriers to the implementation of their reform projects (see Figure 1-2).[28] There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group. Across CETPs, under one-quarter (23%) of respondents pointed to lack of faculty incentives as a major barrier to the implementation of their projects, whereas 45% of the comparison group institutions made the same claim. In general, the other two factors listed, lack of administrative support for reform and difficulty getting new courses "on the books," were not commonly reported as major barriers.

Faculty incentives are an important vehicle directly reflecting administrative support. Figure 1-3 compares the PI/campus leads' responses regarding the provision of incentives with

[27] Responses of PIs/campus leads were statistically adjusted so that each CETP received an equal weight, regardless of the number of partner institutions (e.g., Temple had just 2; Louisiana had 14).
[28] Respondents could answer that each item was "not a barrier at all," "somewhat of a barrier," or a "major barrier."

the ones provided by faculty respondents. In general, however, faculty reports of incentives were lower than the reports of the principal investigators, except for their reports of "summer salary or stipend" and "other incentive." For example, 67% of the collaboratives' PIs/campus leads said that faculty were provided release time to participate in collaborative activities, but only 16% of faculty concurred that they had received release time. Similarly, more than half of PIs/campus leads indicated that recognition or non-monetary awards were provided to faculty, but only one-quarter of faculty indicated that recognition or awards were inducements. One possible explanation for these discrepancies is that the sampled faculty did not receive incentives that were given or made available to other faculty.

Figure 1-4 compares PI/campus leads' responses regarding the provision of incentives with the responses of the comparison group. The directors of teacher preparation programs reported statistically fewer incentives overall ($p < .05$). With lower levels of funding for reform, this result is not surprising, given their comparatively limited resources.

Reform Climate

Since the climate for reform can promote or hamper innovation, we asked PIs/campus leads and comparison group respondents to rate the extent to which 10 variables measuring the "climate" were barriers to implementing reforms. Figure 1-5[29] summarizes data collected for both groups on factors that were reported to be a "major barrier" by respondents. There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group, with one exception: "Level of Faculty Research Commitments" ($p < .05$), with CETPs indicating higher values. Three climate variables stand out as problematic for PIs/campus leads: level of faculty research commitments, promotion and tenure guidelines that emphasize research over teaching effectiveness, and level of faculty teaching responsibilities. These were cited as a "major barrier" by 37%, 33%, and 21% of respondents across collaboratives, respectively. For the comparison group, the three barriers ranked the most problematic were: level of faculty teaching responsibilities (34%), faculty resistance to change (19%), and building faculty buy-in in the disciplines (16%).

Another way to compare the impact of reform climate across the CETPs is via "response counts." These response counts represent the averaged total number of climate variables selected as major barriers out of the 10 survey items related to climate (see Figure 1-6). Obviously, the lower the number of reported barriers the better the climate for reform. The 10 items aggregated provide a measure of the climate for reform within the collaboratives and within the comparison institutions. There were no statistically significant differences for these

[29] Respondents could answer that each item was "not a barrier at all," "somewhat of a barrier," or a "major barrier."

data between the individual CETP projects or between the CETPs as a group and the comparison sites as a group.

Preparation of Faculty to Teach Reformed Courses

A final factor that can affect the implementation of reform is the readiness of faculty to teach reformed courses. There were no statistically significant differences for this factor between the individual CETP projects or between the CETPs as a group and the comparison sites as a group. According to most PIs/campus leads, faculty readiness was not a major barrier to project implementation— fewer than 10% of CETPs overall flagged this as a problem, compared with 12% of directors of teacher preparation (data not shown).

Professional development activities were an important component of the CETP projects. Of the PIs/campus leads, the large majority reported that their programs offered professional development for faculty. However, there was no statistically significant difference between the percentages of comparison group respondents (76%) and CETP PI/campus lead respondents (84%) who indicated that they had provided professional development for faculty (data not shown). As will be discussed in Chapter 3, many of the CETP faculty surveyed received professional development (approximately half) or provided professional development (43%). Furthermore, 77% of the CETP faculty reported that they used skills learned via CETP professional development.

Louisiana implemented a faculty intern program to help faculty members learn more about mathematics and science reform in the K-12 sector and the needs of K-12 teachers so that they could teach science and mathematics more effectively. The faculty interns were paid a weekly stipend to participate in a summer workshop sponsored by Louisiana's Statewide Systemic Initiative (LaSIP), the state's K-12 reform effort to improve mathematics and science teaching and learning. Some of the interns became actively involved in their institution's LaCEPT initiative, bringing their understanding of K-12 teachers' needs to their own classroom teaching.

Curricular Reform

New, revised, and reformed courses are at the heart of the CETP interventions. In this section, we cover curricular reform (i.e., changes in the breadth, depth, and substance of what is taught). However, before we begin an in-depth presentation and explanation of the data, we describe the data collection as an aid to the reader's understanding.

Exhibit 1-1 is taken from question 11 on the PI/Campus Lead Survey, see Appendix C). In presenting the findings for this item, we selected only those cases in which the respondent reported that the reform was part of the project and was very important to the project and that

he/she was either somewhat or very satisfied with the reform strategy's current status. Only those cases were selected that provided answers that correspond to the yellow highlighted material in the exhibit.

Exhibit 1-1
Sample Item Setup and Response Logic for Reform Strategies

11. Indicate whether each of the following course reform foci is part of the CETP project, how important each reform focus is to the CETP project, and how satisfied you are with its current status.

Course Reform Focus	**Is this a part of your CETP project?**	**How Important? 1 = Not at all 2 = Somewhat 3 = Very**	**How Satisfied? 1 = Not at all 2 = Somewhat 3 = Very**
Content			
Curriculum integrates content across the sciences and mathematics	Yes → No	1 2 or 3	1 2 or 3

Source: CETP Principal Investigator and Campus Lead Survey.

Figure 1-7 lists seven curriculum reform strategies that support student learning. There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group, with one exception: "Link between Content and Method Is Explicit" ($p < .01$), with comparison sites indicating higher values. High percentages of CETP respondents and comparison site institutions reported that their reformed courses were aligned with science and mathematics standards, that the courses focused on key concepts, and that the content was culturally sensitive (over 60% for each). Although most of the variables are not statistically significant, there is a clear pattern in the direction of the findings, with the comparison group reporting higher levels of satisfaction with the current status of curricular reform strategies than did the CETPs.

Successful implementation of standards-based, hands-on coursework depended on an instructor's understanding of and comfort with an inquiry approach to teaching and learning. To help Colorado's faculty participants assess the extent to which their pedagogy was consistent with national standards and the project's vision, Colorado's evaluation team developed a Course Checklist. During the final class period of a CETP-revised course, the instructors gave students time to complete the Checklist and rate the degree to which each of 28 teaching strategies had been implemented by the instructor and the helpfulness of each strategy. The Checklist also facilitated the collection of student demographic data.

Figure 1-8 disaggregates the data provided in the preceding figure. For this graphic, we use response counts, the total number of responses that the respondent was either somewhat

or very satisfied with the current status of the reform strategy. There were no statistically significant differences for these data between the individual CETP projects or between the CETPs as a group and the comparison sites as a group.

Pedagogical Reform

Respondents were also asked about 12 pedagogical strategies used in the course reforms. It is evident from the data (see Figure 1-9) that high percentages of CETP PIs/campus leads reported using most of these with some degree of success. Promoting positive attitudes toward science/math, active learning, problem-based learning, and innovative assessment of student learning were the most frequently cited strategies (80% or more of the CETP respondents). A relatively low percentage of respondents (42%) reported, however, that courses were being taught by multidisciplinary teams. Taken together, these data suggest that CETP courses are taught in a manner consistent with best practice. There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group. Unlike for curricular reform strategies, there was no clear pattern in the responses of the CETPs and the comparison sites.

Figure 1-10 compares individual CETPs, CETPs overall, and the comparison sites on innovative pedagogical reform strategies. There were no statistically significant differences for these data between the individual CETP projects or between the CETPs as a group and the comparison sites as a group.

Summary

Implementation of reform involves a myriad of factors, including funding for reform, administrative support for reform, and reform strategies. NSF funded the five CETP projects included in the summative evaluation at approximately $5 million each for a period of 5 years. All the collaboratives sought additional funding (both internal and external) to support their reform efforts. CETP institutions received nearly four times as much total funding as comparison sites (approximately $1 million versus approximately $300,000), a difference that was statistically significant. The CETP institutions reported that relatively large proportions of funding for teacher preparation reform were contributed by their own institutions, which is a positive indicator of administrative support and a potential indicator for institutionalization of the reforms.

Faculty buy-in was critical to the implementation and success of reform efforts. Overall, the CETPs did not experience administrative barriers to reform, and faculty were offered tangible as well as intangible rewards for participation. Interestingly, faculty reported receiving fewer incentives, especially with respect to release time and additional support staff, than PIs/campus leads from the same institutions reported offering. The CETPs reported a

significantly higher number of incentives than comparison site institutions. The ability to provide tangible incentives is clearly linked to monetary resources, which ties in with the finding above that CETPs were richly endowed relative to comparison sites.

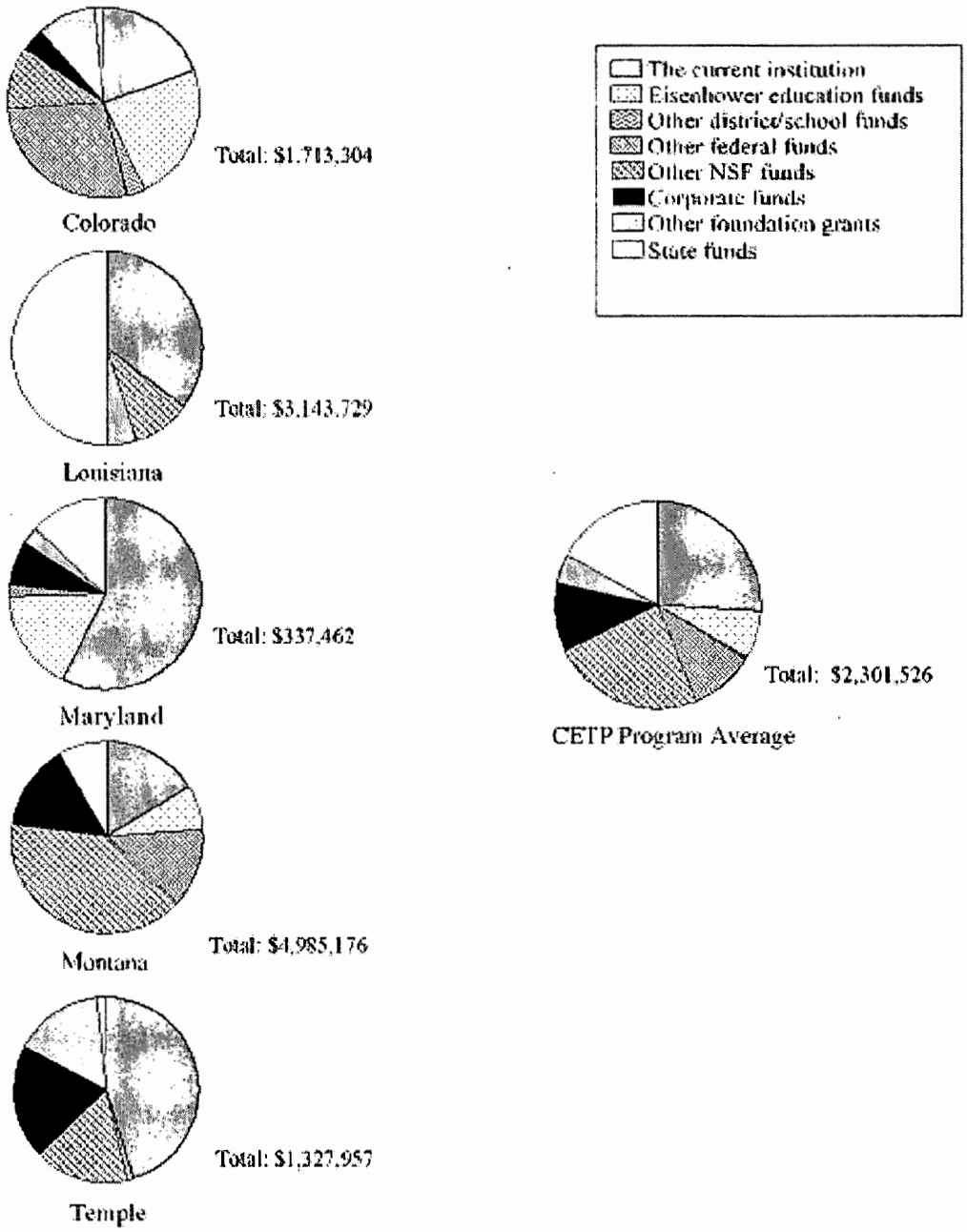
In terms of reform strategies, the comparison projects reported higher levels of satisfaction with the current status of curricular reform strategies than did the CETPs, though only one difference was statistically significant. CETP projects and comparison projects both reported high use of innovative pedagogy, and there were no statistical differences between the groups.

Just under 300 courses were either developed or revised by the five collaboratives included in the summative evaluation over a 4- to 5-year period.[30] However, our qualitative data collected with the assistance of disciplinary content experts indicated that the quality of new or revised CETP courses was very uneven across and within CETPs and across and within institutions.

[30] Note: Course counts include all new/revised courses, regardless of their quality.

Figure 1-1

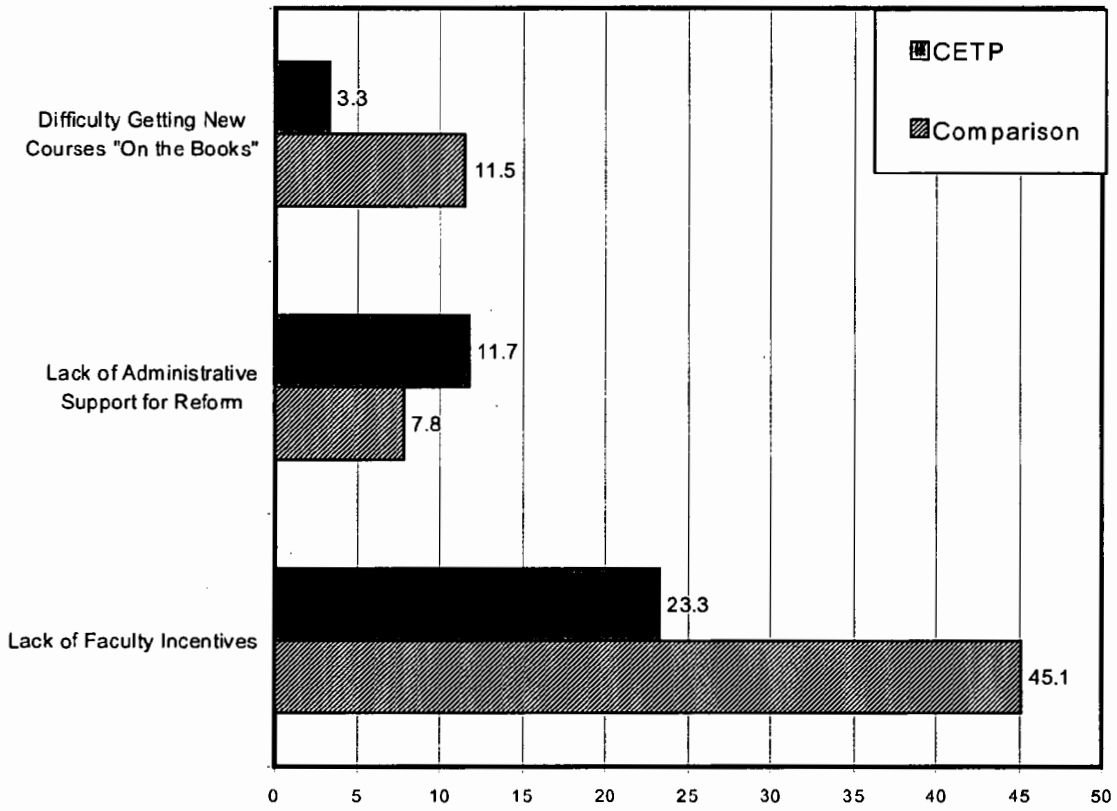
Relative Contributions of Non-CETP Funding, by CETP Project and CETP Program (1996-1999)



Source: NSF CETP Monitoring System

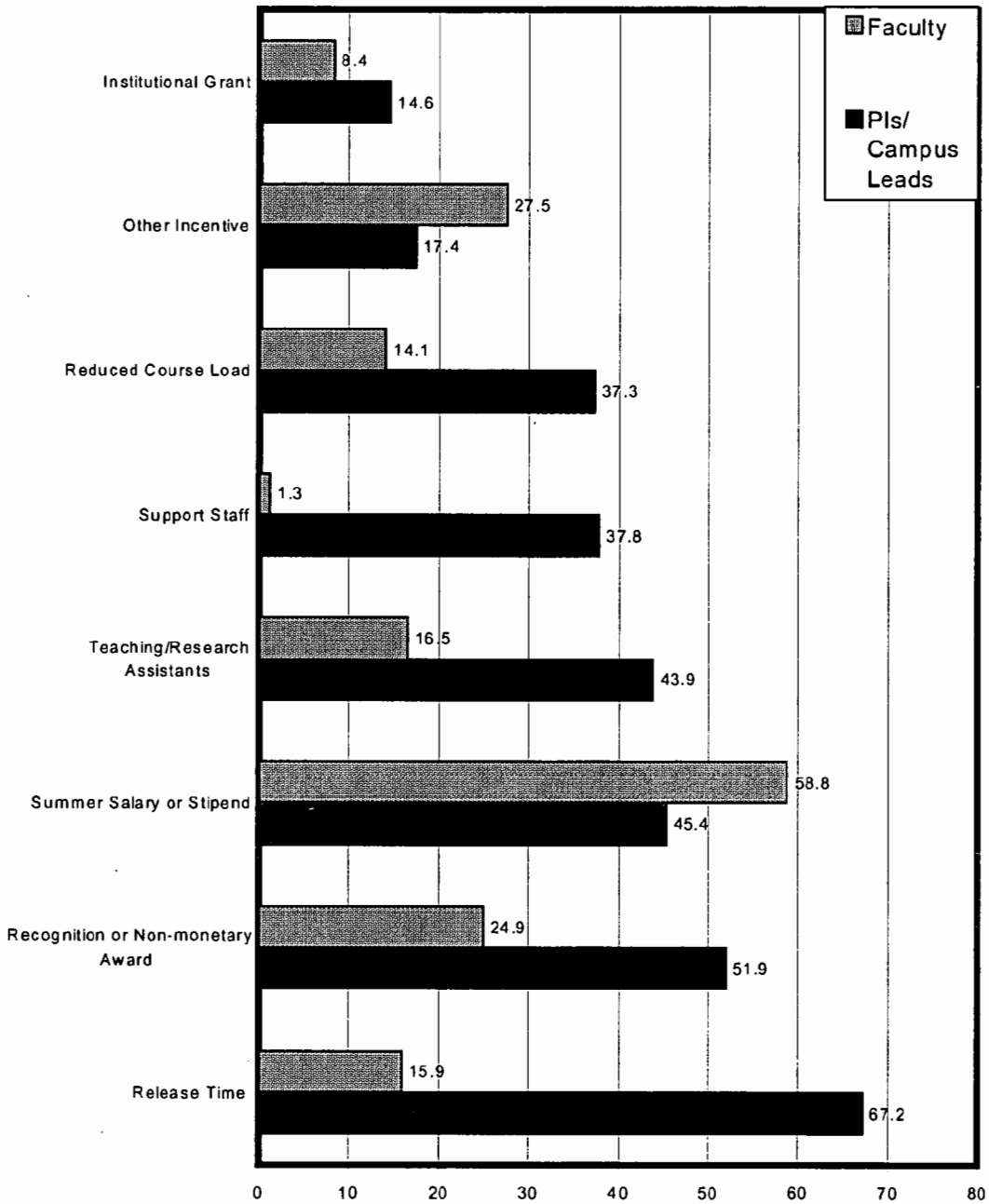
Note: All data are project/program averages.

Figure 1-2
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Indicating Administrative Factors Were Major Barriers to Project Implementation



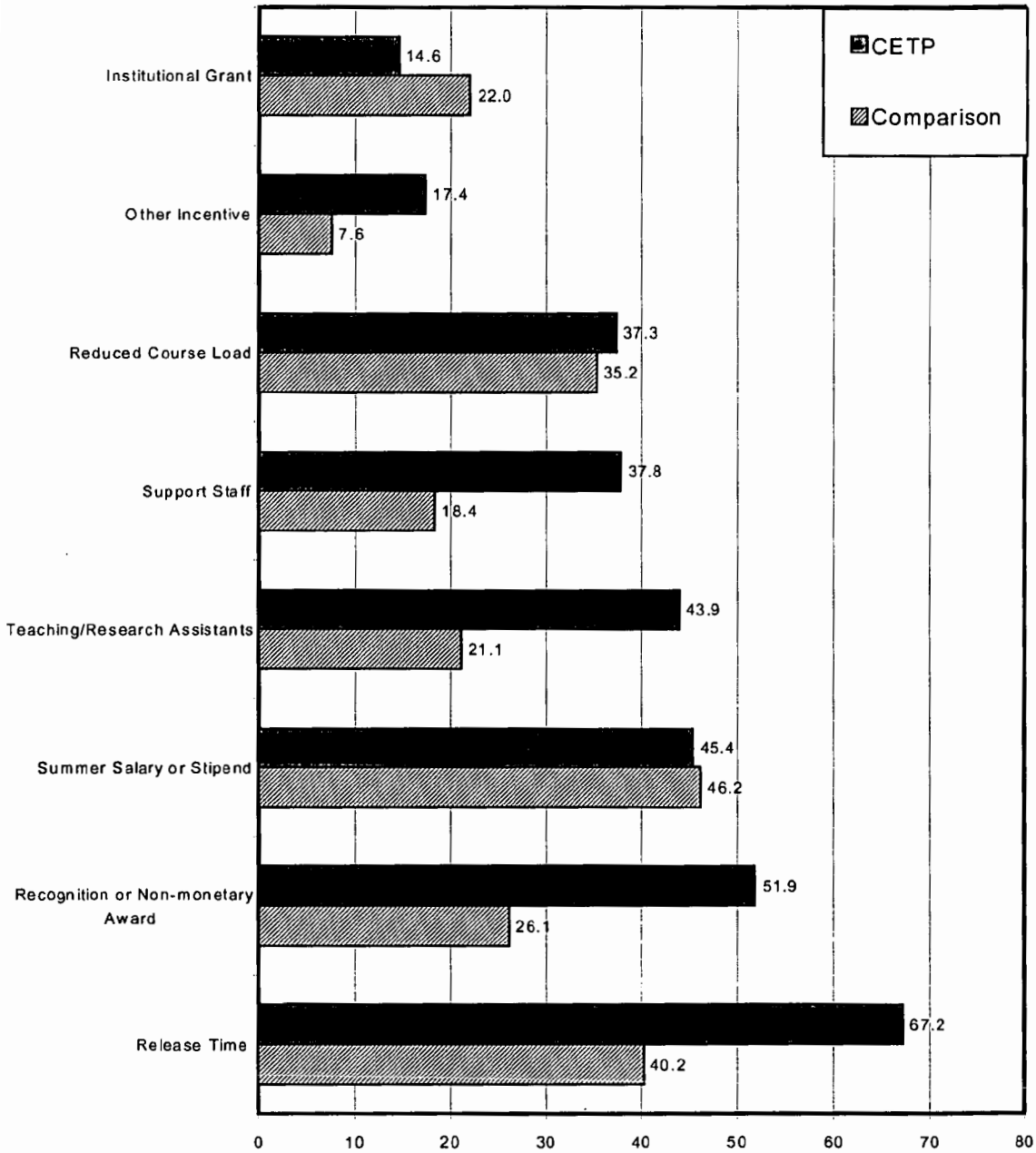
Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.

Figure 1-3
Percentage of CETP PIs/Campus Leads and CETP Faculty Indicating Types of Faculty Incentives Offered/Received for CETP Involvement



Sources: CETP Principal Investigator/Campus Lead Survey and CETP Faculty Survey.
Note: All data are program averages.

Figure 1-4
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Indicating Types of Faculty Incentives Offered for CETP Involvement*

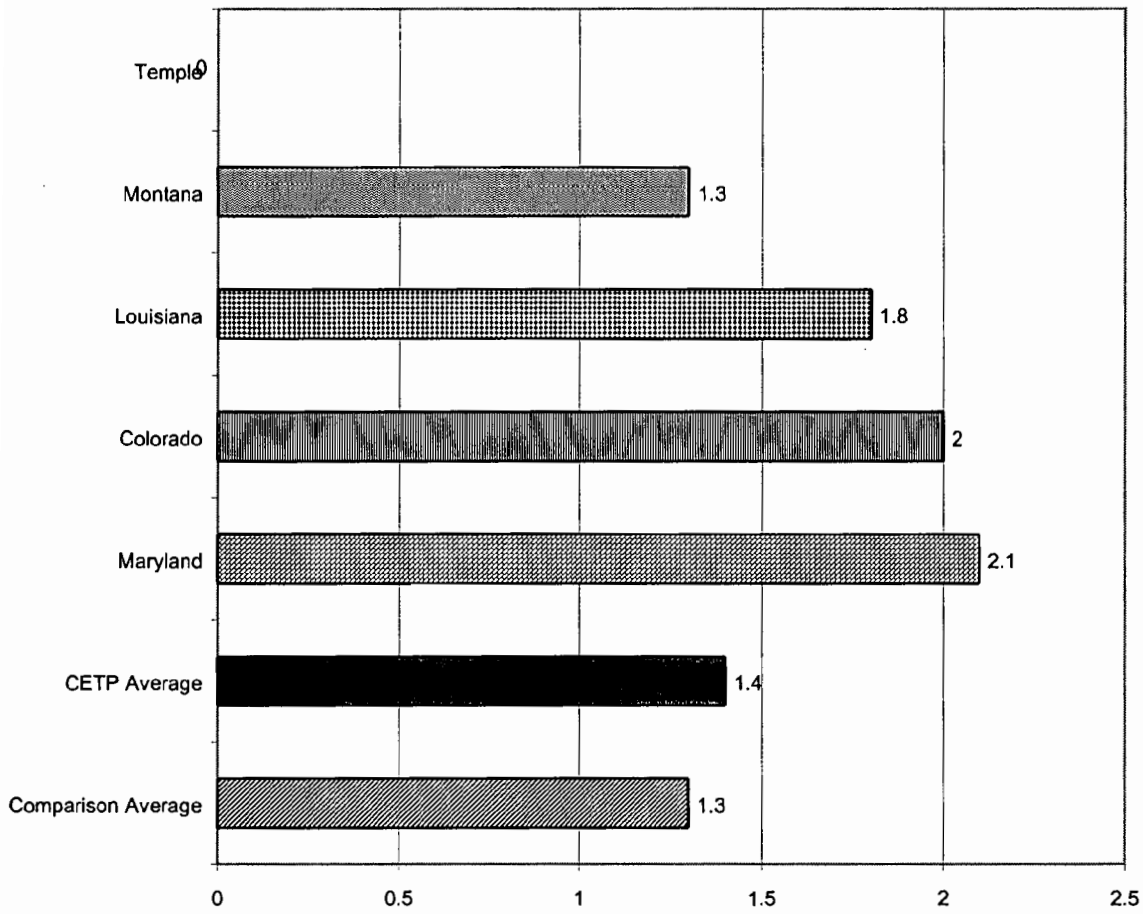


Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.
* Overall, the use of faculty incentives was significantly different at .05.

Figure 1-5
Percentage of PIs/Campus Leads and Directors of Comparison Projects Indicating Reform Climate Factors Were Major Barriers to Project Implementation

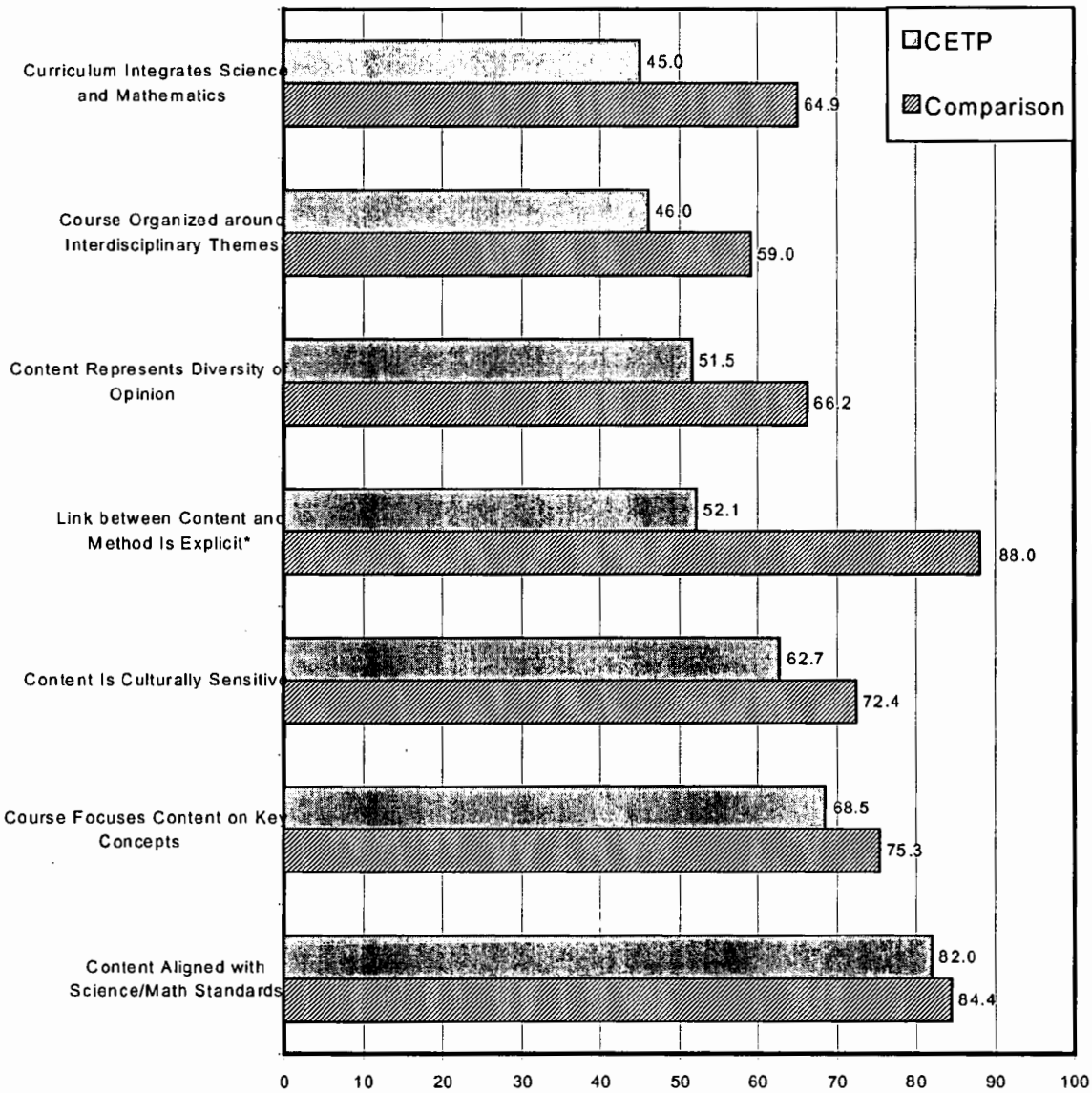
Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.
* Significantly different at $p < .05$.

Figure 1-6
Response Counts of Major Climate Barriers, by CETP Project, CETP Program, and Comparison Group



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are project/program averages.

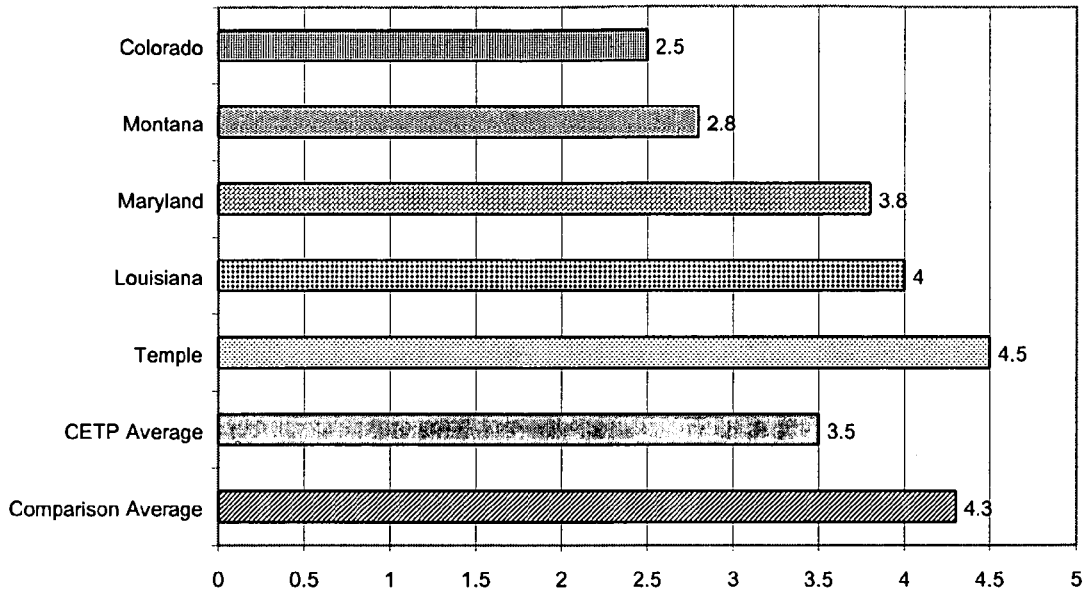
Figure 1-7
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Indicating Successful Implementation of Innovative *Curriculum Reform* Strategies



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.
* Significantly different at $p < .01$.

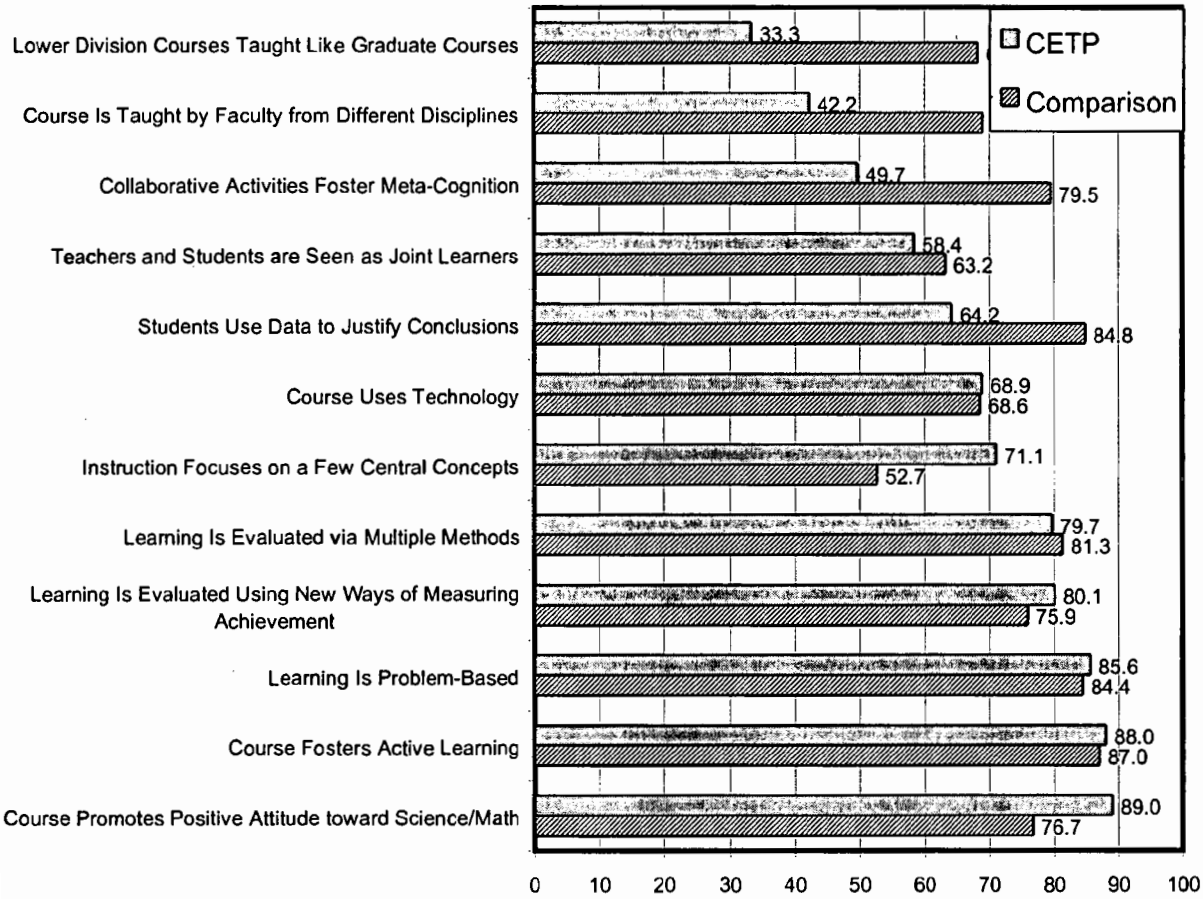
Figure 1-8

Response Counts of Successful Progress Implementing Innovative Curriculum Reform Strategies, by CETP Project, CETP Program, and Comparison Group



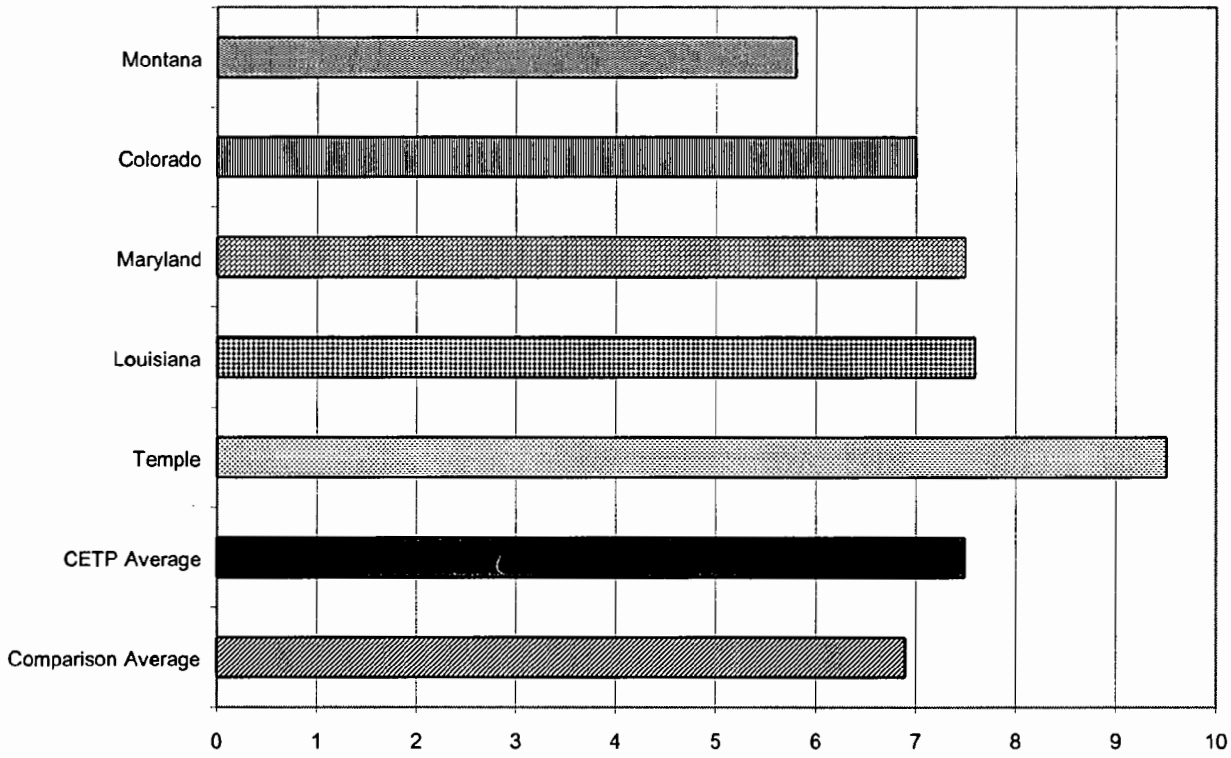
Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are project/program/group averages.

Figure 1-9
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Indicating Successful Implementation of Innovative *Pedagogical Reform* Strategies



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.

Figure 1-10
Response Counts of Sucessful Implementation of Innovative
***Pedagogical Reform* Strategies, by CETP Project, CETP Program, and Comparison Group**



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Program Survey
Note: All data are project/program/group averages.

CHAPTER 2. OUTCOMES FOR STUDENTS

One of the primary goals of NSF's CETP initiative was "to improve significantly the science, mathematics, and technology preparation of future K-12 teachers and their effectiveness as educators in these areas."[31] In this chapter, we present our findings with respect to the characteristics of the CETP students who participated in CETP reforms, the program outcomes for all CETP students, and the program outcomes specifically focused on students who are from groups that are underrepresented in mathematics and science. The survey data reported here are derived from the NSF CETP Monitoring System and from surveys of CETP PIs/campus leads, CETP faculty, and directors of teacher preparation at the comparison projects.

Student Participation

Directly related to the goal of better preparing teachers in mathematics, science, and technology is the opportunity for students to engage in mathematics and science courses that were developed according to the principles of best practice in teacher preparation. According to the most recent data available from the NSF CETP Monitoring System (1999), on average, 727 students were involved in CETP courses at each CETP institution.

As Figure 2-1 indicates, the number of students involved in reformed courses ranged from 170 per institution in the Maryland CETP to 1,795 in the Temple CETP in 1999.[32] The sheer numbers of students involved in the reformed courses were one of the biggest differences between the CETP program and the comparison institutions, which averaged just over 100 students per project.[33] The large discrepancy may be due in part to the fact that the reforms at comparison sites were generally younger than the reforms at the CETPs (41% began their teacher preparation reforms in 1996 or later). It follows that the comparison sites may not have had adequate time to gather the institutional momentum needed to expand and include more students in their reform work. It does appear, however, that the CETP projects apparently provided improved opportunities for student access to revised courses that reflected best practices in teacher preparation.

Figure 2-2 provides racial/ethnic and gender information on the students involved in CETP reforms. From these figures, we observe that the majority of students enrolled in CETP courses (70%) were white (non-Hispanic) and 14% were African American. As would be expected, given the variety of contexts for the CETP reforms, participation of minority students of a particular race/ethnicity was uneven. For example, Temple had relatively high percentages of

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[31] *Undergraduate Education Program Announcement and Guidelines*, NSF 97-29.
[32] Note that the student counts reported in the NSF CETP Monitoring System include double counts.
[33] This difference was statistically significant at the $p < .000001$ level.

African Americans (41%) and Asians (7%), whereas Colorado had the highest percentage of Hispanics (7%). Montana, on the other hand, had the highest percentage of American Indians (2%). Maryland and Philadelphia had the fewest non-Hispanic whites (37% and 41%, respectively), whereas Montana had the most (85%).

The types of students enrolled in CETP courses coincided fairly well with reports by PIs/campus leads of their projects' "primary focus." The comparison group reports followed this general ranking, as well, with the exception of American Indians and Hispanics, whom they prioritized higher than their actual representation.

In terms of the academic majors of CETP students in 1999, CETP faculty reported that a majority (60%) were elementary education majors (Figure 2-3). The next most commonly reported major was science (18%), followed by mathematics/science (12%) and mathematics (10%). Relative to survey data collected by SRI in 1996, education majors were down by 30 percentage points, while mathematics and science majors were up (by 5 and 12 percentage points, respectively).[34] These shifts are in keeping with the intentions of NSF to improve the preparation of future SMET educators. Colorado accounts for much of the increase in science majors (with 46%, the highest percentage across collaboratives). The academic majors of comparison group students were very similar to those of CETP students.

Student Outcomes

Two types of data were collected on student outcomes: quantitative data from the faculty survey and qualitative data collected via open-ended items from PIs/campus leads and the comparison group. Faculty respondents were asked to rate the CETP project's contribution regarding student outcomes on a scale ranging from "Major Negative Impact" to "Major Positive Impact" (see Exhibit 2-1). For each outcome, only faculty who responded "Some Positive Impact" or "Major Positive Impact" were used in the reporting of a positive outcome for students.

[34] SRI deliverable: *Preliminary Findings Report for the Evaluation of NSF's Collaboratives for Excellence in Teacher Preparation Program* (May 1997).

Exhibit 2-1
Sample Item Setup and Response Logic for Student Outcomes

9. To what extent has the CETP project contributed to the following outcomes for students?

	Impact				
Student Outcome	**Major Negative impact**	**Some Negative impact**	**No impact**	**Some Positive impact**	**Major Positive impact**
More students completing introductory SMET courses				☑	Or ☑

Source: CETP Faculty Survey.

Two of the strongest positive responses were to statements that compared CETP students' mastery of SMET with other students': 70% of faculty respondents indicated that the project had had some or major positive impact on CETP students compared with prior preservice students, and 65% indicated a positive effect of the project on CETP students compared with current non-CETP students (Figure 2-4). Very positive responses were also given regarding the CETP project's impact on students' understanding of SMET concepts (68%) and their confidence in applying SMET skills (66%). Figure 2-5 depicts the average counts of responses for the 11 items mentioned above for each CETP and for the CETPs as a group.

The Temple/CCP CETP found that the mathematics preparation of CETP students had improved largely because of the CETP's development of an introductory math methods course that provided pre-college, basic mathematics for the significant number of elementary education students who were not ready for college-level mathematics. By requiring that all elementary education majors take the newly developed basic mathematics course, or pass the course-exit competency arithmetic skills test, before taking the two other required mathematics courses, this CETP helped its graduates to be better prepared than students who graduated prior to implementation of the CETP.

Figure 2-6 compares CETP PI/campus lead responses to open-ended questions with the responses of the directors of comparison projects.[35] There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group. Directors of teacher preparation programs at comparison sites tended to provide more positive comments regarding preservice students' positive attitudes, comfort level with material, and confidence in their own ability to teach than did CETP PIs. They also reported more positive comments than CETP PIs indicating that students were better prepared to teach and

[35] It should be noted that open-ends did not provide all respondents with the same opportunity to respond to a particular outcome. Thus, we interpret the following results with caution.

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"very hirable." It is noteworthy, however, that none of the directors of teacher preparation made positive comments with respect to "Expanded Networking Opportunities" or "Scholarship Support."

Although the above student outcome data are not based on formal assessments of students' knowledge, skills, or attitudes, they do reflect respondents' "expert knowledge" of students. Ideally, to assess the CETPs' impact on students, we would have liked to use assessment data available for CETP students, non-CETP students in the same institutions, and the comparison group, such as scores on Praxis II or a state-developed assessment. However, at the time these analyses occurred, Praxis data linked to individuals or institutions were not available. State-developed assessments tended to vary from state to state (if they existed at all) and were not available for individuals or institutions. Grades would not have been a good choice as an outcome measure, for several reasons: courses are not comparable across institutions, there may be more or less grade inflation from institution to institution, and grades are too confidential. Course-taking patterns provided another alternative, but because courses and course sequences are not comparable across institutions, these data would not have been precise enough to capture CETP effects. Thus, our best data at the time of this writing were faculty's judgment of CETP students' knowledge, skills, and attitudes, and the perceptions of PIs/campus leads and directors of teacher preparation regarding outcomes for students.

Outcomes for Underrepresented Students

We reviewed above the ethnic/racial composition of the CETP student populations, noting that the large majority of students were white (non-Hispanic). Two items on the PI survey addressed recruitment of underrepresented students into SMET courses and retention of underrepresented students in SMET courses. As with reform strategies in Exhibit 1-1, respondents were asked whether each of these strategies was part of their project, how important it was to the project, and how satisfied he/she was with its current status. We then selected only those cases in which the respondent reported that the reform was part of the project and was very important to the project, and that he/she was either somewhat or very satisfied with the reform strategy's current status. Thus, the strategies discussed below are those that are most likely to be operational and relatively successful.

Figure 2-7 shows the success the CETPs and comparison sites had in their efforts to recruit and retain underrepresented groups. Asians and African Americans were the primary beneficiaries of CETP recruitment efforts (approximately 70% of respondents flagged these groups). Hispanics, Asians, and African Americans were the main recipients of CETP retention efforts (approximately 70% of respondents flagged these groups).

In general, the CETPs attempted to educate faculty participants about, and to provide for, the needs of underrepresented students in academic classes. For example, Colorado held brown-bag discussions and cosponsored a conference that focused on issues of diversity, and asked students to routinely complete course checklists to obtain feedback on instructors' sensitivity to their learning needs. Montana provided "bridge" courses to help underrepresented students adjust to university life and improve their chances for academic success in college mathematics and science courses and completion of an undergraduate degree. The bridge courses were held during the summer on a participating university campus. Temple University and several of the institutions in Louisiana developed basic mathematics courses for student participants to strengthen their comprehension of mathematical concepts, dissipate math phobia, and hone skills needed to successfully complete algebra and other mathematics courses. At Temple, all elementary education students were required to take the newly developed course and/or successfully complete the exit exam.

Comparison group projects also focused recruitment programs, courses, and retention efforts on underrepresented students. Generally, CETPs indicated a stronger focus, but there was not a statistically significant difference between the two groups on any of these measures.

NSF Scholarships

To further the recruitment of highly capable future teachers, the collaboratives set aside project funds yearly to provide scholarships. In the following paragraphs, we present three tables with data about the NSF scholar awards program obtained from the 1999 NSF CETP Monitoring System. The tables provide descriptive information about the awards made in 1999, which racial groups the awards affected, and the fields of study of the recipients.

Table 2-1 provides background information about the award recipients by collaborative and the financial resources available for them. The data reported indicate that the Louisiana collaborative provided fewer scholarships, on average, but each award carried a higher level of financial support. The other four collaboratives appear to have provided more awards with less total funding per award recipient. We can also infer that the Montana and Colorado collaboratives provided proportionately more awards to minority students in 1999 (55% and 43%) than did the other collaboratives. Also, it is rather remarkable to note the very narrow range of the average GPAs of award scholarship recipients across collaboratives (from a low of 3.47 to a high of 3.59).

Table 2-2 provides a more detailed racial/ethnic breakdown of the scholarship recipients. From the table, we can deduce that the Colorado collaborative awarded scholarships to the greatest number of minority groupings, and Montana provided the largest reported proportion of scholarships to underrepresented groups. It is also apparent from the table that Maryland

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provided proportionately fewer scholarships to ethnic/racial minorities than did any of the other collaboratives.

In Table 2-3, data on the majors for NSF awards are presented by collaborative. Colorado awarded its scholarships only to students studying mathematics and the sciences, whereas Louisiana, Maryland and Temple awarded their scholarships to predominantly education majors. These observations indicate the grade-level foci of the collaboratives, with Colorado focusing on secondary mathematics and science teachers.

Summary

According to the NSF CETP Monitoring System, the number of students involved in CETP courses ranged, on average, from 170 per institution in one CETP to 10 times as many per institution in another CETP (in 1999). The number of students involved in CETP-reformed courses was statistically greater than the number of students in reform projects in the comparison sites by a factor of approximately seven. Clearly, the higher level of CETP funding enabled CETP projects to reach many more students than comparison sites.[36]

Close to three out of four students involved in CETP projects were white, and nearly two-thirds were female. The majority were elementary education majors (60%). This profile does not differ markedly from the traditional image of a preservice teacher, but compared with data collected early in this evaluation, the proportion of science and math majors did increase over the years, and more males are now preparing to be teachers under the CETP program.[37]

CETP faculty reported positive outcomes for students along a number of dimensions. Close to or over two-thirds of faculty listed mastery of SMET and related skills (especially with respect to non-CETP students), confidence in applying SMET skills, understanding of SMET concepts, and mastery of SMET knowledge relative to that of preservice students prior to the CETP project.

In terms of outcomes for underrepresented students, high proportions of CETP institutions reported recruitment focused on Asians and African Americans and retention efforts focused on Hispanics, Asians, and African Americans. Comparison projects engaged in recruitment and retention efforts focused on underrepresented students at levels not significantly different from those of the CETPs.

The qualitative data were consistent with the quantitative data in suggesting positive outcomes for CETP students. Unfortunately, at this point, few impact data are available from

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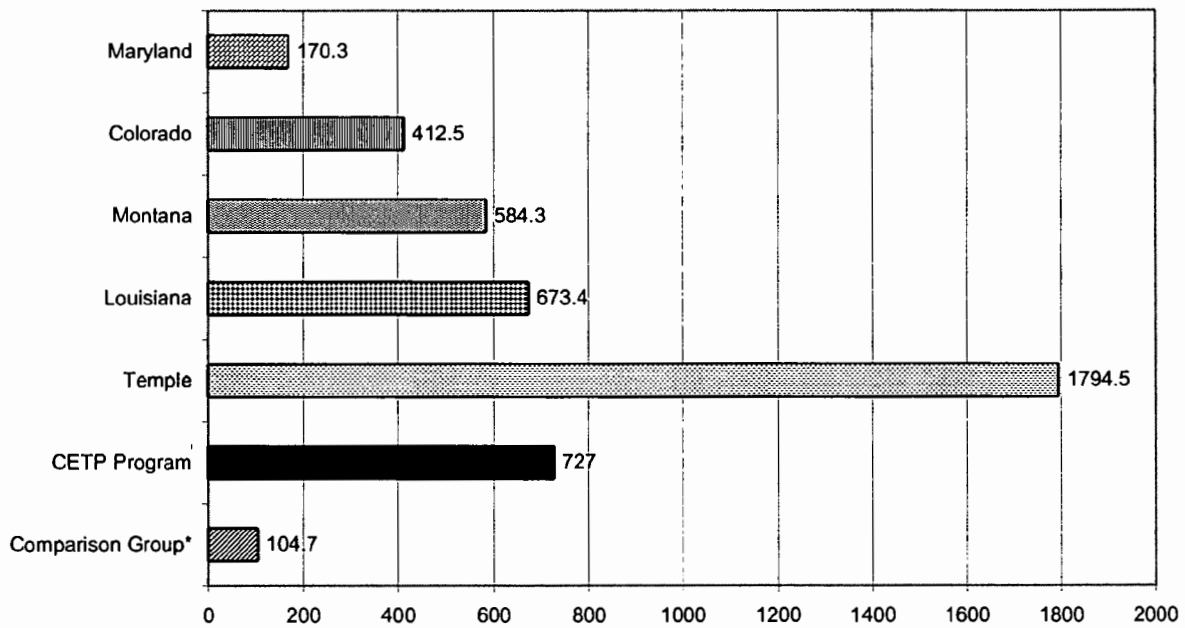
[36] The reader is reminded that the CETP data, which were taken from the NSF CETP Monitoring System, include double counts of students, so the difference may not be as great as indicated in the text.

[37] In 1996, 91% of CETP students reported majoring in education, 5% in math/science, and 4% in some other field. At that time, approximately 80% of CETP students were female. SRI deliverable: *Preliminary Findings Report for the Evaluation of NSF's Collaboratives for Excellence in Teacher Preparation Program* (May 1997).

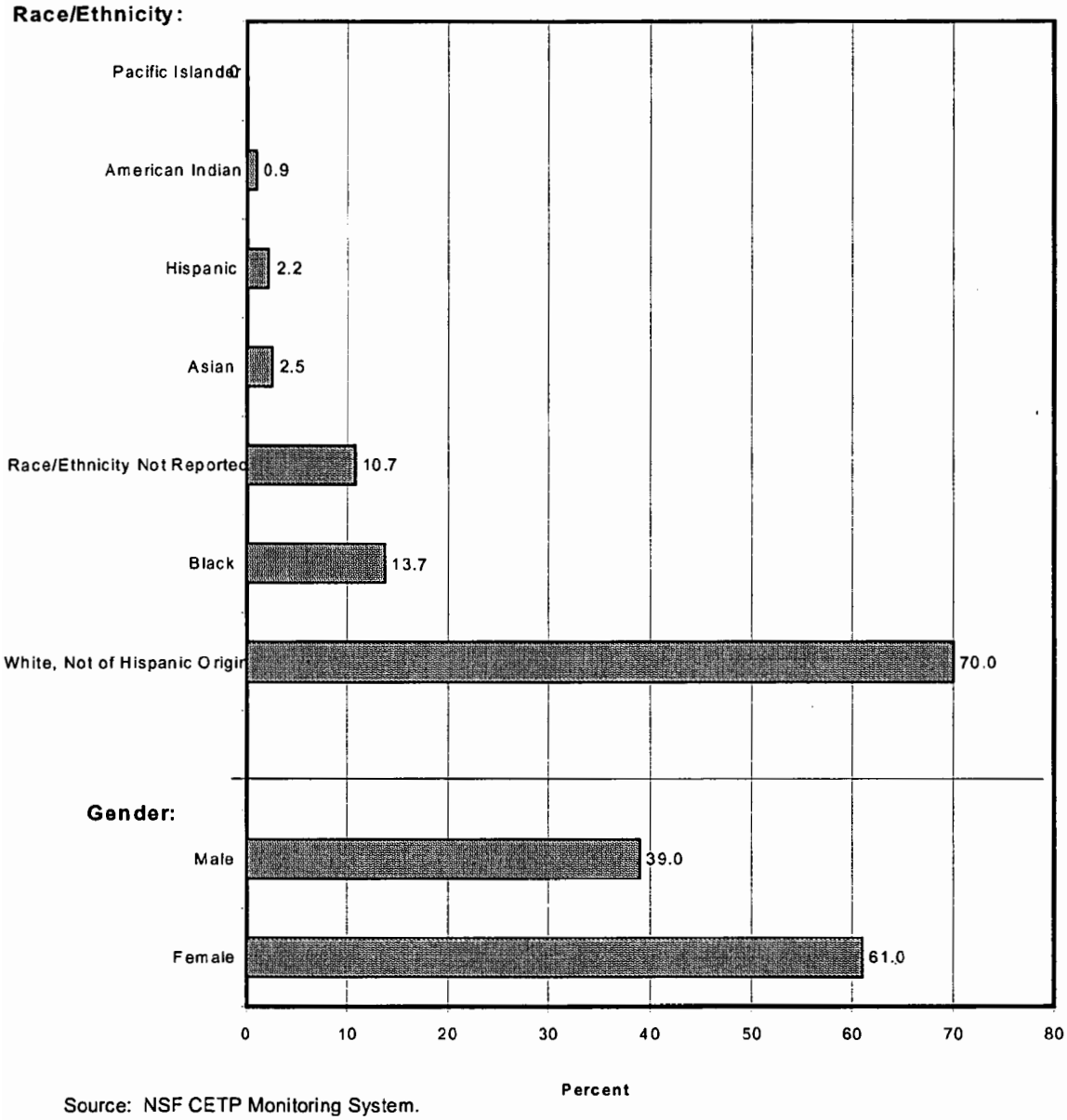
individual CETPs that document changes in what preservice students know or can do as a function of CETP-reformed courses/programs. Most of the data collected by CETPs is course specific, anecdotal, or attitudinal. The strongest data are those from third parties, such as principals and cooperating teachers, who have both an objective viewpoint and the perspective to compare CETP students with non-CETP students. As indicated above, their reports are promising.

Figure 2-1
Number of Students per Institution, by CETP Project, CETP Program, and Comparison Group (1999)



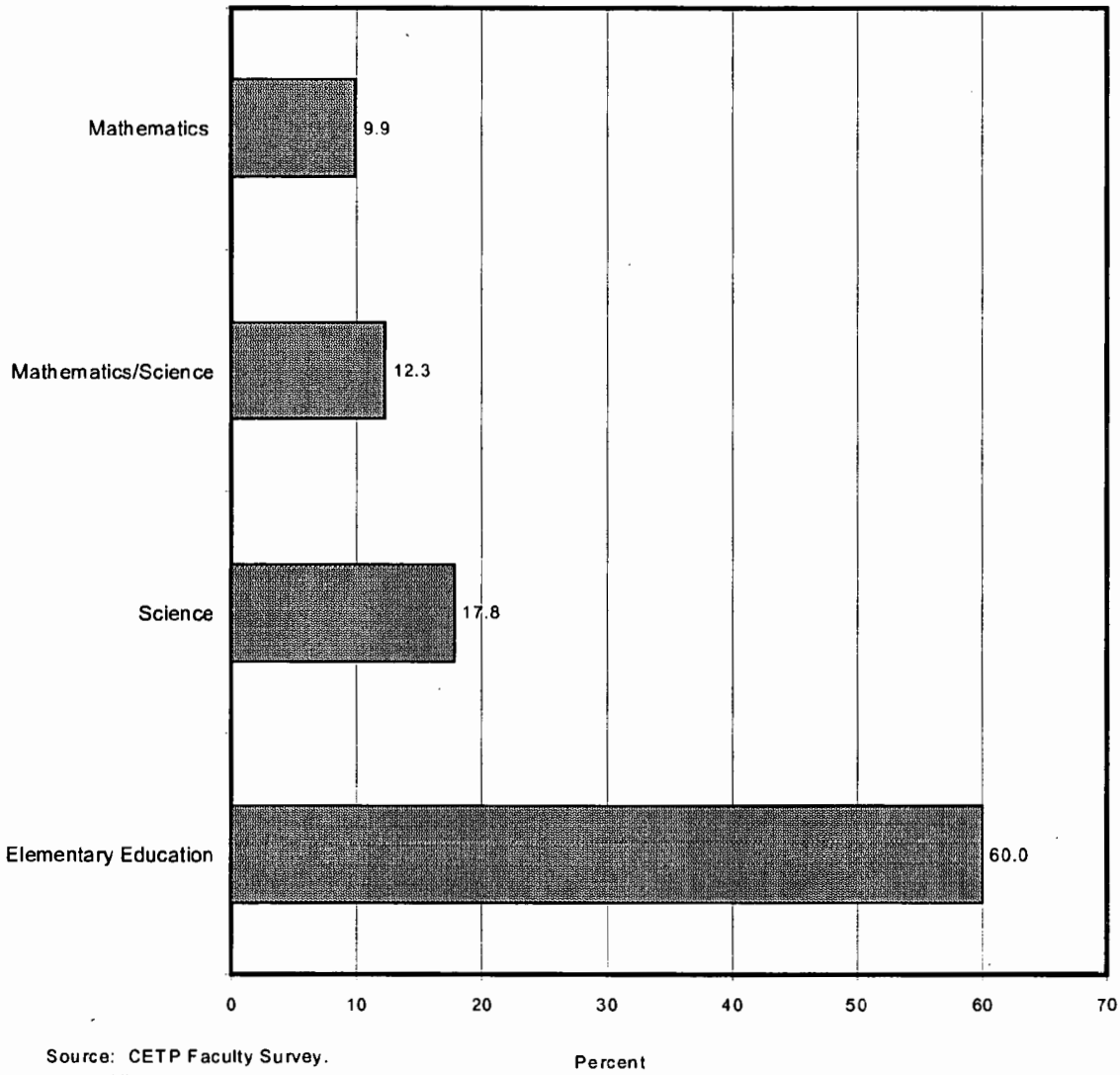
Sources: NSF CETP Monitoring System and Director of Teacher Preparation Survey.
Note: All data are project/program/group averages.
* Singnificantly different from CETP program a $p < .000001$

Figure 2-2
Gender and Racial/Ethnic Distribution of Students Enrolled in CETP Courses (1999)



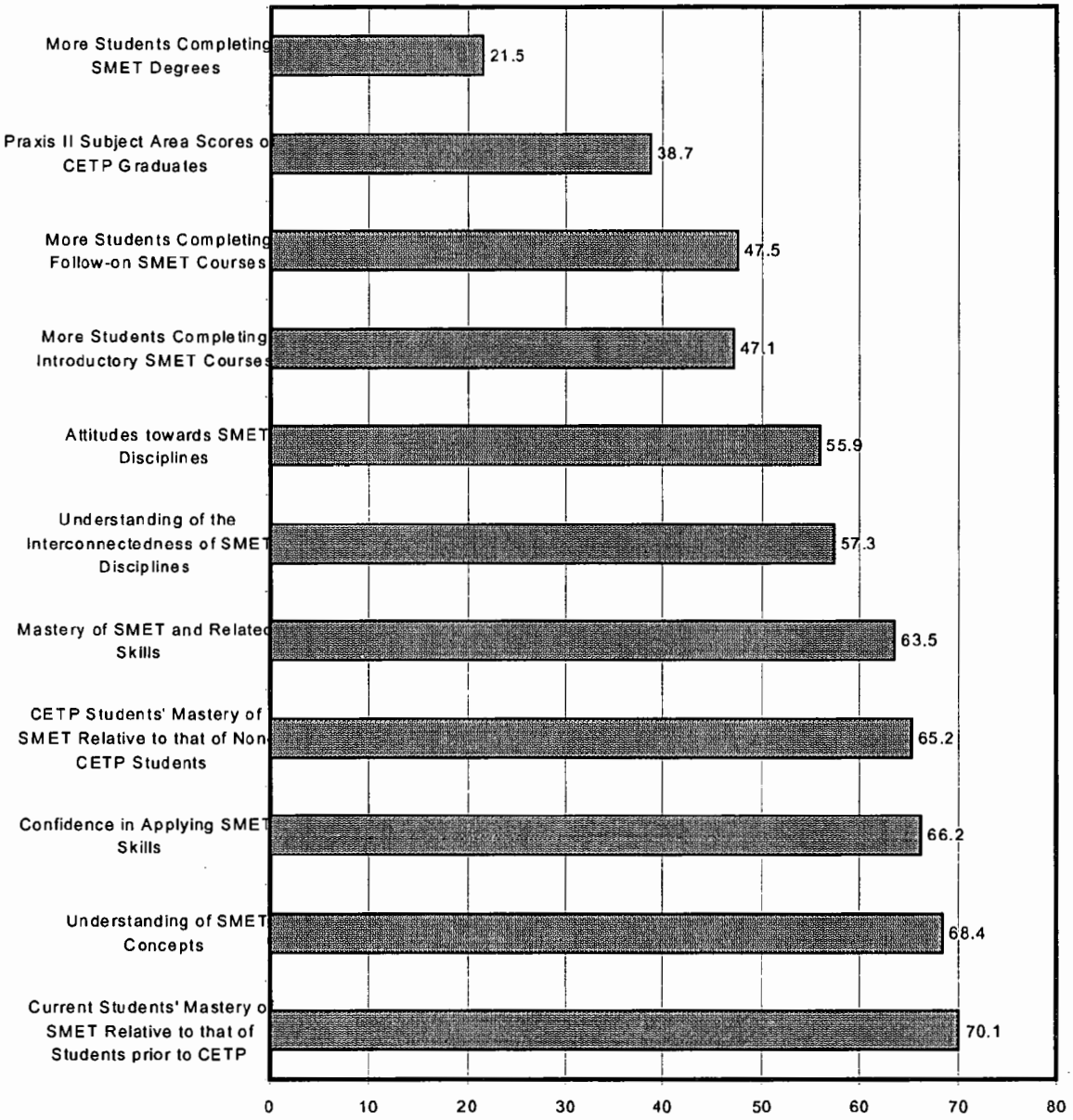
Source: NSF CETP Monitoring System.
Note: All data are program averages.

Figure 2-3
Academic Majors of Students Enrolled in CETP Courses
(1999)



Source: CETP Faculty Survey.
Note: All data are program averages.

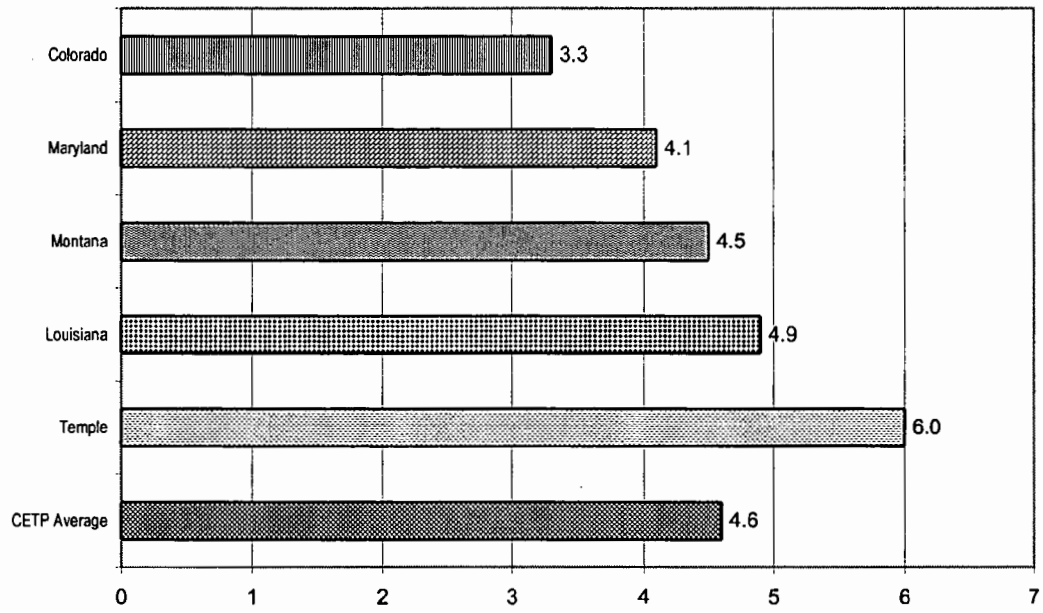
Figure 2-4
Percentage of CETP Faculty Indicating Positive Student Outcomes



Source: CETP Faculty Survey.
Note: All data are program averages.

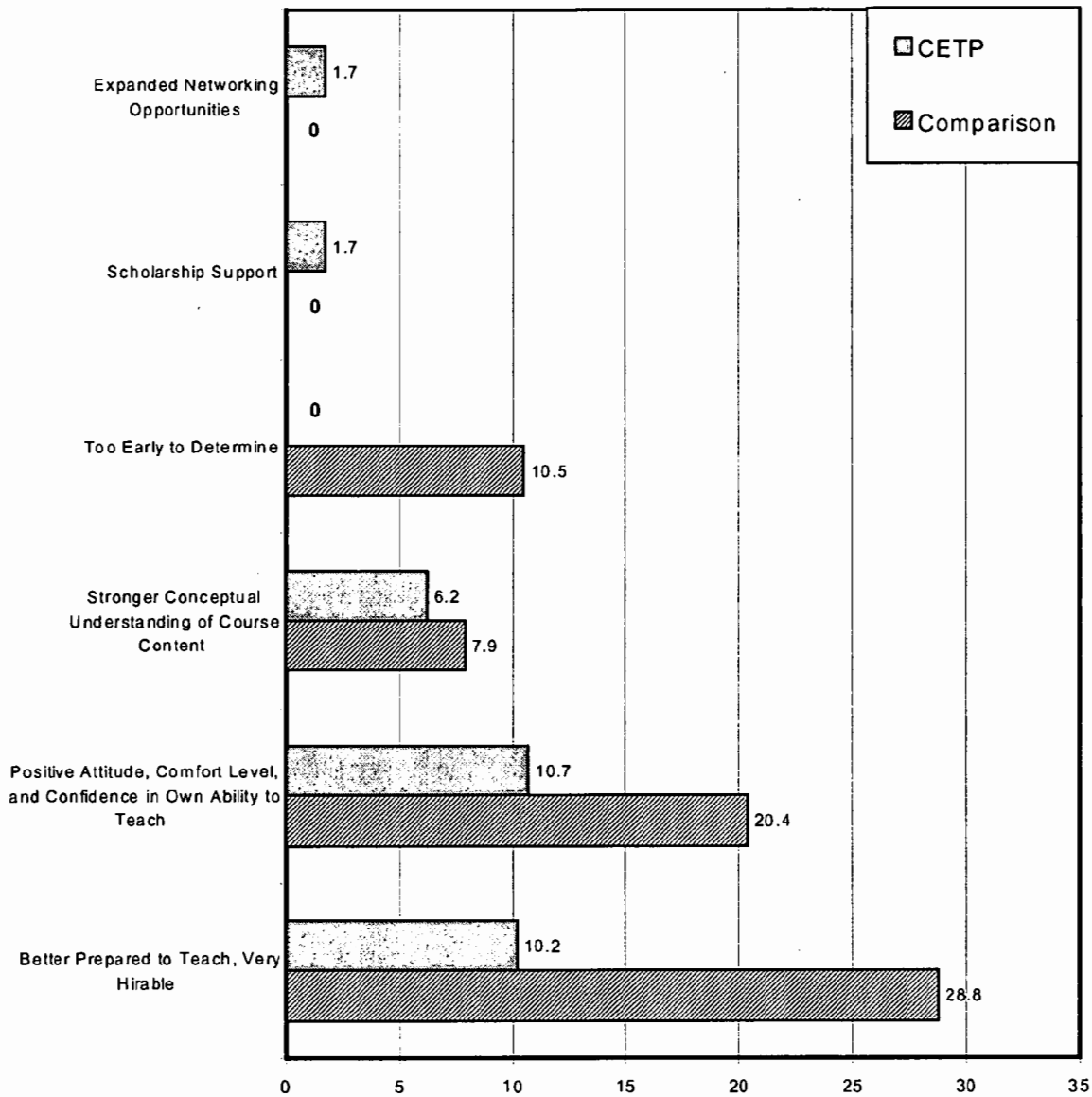
Figure 2-5

Response Counts for Number of Positive Student Outcomes, by CETP Project and CETP Program



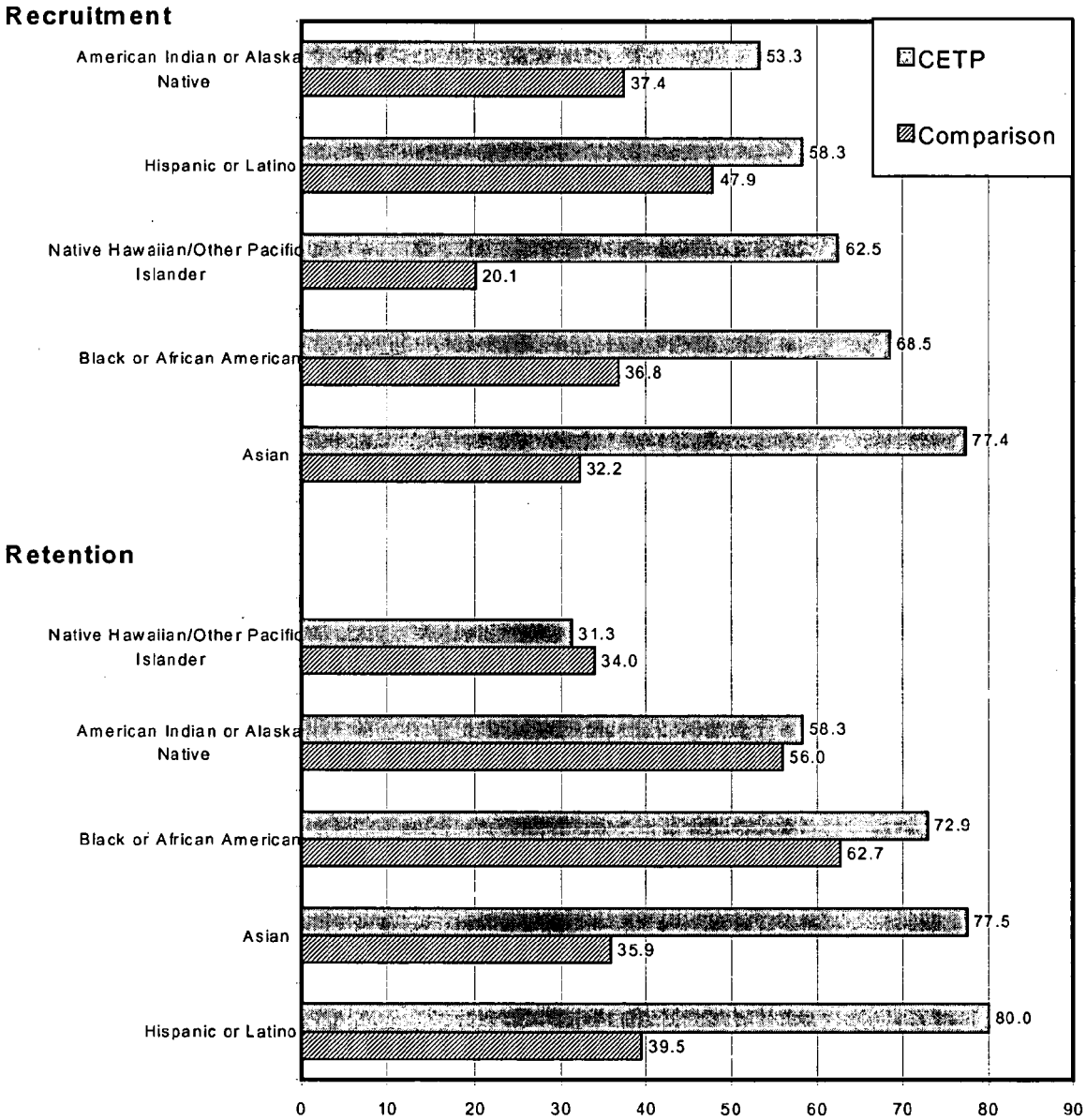
Source: CETP Faculty Survey.
Note: All data are project/program averages.

Figure 2-6
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Indicating Positive Outcomes for Students (Open-Ended Comments)



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.

Figure 2-7
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Indicating Successful Implementation of Recruitment and Retention Strategies for Underrepresented Students



Source: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.

Table 2-1
NSF Scholar Awards
(1999)

	Colorado	Louisiana	Maryland	Montana	Temple
Total Number of Awards	47	27	94	67	41
Number of Minority Recipients	20	9	23	37	12
Average GPA of Recipients	3.47	3.52	3.55	3.49	3.59
Total Funding for Scholar Awards	$99,834	$139,265	$148,466	$104,250	$67,462
Average Funding per NSF Award Recipient	$2,124	$5,158	$1,579	$1,556	$1,645
Percent Female Recipients	77	78	87	79	68
Percent Male Recipients	23	22	13	21	32

Source: NSF CETP Monitoring System.
Note: All data are project averages.

Table 2-2
Percentage of NSF Scholar Awards, by Race/Ethnicity
(1999)

Race/Ethnicity	Colorado	Louisiana	Maryland	Montana	Temple
American Indian	0	0	0	47.8	0
Asian	8.5	0	4.3	1.5	2.4
African American	6.4	33.3	20.2	0	24.4
Hispanic	21.3	0	0	6.0	2.4
More than one race	2.1	0	0	0	0
Pacific Islander	4.3	0	0	0	0
Unknown	12.8	0	2.1	0	7.3
White, Not Hispanic	44.6	66.7	73.4	44.7	63.5

Source: NSF CETP Monitoring System.
Note: All data are project averages.

Table 2-3
Percentage of NSF Scholar Awards, by Major
(1999)

Major	Colorado	Louisiana	Maryland	Montana	Temple
Biology	8.5	3.7	1.1	4.5	2.4
Chemistry	6.4	0	0	0	0
Education	0	66.7	95.7	37.3	95.2
GeoScience	4.3	0	0	0	0
Math	61.7	14.8	0	9.0	0
Math/Science	2.1	7.4	0	7.5	0
Science	17.0	0	0	7.5	0
Other	0	7.4	3.2	34.2	2.4

Source: NSF CETP Monitoring System.
Note: All data are project averages.

CHAPTER 3. FACULTY INVOLVEMENT AND COLLABORATION

In addition to the goal of strengthening the capabilities of future SMET educators, NSF had a second goal for the collaboratives: "to engage fully the departments of science, mathematics, engineering, technology, and education and their faculties in the preparation of teachers."[38] This goal was directed at creating a critical mass of faculty involved in reform, breaking down traditional academic barriers that prevented faculty from within and across disciplines and institutions from collaborating with one another, and focusing faculties' efforts on a unified vision of reform within collaboratives. This chapter provides an overview of the number and types of faculty involved in the CETPs, the nature and extent of their involvement, and the nature and extent of their collaborative efforts. We also look at the impact of CETP involvement on participating faculty.

Faculty Counts and Characteristics[39]

Overall in 1999, more than 450 faculty were involved in the implementation of the CETP reform activities in the five collaboratives included in this evaluation. On average, there were 90 faculty per CETP, or 15 faculty per CETP institution.[40] Figure 3-1 (top bar) displays the numbers of participating faculty involved in teacher preparation reforms. The average number of CETP faculty engaged was not found to be statistically different from the average of 16 faculty involved per comparison group institution, nor were there significant differences between the CETP projects themselves.

With regard to the SMET disciplines, the CETPs as a group averaged 5 disciplines; the comparison sites as a group averaged 4 (see Figure 3-1, bottom bar). There were no

[38] *Undergraduate Education Program Announcement and Guidelines,* NSF 97-29.
[39] Except where noted, the data in this section on faculty characteristics were based on data from the NSF CETP Monitoring System.
[40] These counts reflect those faculty who *implemented* services, rather than who benefited from CETP services.

statistically significant differences for these data between the individual CETP projects or between the CETPs as a group and the comparison sites as a group.

The two multicolored bars in Figure 3-2 compare the relative proportions of faculty from various disciplines involved in CETP reform activities and in reform activities at comparison institutions. Note that comparison group respondents reported a higher percentage of faculty from colleges or schools of education than the CETPs (65% and 20%, respectively). These findings reflect and support the CETPs' interdisciplinary emphases.

According to the data collected (see Figure 3-3) by the 1999 NSF CETP Monitoring System, more male faculty (55%) than female faculty (45%) were involved in the CETP initiatives. Furthermore, half of the CETP faculty "workforce" was tenured (28% full professors and 22% associate professors, not shown). Not surprisingly, fewer assistant professors (20%) were involved (most likely because they were focusing on their research and publications, rather than involvement with teaching-related activities, which have less weight in promotion and tenure). Furthermore, faculty who were not on the tenure track participated as frequently in CETP work as did associate professors.

It was also found that the racial/ethnic profile of CETP faculty roughly paralleled that of students enrolled in CETP courses, with the majority reporting their racial group as white (non-Hispanic) (82% faculty, 70% students), followed by African American, Asian, Hispanic/Latino, American Indian, and Hawaiian/Pacific Islander.

Faculty Involvement and Collaboration

Figure 3-4 shows the various ways in which faculty were involved in CETPs. The most common form of involvement was "Using Teaching Strategies or Applying Concepts from CETP Professional Development" (77%). In addition, more faculty attended professional development sponsored by CETP (nearly 50%) than provided it (43%). Faculty were also much more likely to report having taught a CETP course on their own (almost 60%) than in collaboration with other faculty, either from their own discipline or from other disciplines (approximately 10%). Similarly, they were much more likely to report having developed/revised a CETP course or lab independently (35%) than in collaboration with colleagues from other disciplines (20%). These data indicate that faculty collaborated with faculty from their own disciplines in developing/revising courses; however, it appears that they did not necessarily engage in interdisciplinary work. Furthermore, more than half of the collaboratives' faculty (53%) reported membership (at some point) on an interdisciplinary committee within their own institution to plan, coordinate, and/or implement reform. A smaller percentage (26%) were involved with a partner institution to plan, coordinate, and/or implement reform. More than half (55%) of faculty worked with pre-college educators. We cannot compare CETP faculty's involvement with involvement

of faculty at comparison group institutions, because we did not survey comparison project faculty.[41]

Figure 3-5 provides data from a range of activities specifically related to successful collaboration. The graphs depict data from the CETP PIs/campus leads and from directors of comparison projects. There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group. However, high levels of collaboration (over 70%) were reported by both groups in the following areas: "Collaborating with Education Faculty in Revising/Teaching Courses," "Working with K-12 School Staff in Field Placements," "Collaborating with Faculty across Disciplines in Revising/Teaching Courses," "Collaborating with K-12 Staff in Revising/Teaching Courses," and "Collaborating with Faculty across Disciplines in Teaching SMET Courses."

Education faculty seldom worked collaboratively with SMET faculty to revise SMET courses. In general, collaboration was influenced by factors such as a CETP's general strategy for course reform, historical relations between SMET and education faculty at an institution, a faculty participant's dual appointment in both education and SMET departments, and the kind of course to be revised. CETP strategies that encouraged collaborative, active involvement of both content and education faculty included: use of curriculum development committees or teams with representation from the sciences, mathematics, and education; assumption of an interdisciplinary focus overall; development of a common vision among faculty participants of the kind of knowledge, beliefs, and attitudes about science and mathematics that would provide a strong foundation for K-12 teachers; consensus among faculty participants regarding expectations for course reform and the overall CETP program; and support for combined content-methods courses.

Outcomes for Faculty

Next, we turn to the outcomes for faculty as individuals ("What has been the primary outcome of the CETP project thus far for faculty?") as reported by PIs/campus leads and directors of comparison projects. The responses to the open-ended question were coded, weighted in a similar manner as in the quantitative data, and analyzed. The responses fit into one or more of five categories (see Figure 3-6). There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group. The CETP PIs/campus leads regarded increased networking opportunities as a positive outcome for faculty, whereas none of the comparison group institutions made the same report. Note that very few respondents from each group commented on "Minimal Impact/Inconclusive Data."

[41] Faculty from comparison sites were intentionally not surveyed to reduce burden on these non-CETP-funded sites.

Louisiana's (LaCEPT) leadership successfully addressed the issue of faculty recognition for time invested in curriculum development and teaching via recommendations from LaCEPT's National Visiting Committee and access to state-level policy-makers. The state's Board of Regents changed academic review and funding policies to reward colleges that valued teaching excellence and worked to improve undergraduate education and teacher preparation programs. The actions of the Regents were perceived by LaCEPT participants as a demonstration of commitment to change campus priorities and policies.

Summary

More than 450 faculty were involved in the reform efforts of the five CETP projects included in the summative evaluation in 1999 alone (this was not significantly different from the number of faculty involved in comparison projects). More than 80% of CETP faculty were white, and over half were males.

Reform efforts of comparison projects tended to involve proportionately more education faculty than disciplinary faculty, relative to the CETPs. On average, the CETPs had equal proportions of education faculty, biological/agricultural sciences faculty, and mathematics/statistics faculty involved in teacher preparation reform. Very few engineering or computer science faculty were involved in CETP reform efforts.

The most frequently reported types of faculty involvement were using strategies picked up in CETP professional development, teaching a CETP course or lab, working with pre-college educators, and participating on an interdisciplinary committee at their own institution (over half of faculty surveyed indicated these types of involvement).

Nearly three-fifths of CETP faculty reported that they taught CETP courses on their own rather than in collaboration with others. According to PIs/campus leads and directors of teacher preparation, the most frequent forms of collaboration for faculty from both groups were: "Collaborating with Education Faculty in Revising/Teaching Courses," "Working with K-12 School Staff in Field Placements," "Collaborating with Faculty across Disciplines in Revising/Teaching Courses," "Collaborating with K-12 Staff in Revising/Teaching Courses," and "Collaborating with Faculty across Disciplines in Teaching SMET Courses."

Although CETP faculty and PIs/campus leads reported engaging in collaborative activities across disciplines and across institutions (the latter to a lesser extent), the qualitative data indicated that consistent collaboration was difficult to achieve. Faculty had serious time constraints due to teaching and research responsibilities, students from different institutions had different needs, and the different cultures and politics of institutions affected reform efforts. At best, institutions within a collaborative operated under a similar philosophy of reform and engaged in some of the same types of curricular and pedagogical reform efforts.

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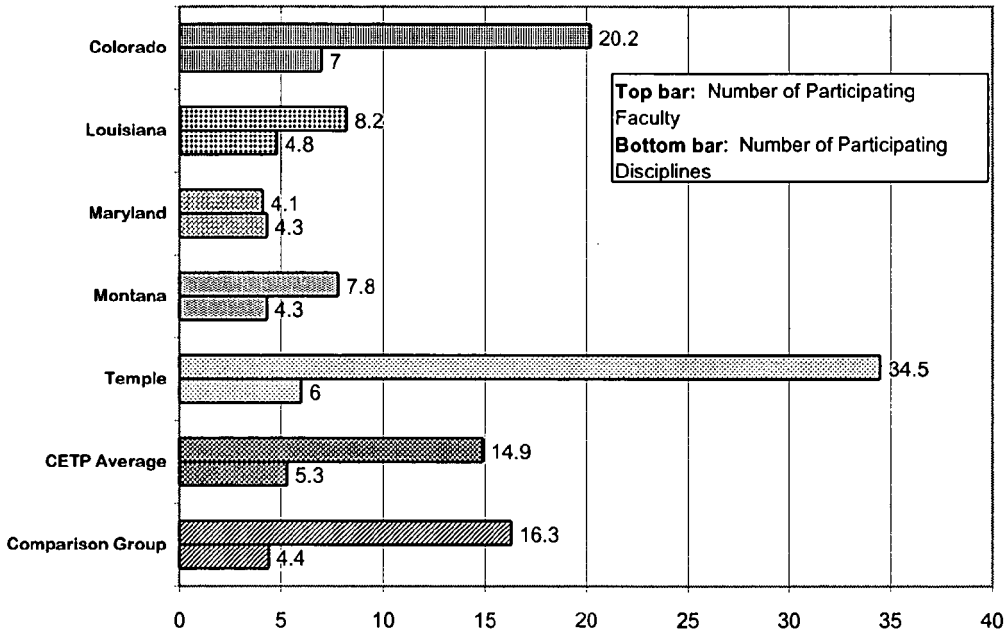
Figure 3-1

Number of Faculty and Participating Disciplines, by CETP Project, CETP Program, and Comparison Group (1999)

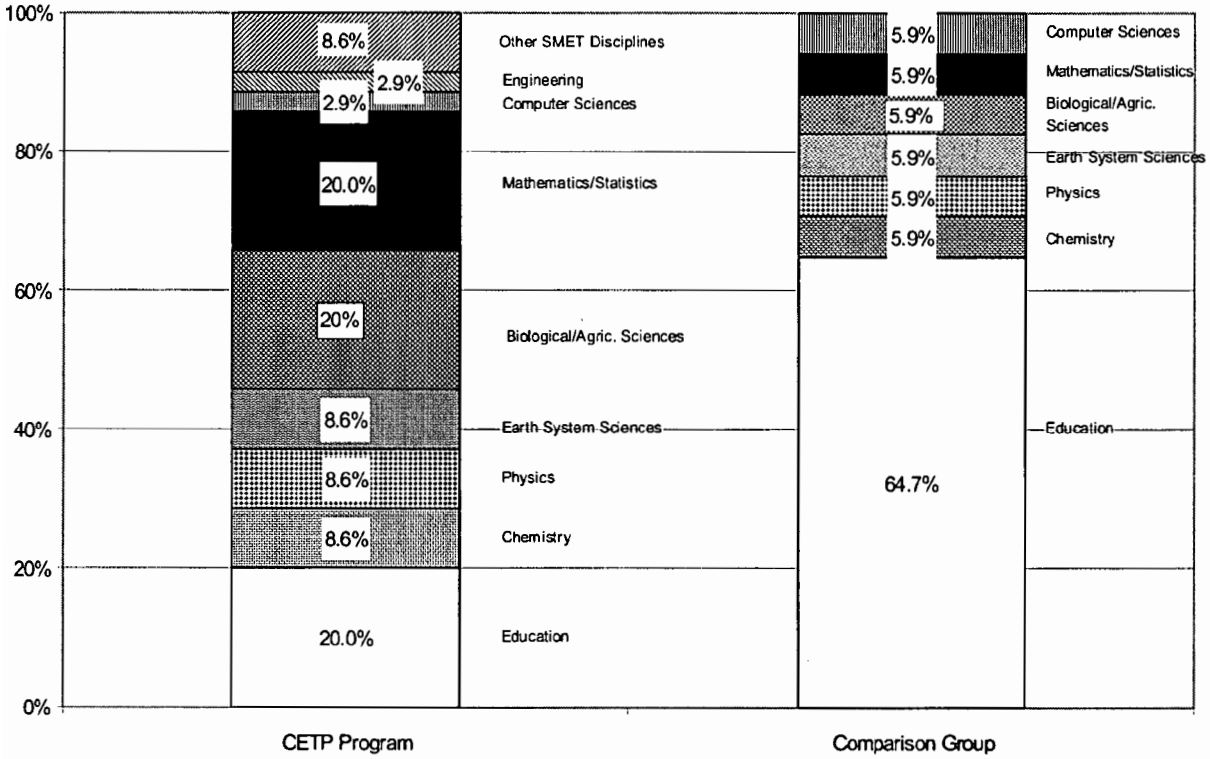


Sources: NSF CETP Monitoring System , CETP Principal Investigator and Campus Survey and Director of Teacher Preparation Survey.

Note: All data are project/program/group averages.

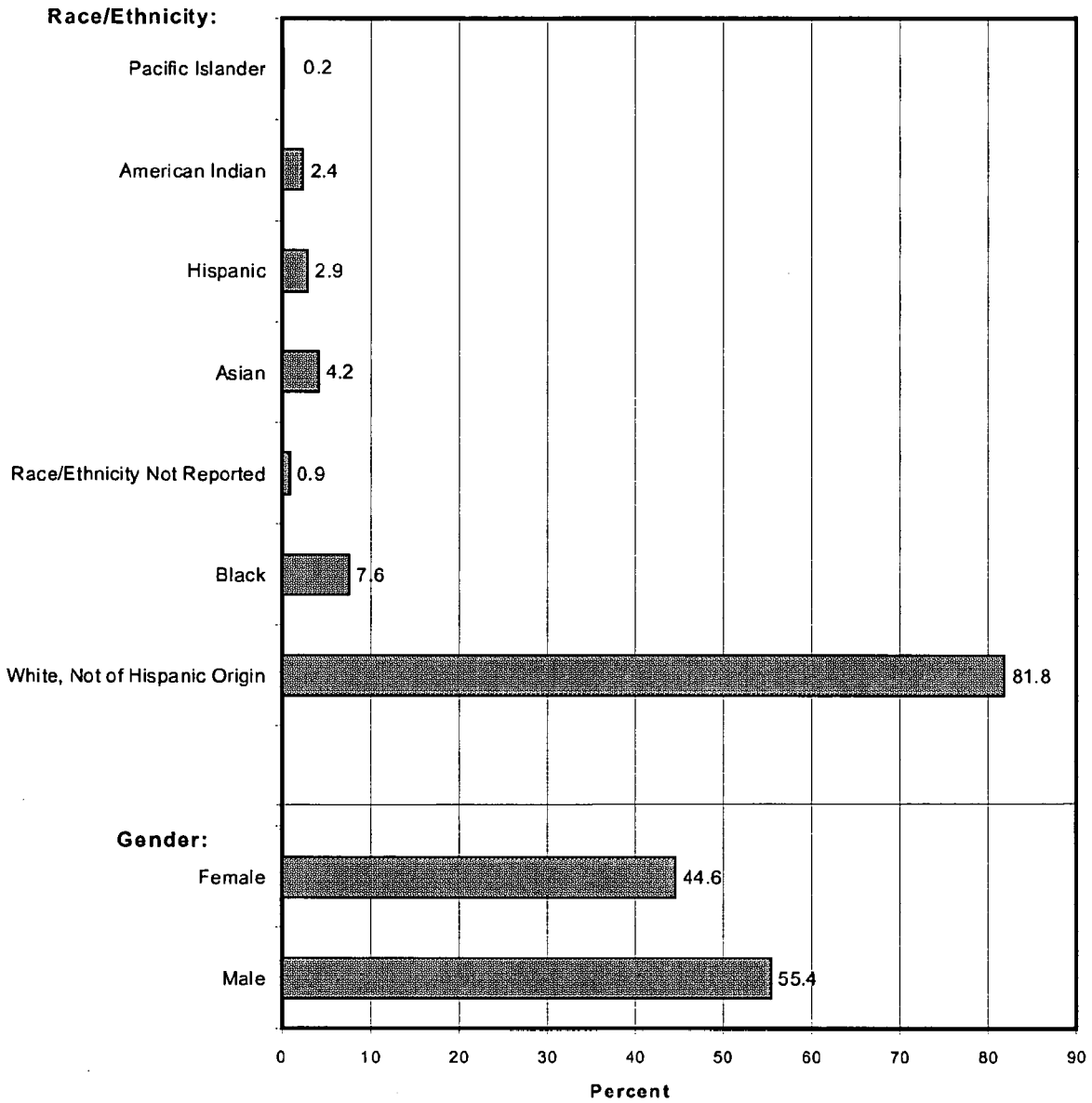
Figure 3-2

Average Percentage of Education and Disciplinary Faculty Involved in CETP Projects and Comparison Projects (1999)



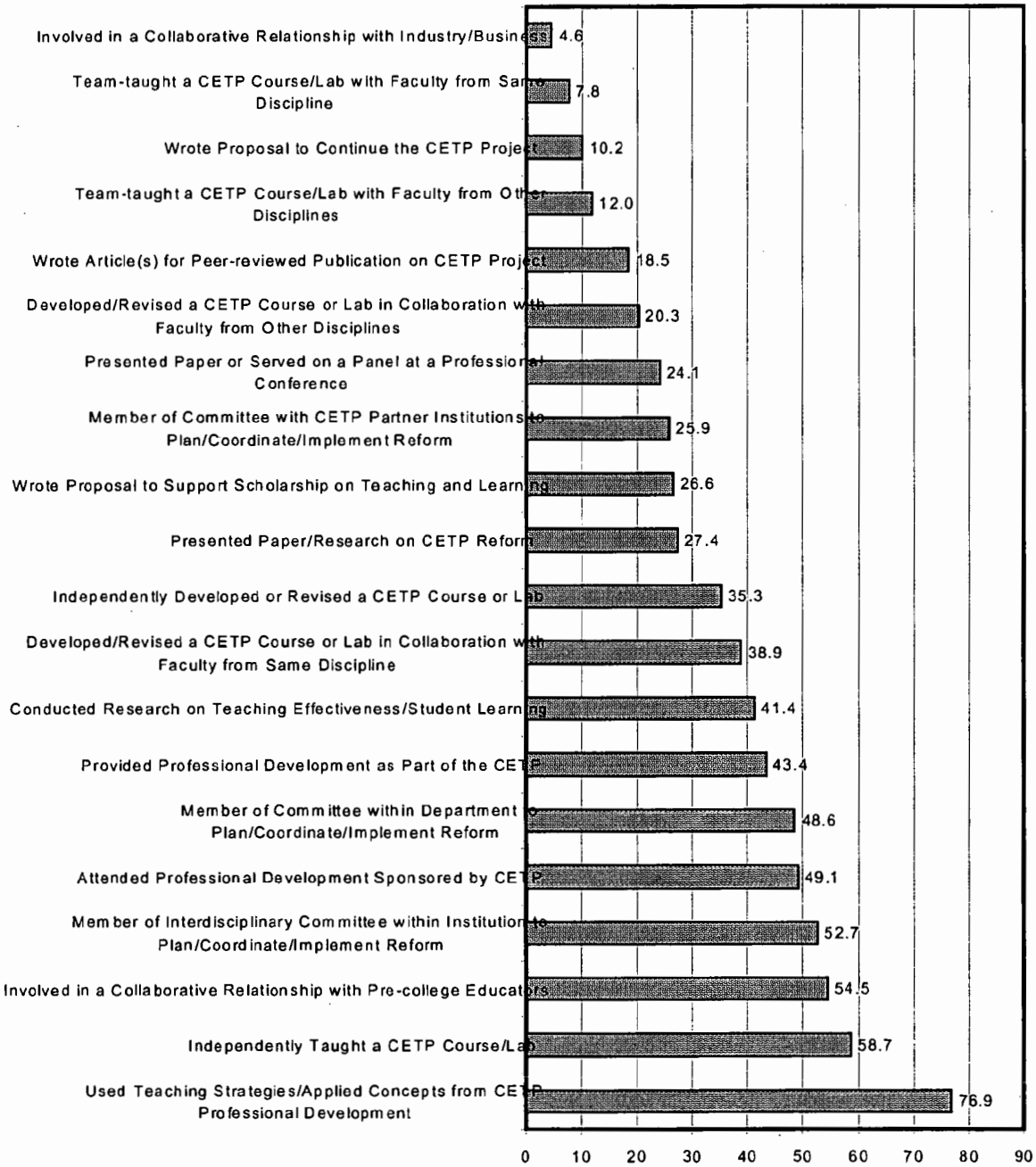
Source: CETP Principal Investigator and Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.

Figure 3-3
Gender and Racial/Ethnic Distribution of Faculty Participating in CETP (1999)



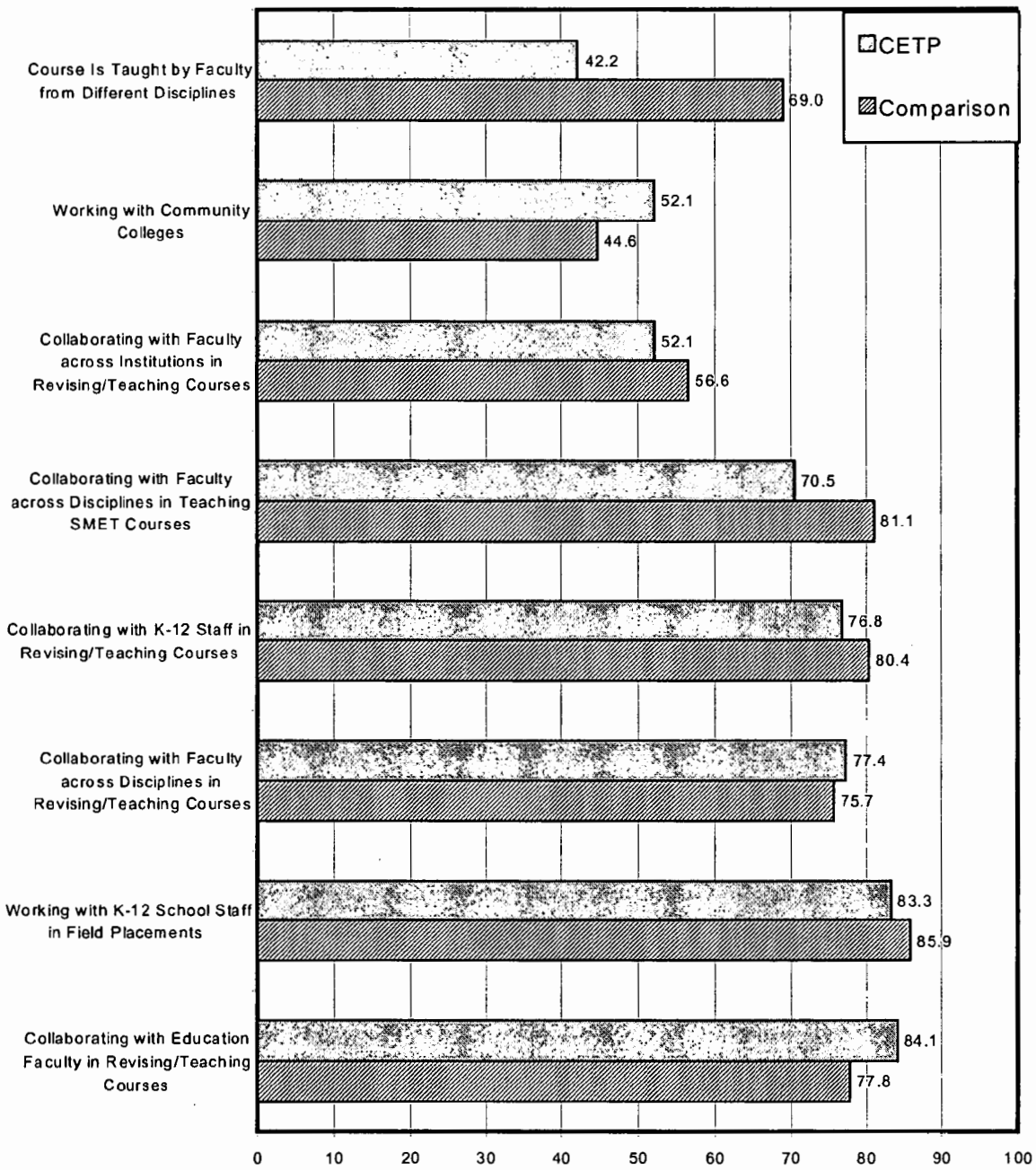
Source: NSF CETP Monitoring System.
Note: All data are program averages.

Figure 3-4
Percentage of Faculty Indicating Types of Involvement in CETP (1998-1999)



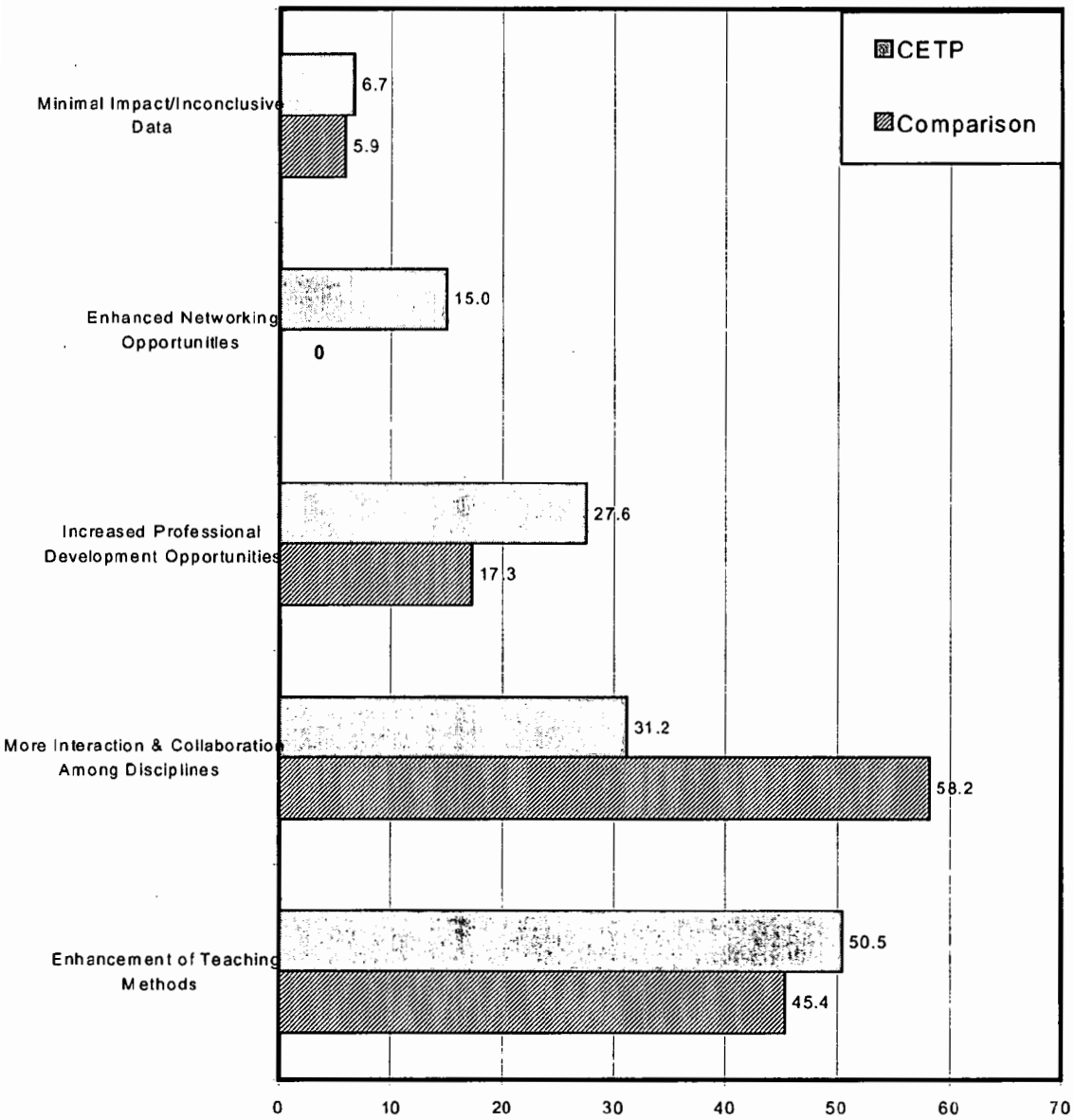
Source: CETP Faculty Survey.
Note: All data are program averages.

Figure 3-5
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Indicating Successful Collaborative Activities



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.

Figure 3-6
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Indicating Positive Outcomes for Faculty (Open-Ended Comments)



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.

CHAPTER 4. IMPACT ON THE LEARNING INFRASTRUCTURE AND INSTITUTIONALIZATION OF REFORM

To accomplish NSF's goals of strengthening the capabilities of future SMET teachers and engaging the cooperative efforts of disciplinary faculty in this endeavor, changes must take place in the learning infrastructure of institutions that engage in teacher preparation. Further, these changes must be sustained, or "institutionalized." We address both the learning infrastructure and the institutionalization of CETP and comparison project reforms in this chapter. Indicators of a reformed learning infrastructure and institutionalization are related. They include changes in the number of faculty participating in reform from year to year, the number of reformed courses and their disciplines, whether reformed courses were formally approved and required for certification, reform of the teacher preparation program, and concrete plans for continuation funding.

The Reform "Workforce"

In Chapter 3, Figure 3-1, we provided the average counts of faculty involved with the implementation of reforms in 1999 and their characteristics. Here we will examine more closely the annual increase in the number of faculty involved. Increases in the number of faculty involved should reflect gathering institutional interest in reform. There is, of course, no guarantee that increasing the numbers of faculty during the life of a project will ensure continued involvement, but without their participation, there seems little chance for project sustainability. The rates of change in faculty involvement were calculated between program years and then averaged across all the collaboratives to provide a measure of faculty engagement. Figure 4-1 summarizes faculty growth rates by CETP, CETPs as a group, and the comparison sites as a group. There were no statistically significant differences for these data between the individual CETP projects or between the CETPs as a group and the comparison sites as a group. Although none of the differences were significant, all the CETPs and the comparison sites show evidence of increasing faculty involvement over time.

Maintenance of the momentum created by a CETP's presence typically was given more careful consideration during the final 1 or 2 years of the project, and plans typically were linked to the initial strategy of the CETP to implement reform of mathematics and science teacher preparation. For example, CETPs that had sponsored mentor programs providing professional development for K-12 teachers (e.g., Maryland) or induction activities (e.g., Montana) as an integral part of their overall approach sought support from state or professional organizations to assume the activity and help ensure continuation of that facet of the CETP program. Although the methods used and intensity of training would most likely change, the overall purpose and usefulness of the initial activity could continue.

Efforts to Reform Courses

The numbers of reformed courses offered at the collaboratives were collected via the NSF CETP Monitoring System. On average (Figure 4-2), there were reported to be 7 reformed courses per institution across the CETPs, involving 5 different disciplines per institution. Comparison group projects also offered, on average, 7 reformed courses per institution, but the number of disciplines was lower, at 3 per institution. There were no statistically significant differences for these data between the individual CETP projects or between the CETPs as a group and the comparison sites as a group.

Another measure that assesses the impact of the CETP projects on the learning infrastructure is whether the courses received department approval and whether the courses are now required for certification. On average, over 80% of CETP faculty reported that their revised courses received departmental approval[42] (data not shown). The range of responses varied from 70% of reformed courses to over 95. According to CETP faculty, between 31% and 76% of reformed courses are now required for a teaching credential, with a 50% average across the collaboratives. From these data on the extent to which reformed courses are incorporated into the teacher preparation "system," we can conclude that there is a wide variability between collaboratives, but the data are promising.

[42] This question was not included on the PI/Campus Lead Survey or the Director of Teacher Preparation Survey. Thus, only CETP faculty data are reported.

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The direction stimulated by the presence of a CETP project on a campus may endure beyond CETP-developed courses via new faculty hires and institutional centers dedicated to instructional change. For example, two of the Montana (STEP) PIs are founding co-chairs of the Big Sky Institute on the Montana State campus. This is a regents-approved, campus-funded initiative to sustain commitment to excellence in teaching and learning, and support outreach to the K–12 sector. Montana State now offers the MS in Science Education, and Montana's CETP (STEP) gets credit for getting that program established. At University of Montana, the education methods courses have been completely redone, using a block format that coordinates methods in several disciplines, provides simultaneous field experience, and provides for joint planning between university faculty and teachers. STEP was a major player in this endeavor, and the new format is now institutionalized completely. At University of Montana, an interesting long-term impact emerged. STEP activities and people are credited with influencing the direction of hiring of some young faculty, and some of these faculty are likely to have profound long-term effect on their departments' direction in teaching. At University of Montana, there was substantial awareness of the impact of material purchases on the STEP budget. Two major classrooms, for Mathematics and General Science, were renovated and equipped, and a Teaching Resource Center established. Staffing for the latter is now funded by the Education Department. These are perceived by faculty as important determinants of the persistence of reform.

Efforts to Reform Teacher Preparation Programs

A more direct measure of change in the learning infrastructure for preservice teachers is the extent to which the teacher preparation program was reformed. Figure 4-3 compares responses of CETP PI/campus leads and directors of the comparison projects on a number of survey items pertaining to the reform of components of the teacher preparation program. The items were analyzed in the same manner as the other reform items in Chapters 1 and 3 (i.e., whether the reform was part of their project, how important it was to the project, and satisfaction with current status of the reform. There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group, with one exception: "Following up Graduated Students as Beginning Teachers" ($p < .00001$) with (CETPs indicating the higher value (the comparison groups reported 0). Overall, the responses were positive for both groups—all were over 50% of respondents, and most were over 70%. These data are very positive with respect to the reform of teacher preparation programs. Most notable were outcomes related to working with K-12 staff in field placements, facilitating mentor relationships, and working with supervising teachers regularly.

We also created an index or "response count" based on this set of items that tallied the number of responses that indicated satisfaction with the current status of the reform (see Figure 4-4). There were no statistically significant differences for these data between the individual CETP projects or between the CETPs as a group and the comparison sites as a group.

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In addition to the survey items discussed above, we asked CETP PIs/campus leads and directors of comparison reform projects an open-ended question: "What has been the primary outcome of the CETP/reform project thus far on the teacher preparation program at this institution?" Figure 4-5 reports the responses. There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group. High percentages of both groups reported "Curricular Changes in Mathematics & Science," while low percentages of both groups reported "Better-Prepared Graduates."

Likelihood for Continuation Funding

A final indicator used to assess the degree of potential institutionalization of the CETP reforms was PIs'/campus leads' reports on the likely sources for continuation funding.[43] The data in Table 4-1 suggest that reform leaders believe that they have support from institutional leadership to "buy into" the reforms and that the leadership will continue to support them with internal resources. Nearly 90% of the collaboratives reported that the institutions themselves would continue to support the CETP-related reforms. Not all were so optimistic, however. Nearly 20% were not certain where continuation funding would come from.

Table 4-1
Percentage of PIs/Campus Leads Indicating Likely Sources of Continuation Funding

Source of Funding	Percentage
This Institution	89.7
Current Source(s) of External Support	39.7
New NSF Funding	37.9
Other New Source(s) of External Support	28.9
Don't Know	18.4

Source: CETP Principal Investigator/Campus Lead Survey.
Note: All data are program averages.

Summary

Changes to the learning infrastructure included growth in the "critical mass" of participating faculty and disciplines involved in teacher preparation, the number of courses actually developed or reformed, and changes made to the teacher preparation program itself. We found that the rate of faculty involvement increased annually at the rate of approximately 4 faculty per year per institution. However, CETP growth rates were not statistically greater than rates calculated for the comparison projects.

CETPs reported approximately 7 new or revised courses per institution, as did comparison projects. More disciplines were involved in CETP-reformed courses than in comparison projects

[43] This item was not included on the Director of Teacher Preparation Survey.

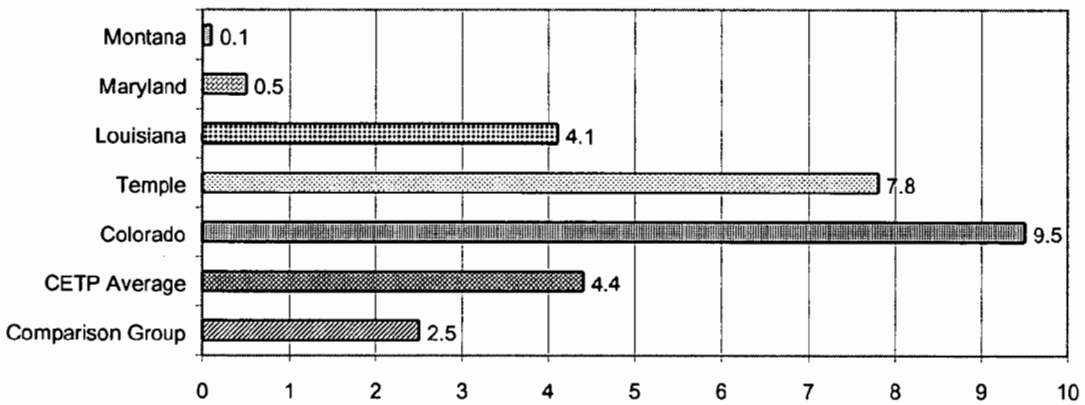
(5 versus 3), which is consistent with the greater number of disciplines taking part in CETP reform. But this difference was not statistically significant.

Aside from course reform, both the comparison group and the CETPs made positive reports about success in implementing reforms to the teacher preparation program, such as working with K-12 school staff in field placements and facilitating mentor relationships for beginning teachers.

Few data were available on the potential institutionalization of CETP reforms. When asked about continuation funding, most PIs/campus leads indicated that their own institutions would pick up funding for the reform, and this report is supported by the relatively large financial contributions institutions make relative to external sources of funding.

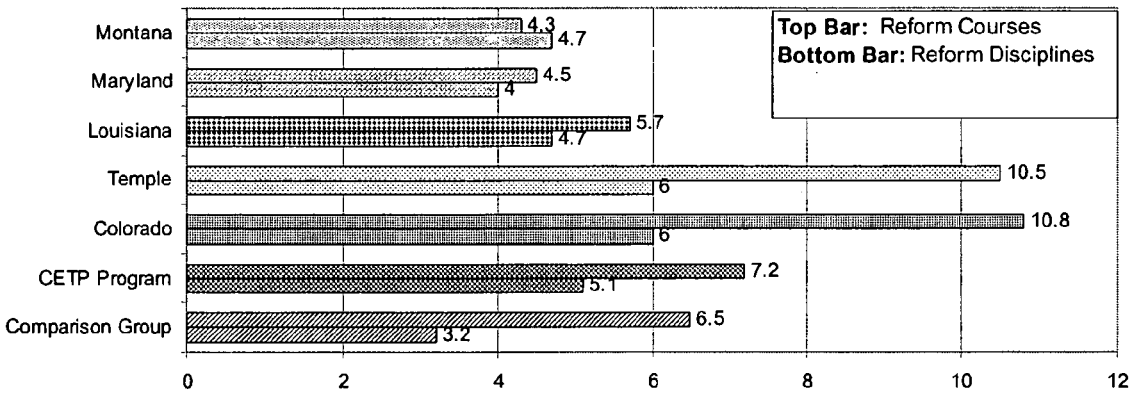
Figure 4-1

Annual Increase in the Number of Faculty Participating in Reform Activities per Institution, by CETP Project, CETP Program, and Comparison Group



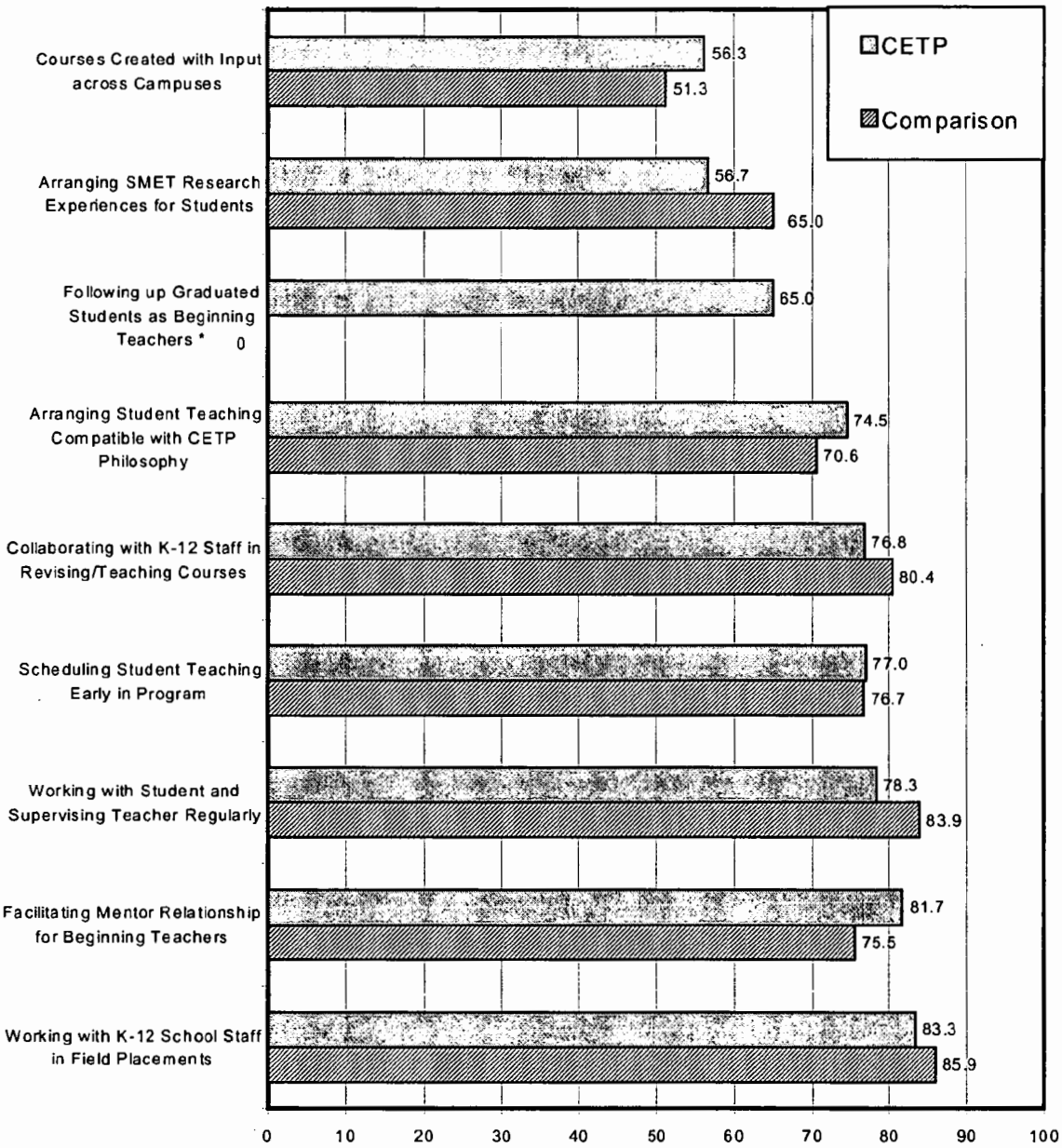
Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are project/program/group averages.

Figure 4-2
Response Counts for Number of Reformed Courses and Number of Disciplines Involved, per Institution, by CETP Project, CETP Program, and Comparison Group



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are project/program/group averages.

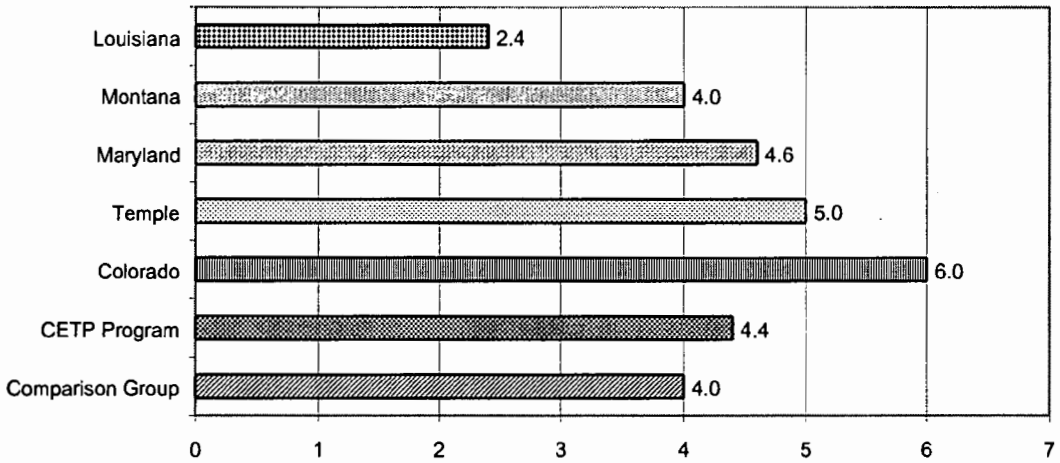
Figure 4-3
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Indicating Positive Outcomes for Teacher Preparation Programs



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.
* Significantly different at $p < .00001$.

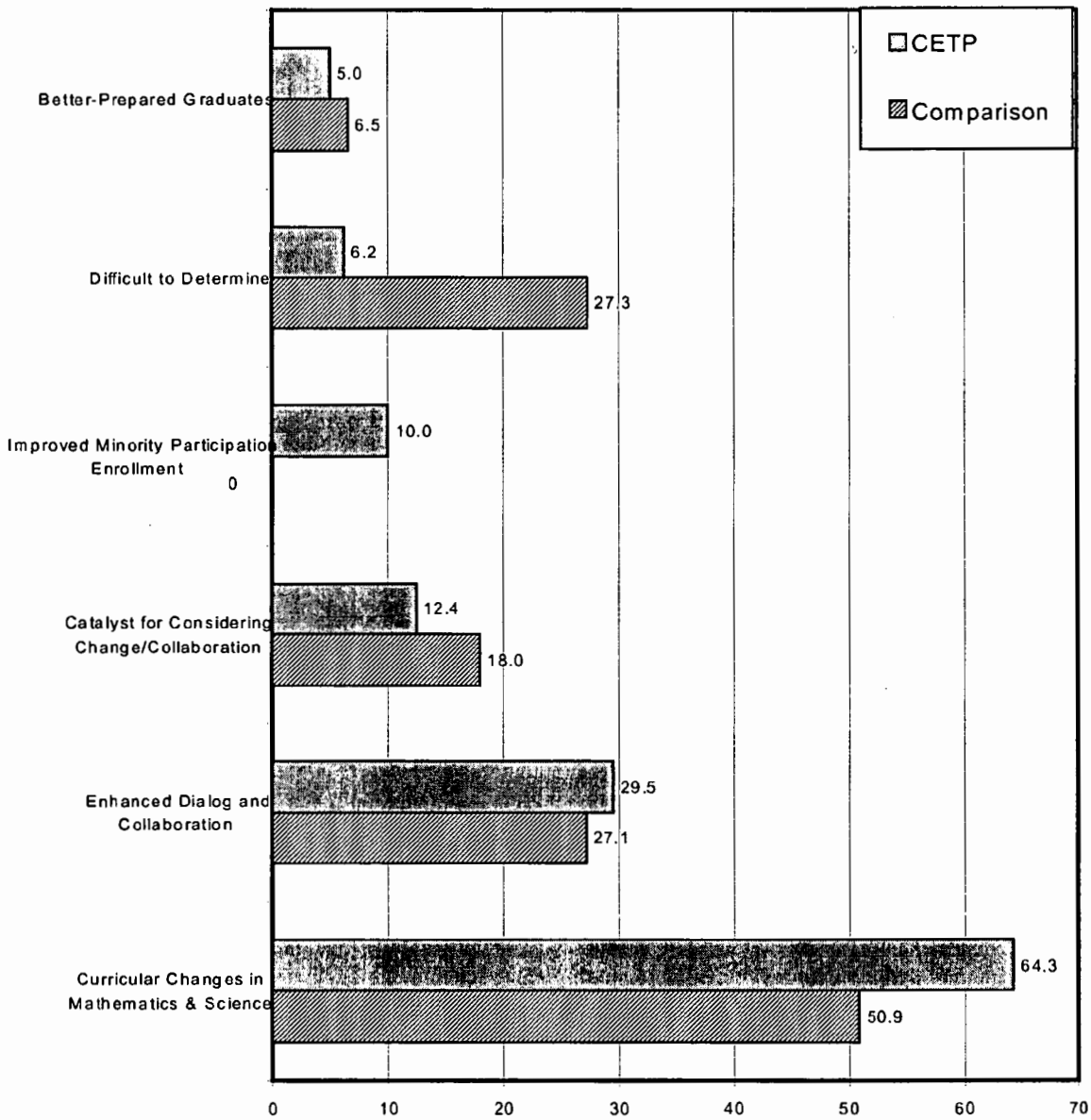
Figure 4-4

Response Counts of Successful Implementation of Innovative Teacher Preparation Program Reform Strategies, by CETP Project, CETP Program, and Comparison Group



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are project/program/group averages.

Figure 4-5
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Indicating Positive Outcomes for Teacher Preparation Programs (Open-Ended Comments)



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.

CHAPTER 5. DISSEMINATION AND MODEL GENERATION

The impact of the CETP program on the national teacher preparation community was an important goal of the reforms. The collaboratives used a variety of approaches to share their ideas and strategies concerning teacher preparation reform. In addition to reporting the dissemination approaches used by the CETPs and comparison projects, we will also present comments made by the PIs/campus leads and directors of comparison projects concerning which program components they considered replicable. In the last section of the chapter, we will provide statistical findings about the extent to which the CETPs actually represent different "models" of reform.

Dissemination Strategies

From SRI survey data, it was found across collaboratives that, on average, 78% of the institutions reported that they were involved in "disseminating the CETP project to the broad national community through peer-reviewed and/or commercial channels." Of this group, 64% reported that dissemination was a very important part of the reform, and 75% were either "somewhat satisfied" or "very satisfied" with the teacher preparation improvements (data not shown).

Figure 5-1 summarizes the responses for the types of dissemination strategies used by collaboratives and comparison projects. There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group, with one exception: "Individuals have visited the CETP project Web site" ($p < .05$), with the higher value favoring the CETPs. The most commonly reported types of dissemination activities made by the collaboratives were: "Individuals from other institutions have requested CETP curricula or other CETP products," "Individuals from other institutions have attended CETP symposia/workshops/conferences," and "Individuals from other Institutions have visited this campus to meet with faculty and/or administrators or to observe courses/labs."

Though not among the group of most commonly used and reported forms of dissemination, Web site visits were quantitatively the largest form of dissemination activity overall. Unfortunately, only two of the five collaboratives reported the number of Web site visits. However, the average between them was more than 3,275 visits per institution within each collaborative.

Maryland (MCTP), for example, developed an award-winning Web page to make project information available to the international education community. The Web page linked to a variety of other sites that provided information about the MCTP project and courses offered in the state, a collection of essays on constructivism and education, descriptions and tutorials on technology used by the MCTP, and other useful information.

Influencing changes in higher education policy and state certification was not a typical outcome of the CETPs' efforts to reform the mathematics and science preparation of teachers. Our qualitative data indicated that successful steps in that direction appeared to depend on factors such as the CETP's strategy and the breadth of the project, and on the leadership's involvement in state and national reform efforts and their relationship with state policy decision-makers. Whereas local and regional CETPs had little impact on state policy, both Louisiana (LaCEPT) and Maryland (MCTP)—two statewide CETPs—had leadership that was active in national curriculum change efforts and had close contact with state policy-makers (e.g., serving on state task forces, contact with the state's Board of Regents). As a result, the efforts of LaCEPT and MCTP to effect changes in teacher preparation began to have far-reaching implications. Louisiana's Board of Regents changed academic review and funding policies to reward reform efforts, and its Board of Elementary and Secondary Education revised elementary teacher certification requirements to include increased science and mathematics credit hours. Maryland's Higher Education Commission used the MCTP project as a prototype for new directions in the structure of teacher preparation programs in the state.

Replicable Model Components

An important part of the CETP program was to provide the opportunity for other institutions to replicate successful features of the CETP projects. Both PIs/campus leads and directors of comparison projects answered an open-ended survey question about the components of reform that might be replicated by other institutions. The responses were coded and analyzed, and the results are reported in this section.

Figure 5-2 depicts the data from both PIs/campus leads and directors of comparison projects. There were no statistically significant differences for these variables between the CETPs as a group and the comparison sites as a group, with two exceptions: "Course Materials and Specific Programs" ($p < .00001$) and "Mentor Teacher Program" ($p < .05$), with the CETPs indicating higher values (comparison sites made no comments regarding either of these features). Both groups of respondents identified "Approaches to Teaching Courses" most frequently as a replicable component of their programs.

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Analysis of CETPs as "Models"

The approach that each of the CETPs took in the reform of teacher preparation was considered to be unique to the context in which the overall project operated. The CETPs discovered that, even within their projects as a whole, each participating institution required the freedom to develop its own program, undergirded by the CETP's principles but adapted to local circumstances. The narrative descriptions of the collaboratives presented in Part I capture the model features of each CETP as they were viewed from a qualitative standpoint. Now, we examine the CETPs from a quantitative perspective to see whether they "pull apart" as distinct models of reform. Analyses of the reform approaches used by the five collaboratives were based on calculations that total three previously mentioned indexed variables from the CETP Principal Investigator and Campus Lead Survey: (1) response counts for curriculum reform (see Figure 1-8), (2) response counts for pedagogical reform (see Figure 1-10), and (3) response counts for reform of the teacher preparation program (see Figure 4-4).

Figure 5-3 provides a graphical depiction of the means of the collaboratives on the basis of the aggregated data. Each circle in Figure 5-3 represents a collaborative with the center point as the mean of the total of the three variables for that collaborative. The size of each circle represents the uncertainty in the estimation of the mean for that collaborative, based on the sample sizes and variability found in this survey. Large circles (e.g., Temple and Colorado) represent high uncertainty; small circles (e.g., Louisiana) represent low uncertainty in the mean. Circles for two collaboratives that do not intersect or that intersect only slightly would correspond to pairs of collaboratives with statistically significantly different means. As can be seen by the large overlap of all of the collaboratives' circles in this figure, no statistically significant differences were found between collaboratives in the means of their combined scores. Taken together, these data support the conclusion that CETP-to-CETP variation is at most a small factor in variability on these measures, and that most of the variation is from institution to institution.

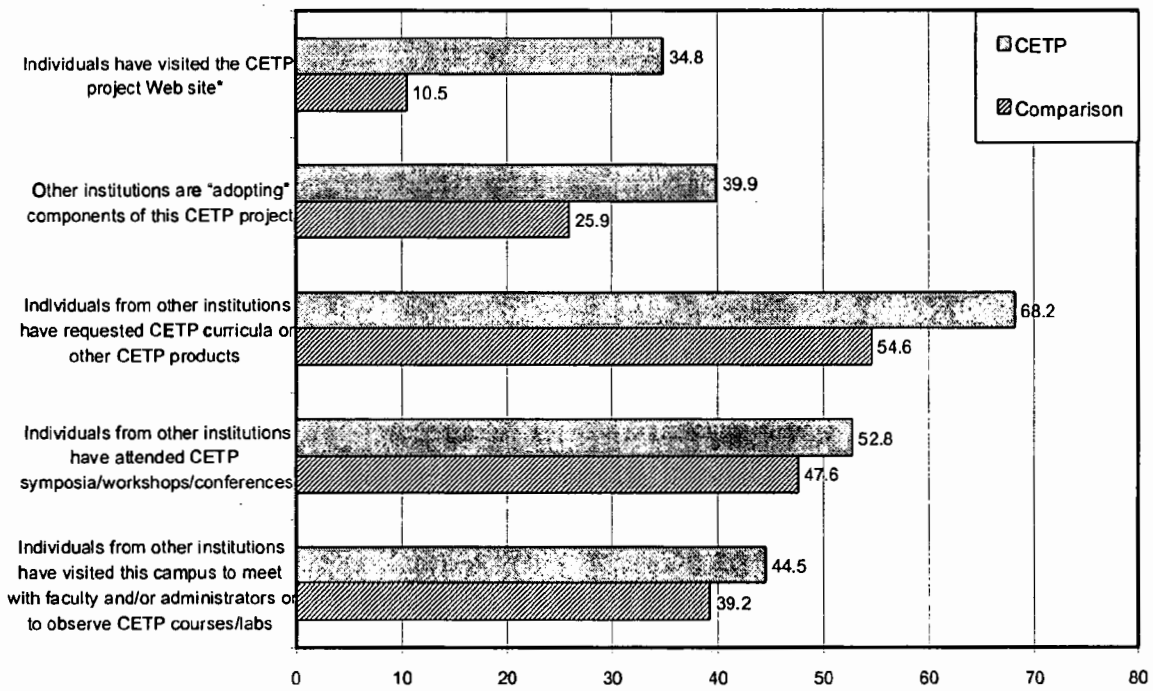
Summary

Most PIs/campus leads reported that they were involved in disseminating the CETP to the national community. The most frequently reported types of dissemination were responding to requests from individuals from other institutions for CETP curricula or products and disseminating the project via CETP symposia/workshops or conferences.. Overall, CETP projects were more actively involved in dissemination activities than were comparison projects, probably because of their more mature stage of development, but, with the exception of one comparison (more hits to CETP Web sites), these differences were not significant.

Both CETP respondents and comparison group respondents answered open-ended questions about replicable model components by citing their "Approaches to Teaching Courses." Nearly half of the CETP respondents also listed course materials and specific programs as replicable for other institutions.

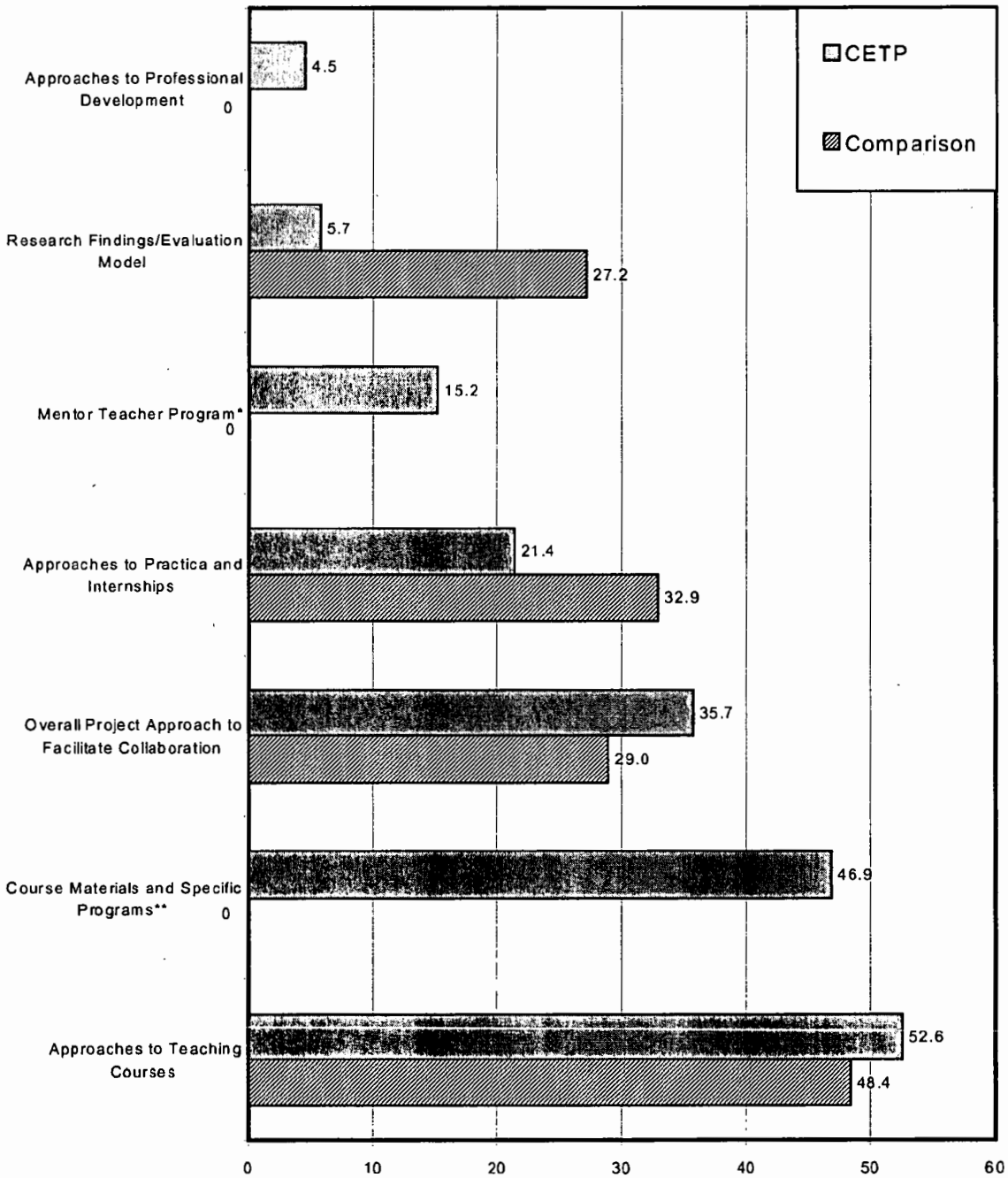
Although the CETP projects were quite distinct from one another in many ways, as indicated in the qualitative data, quantitative analyses of their "approaches to reform" do not indicate significant differences. There was more variation from institution to institution in curricular, pedagogical, and program reform than there was from CETP to CETP. The notion of models of teacher preparation does not hold true when specific strategies are analyzed. Teacher preparation reform reflects the character, needs, and faculty proclivities of individual institutions to a greater degree than it does the clustering of institutions as CETP projects.

Figure 5-1
Percentage of CETP PIs/Campus Leads and Directors of Comparison Projects Reporting Dissemination Activities



Sources: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.
* Significantly different at $p < .05$.

Figure 5-2
Percentage of CETP PIs/Campus Leads and Director of Comparison Projects Indicating Which Aspects Could Be Replicated (Open-Ended)



Source: CETP Principal Investigator/Campus Lead Survey and Director of Teacher Preparation Survey.
Note: All data are program/group averages.
* Significantly different at $p < .01$.
** Significantly different at $p < .00001$.

insert figure 5-3 here

CONCLUSION

This chapter summarizes both qualitative themes and quantitative comparative data. We include reflections on the summative evaluation design, the implications of the design for the findings reported here, and recommendations for further evaluative studies of the CETP initiative.

Summary of Qualitative Themes

The first two cohorts of CETP projects revised an impressive number of courses—just under 300, according to the NSF CETP Monitoring System. Some of these courses were brand new or revised in substantial ways and reflected best practice in terms of both curricula and pedagogy. Others were courses that had been modified only slightly or did not meet standards of best practice, according to our content expert site visitors. Because our site visits were limited in scope, we were not able to observe all reformed courses, and the time when we conducted observations may not have been the optimum time to document best practice. However, we did observe reformed courses in many different CETP institutions over the course of several years. Overall, course reform instigated by the CETPs can be described as uneven and generally not coordinated across institutions within a CETP project. The quality of course reforms may be strengthened with more specific guidelines for quality control.

Collaboration within disciplines and across disciplines within an individual CETP institution was typically strong, although generally limited to the same core set of faculty year after year. Collaboration across partner institutions was less successful, being limited by the practical constraints of faculty time, distance between institutions (especially when many were involved), and, most importantly, real differences in the needs of student populations across institutions and the cultures of different institutions. Interinstitutional collaboration across higher education institutions was primary, with K-12 collaboration playing an important but supporting role. In the spirit of true systemic reform, it might have been better for the CETP initiative to promote more collaborative efforts vertically within the education system - that is, between K-12, higher education, and state education agency levels—involving fewer institutions of higher education and stronger partnerships with K-12 systems.

Student outcomes, by and large, were not well documented by the CETPs. A key reason was that students who had been exposed to CETP reforms were just graduating and entering their first teaching jobs. Several years from now, powerful studies could be done that look at retention rates of beginning teachers, sustained implementation in the classroom of the types of pedagogical reforms and standards-based curricula the CETPs promoted, and effects on K-12 students in CETP-prepared teachers' classrooms.

In terms of the sustainability of reforms, only time will tell. The qualitative data suggest that as the original core team of reform-minded faculty turn to other academic duties or retire, their course reforms may or may not be continued in the same manner as they intended. Much depends on the extent and quality of professional development for faculty coming on board. We learned that characteristics of reformed courses were often tightly coupled with faculty's philosophy of reform and motivation to implement reform.

Summary of Quantitative Data

We summarize the quantitative data that are most directly relevant to four sets of program outcomes: student outcomes (reviewed in Chapter 2), faculty involvement and collaboration (reviewed in Chapter 3), learning infrastructure and institutionalization (reviewed in Chapter 4), and dissemination and model generation (reviewed in Chapter 5). Each of these areas coincides with important GPRA-like outcomes for the CETP program. We focus this section on the CETP program overall in relation to the comparison program, rather than on a comparison of the individual CETP projects.[44]

Table C-1 presents the data collected from CETP PIs/campus leads and from directors of teacher preparation programs at comparison sites, and data from the NSF CETP Monitoring System.[45] We organized the data into Student Outcomes, Faculty Involvement and Collaboration, and Learning Infrastructure and Institutionalization outcome areas, but some outcomes (e.g., number of new/revised/reformed courses) clearly relate to more than one area. Columns two and three show three types of data: (1) average counts of either individuals or units per institution (e.g., number of students, courses), (2) average "response counts" per institution (e.g., the total number of responses indicating successful use of a reform strategy), or (3) average percentage of respondents per institution. Column four indicates whether a difference between CETP program data and comparison group data was statistically significant. It does not identify differences that may be meaningful on a substantive level. As noted earlier in the report, because our sample sizes were not large, the chances of finding statistically significant differences are limited.

Student Outcomes

With just one exception, the CETP program looks very similar to the comparison group with respect to student outcomes. The exception is that CETP provided new or revised courses to a statistically significantly higher number of students (seven times as many per institution).

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[44] Data for each CETP are available for each of the outcomes listed in Table C-1, on request by DUE program officers.

[45] Faculty data are not included because comparable data were not collected from comparison sites. However, with the exception of data on incentives for participation (in which faculty reported fewer than PIs/campus leads), the faculty data were consistent with data provided by PIs/campus leads.

Therefore, although both sets of reform projects were strengthening the preparation of preservice mathematics and science teachers, CETP can claim a much higher overall level of impact, given the number of preservice students affected.[46]

CETP students, on average, were a more diverse group, though not significantly so. (Several individual CETP projects were more diverse than others.) CETP respondents reported a higher level of satisfaction with the current status of reform strategies pertaining to pedagogy and the teacher preparation program, but comparison group respondents reported a higher level of satisfaction with the current status of reform strategies pertaining to curricula. However, there were no statistically significant differences for these data between the individual CETP projects or between the CETPs as a group and the comparison sites as a group.

Data on individual CETP projects indicate that more positive student outcomes are associated with collaboratives that have fewer participating institutions and more cohesive, coordinated programs. Having a smaller number of partner higher education institutions seems to facilitate more regular collaboration, a common vision of reform, development of parallel courses, and articulation agreements, all of which make for a stronger teacher preparation experience for students.

Faculty Involvement and Collaboration

The one significant difference pertaining to faculty involvement and collaboration was the higher number of incentives the CETPs were able to provide participating faculty.[47] CETP institutions had four times as much funding to work with as comparison institutions, a statistically significant difference. Funding is clearly linked to support for reform—providing monetary incentives, funding for release time or reduced course loads, travel for conferences, summer stipends, and additional human resources, all of which would facilitate and reinforce faculty involvement.

Aside from incentives, there were very few differences between the CETP program and the comparison group with respect to faculty involvement and collaboration. It appears that faculty who are motivated enough to engage in reform operate in much the same way, whether they are part of a large, well-funded national program or situated in an institution, school, or department that is undertaking reform on its own. Of particular note is the fact that nearly identical numbers of faculty were involved in CETP reform and comparison group reform per institution. Nearly the same number of disciplines was involved per institution, as well. Though the difference is not statistically significant, it is interesting that comparison group respondents

[46] The CETP student counts were taken from the NSF CETP Monitoring System, which indicates that the student counts include duplicates; it is not known to what extent duplication occurs.

reported higher levels of collaboration on every type of collaborative activity surveyed. CETPs clearly engaged more faculty in professional development, and, although not statistically significant, the fact that 8% more faculty had this opportunity is educationally meaningful. As discussed in relation to the sustainability of reform, as original reformers move on, it is critical that the faculty who take their place be fully capable of teaching reformed courses in the manner intended.

Individual CETP project data suggest that, once again, having fewer higher education institutions involved in a CETP is strongly associated with higher levels of faculty involvement and collaboration. Naturally, funding would be higher per institution when there are fewer institutions, and higher funding would allow for the provision of more incentives and more faculty professional development. It is likely that having fewer institutions in a collaborative allows professional development to be more targeted to the focus of the collaborative and the needs of the participating institutions. With larger numbers of institutions involved, especially if they differ considerably from one another, professional development may not be as tailored to the needs and/or interests of faculty.

Learning Infrastructure and Institutionalization

The third set of outcomes relates to strengthening the learning infrastructure and the potential for the institutionalization of reform. The proportion of internal institutional funding contributing to the CETPs was quite high, as discussed in Chapter 1 (data not shown here), indicating strong administrative support.[48] It seems that the number of funding sources outside of NSF would be a good predictor of continuation for support of reform because there would be more sources to tap for ongoing activities. CETPs had slightly more sources to draw on, but not significantly more. Another indicator of the sustainability of reform is the number of reformed courses (CETP had, on average, nearly one more per institution). Perhaps even stronger indicators of sustainability are the growth rates of participating faculty and participating disciplines. The CETPs' annual faculty growth rate was nearly twice that of the comparison group, a difference that is educationally meaningful, although not statistically significant. The annual rate of disciplines coming on board was less than 1 for both groups.

Repeating the pattern we discussed above for student outcomes and faculty involvement and collaboration, CETP projects with fewer higher education institutional partners appeared to have a stronger chance of institutionalizing reform, based on the variables discussed above.

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[47] The data presented in Chapter 1 indicated, however, that PIs/campus leads reported a higher number of incentives being offered to faculty than faculty themselves reported. The data here are taken from PIs/campus leads.

[48] Data on dollar amounts of funding by source for the CETPs were taken from the NSF CETP Monitoring System. We did not have a similar database for comparison institutions, and neither the CETP PI/Campus Lead Survey nor the Director of Teacher Preparation Survey asked for funding by source.

Dissemination and Model Generation

The CETP projects did more dissemination of their projects than did the comparison sites, especially with respect to creating Web sites and the number of hits on the Web sites. This difference probably is a function of both higher funding and their maturity as projects relative to comparison projects.

A statistical analysis examining differences in approaches to curricular, pedagogical, and teacher preparation program reform across the CETPs showed no differences between the projects. There was more reported variation between institutions within collaboratives than between the collaboratives as projects. Thus, the notion of "models" of reform is not really meaningful, at least at the project level. It appears that the CETPs are doing many of the same types of things to improve the preparation of mathematics and science teachers and probably are sharing successful strategies with one another.

Overall Summary

The CETP program met many of its goals with respect to providing students with improved curricula, more relevant and innovative pedagogy, and stronger teacher preparation programs. It was highly successful in exposing large numbers of potential teachers to these courses. It was also very successful in involving faculty, particularly disciplinary faculty, and the numbers keep growing each year. The potential for institutionalization looks positive at this point, especially because of the relatively large financial contributions of CETP institutions themselves. For each of the outcomes reviewed, CETPs with fewer partners reported more positive findings, even with respect to the number of students involved.

In comparing the CETP program with a set of comparison group institutions undergoing reform, it appears that CETP has some distinct advantages, particularly in the number of students reached and the level of resources available to reward faculty. Although just 2 of the comparisons shown in Table C-1 are statistically significant and in favor of the CETPs, 11 other comparisons indicate more positive findings for the CETPs, some of which are educationally meaningful.

Finally, dissemination of CETP approaches to reform is taking place, but the CETPs do not represent distinct models of reform. Rather, institutions within CETPs appear to use reform strategies that work best for their students and in their institutional culture.

Reflections on the Summative Design and Recommendations for Further Evaluation

The summative design focused on the first two cohorts of awardees because those were the most mature projects and thus most likely to show impact. However, CETPs funded in succeeding years may be quite different in character and are likely to have learned lessons from

their predecessors. Some of our observations and personal communications with internal evaluators support this notion. Had the summative evaluation not been limited to the first two cohorts of awardees, the comparative findings might have been different.

Had we compared the CETPs with a random group of institutions with teacher preparation programs, rather than with a group with some ongoing reform of teacher preparation, the results probably would have been more favorable to the CETP projects. But a small telephone survey of comparison projects indicated that almost all teacher preparation programs claim (at least) to be implementing some type of reform, so such a "random" control group might have been difficult to locate and an artificial representation of the field.

Evaluation work that should continue involves documenting concrete outcomes for students. As we discussed in Part I, there exist few systematic data that go beyond specific courses, specific institutions, or attitudinal measures. And very few data are available on graduated teachers who were exposed to a concentrated CETP preservice experience. Rather than employing a comparative design such as the one used here, evaluators can compare the knowledge and teaching strategies of CETP beginning teachers with those who either had some other type of reformed program or went through a traditional program. That type of design would provide policy-makers with stronger data on which to judge the efficacy of the CETP program.

CETP has taken the lead in focusing more on student outcomes by funding a study to develop evaluation and assessment instruments for measuring student outcomes across CETPs. This type of data will contribute to our understanding of which reforms have an impact on improving the preparation of future mathematics and science teachers.

Table C-1
Review of Key Outcomes, by CETP Program and Comparison Group

Outcome Area	CETP Program	Comparison Group	Statistically Significant Difference
Student Outcomes			
Number of Students Exposed to New/Revised CETP Courses	727	105	$p < .000001$
Level of Student Diversity	2.8	1.8	Not significant
Successful Use of Strategies to Reform Pedagogy	7.5	6.9	Not significant
Successful Use of Strategies to Reform Teacher Preparation Program	4.4	4.0	Not significant
Successful Use of Strategies to Reform Curricula	3.5	4.3	Not significant
Faculty Involvement and Collaboration			
Number of Incentives Available for Faculty Participation	3.2	2.2	$p < .05$
Number of Participating Faculty	15	16	Not significant
Number of Participating Disciplines	5.3	4.4	Not significant
Level of Collaborative Activities	4.3	4.6	Not significant
Provision of Professional Development	84%	76%	Not significant
Learning Infrastructure and Institutionalization			
Number of External Sources of Funding	2.9	2.0	Not significant
Number of New/Revised/Reformed Courses	7.2	6.5	Not significant
Annual Rate of Faculty Increase	4.4	2.5	Not significant
Annual Rate of Increase in Disciplinary Participation	.3	.8	Not significant
Lack of Barriers Due to Administrative Support[49]	.4	.6	Not significant
Lack of Barriers Due to Climate for Reform[50]	1.4	1.3	Not significant

Note: All data reported in this table are at the institutional level. The data are presented as one of the following: (1) average counts of either individuals or units, (2) average "response counts" (e.g., the total number of a particular type of response), or (3) average percentage of respondents per institution.

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[49] For this variable, a lower value indicates fewer administrative support barriers.
[50] For this variable, a lower value indicates fewer reform climate barriers.

APPENDICES

SUMMATIVE EVALUATION of the COLLABORATIVES for EXCELLENCE in TEACHER PREPARATION

March 2001

Appendix A: Comparison Group and Weighting of Data
Appendix B: GPRA Outcomes and Indicators
Appendix C: CETP Surveys
Appendix D: Quantitative Analyses
Appendix E: Comparisons Between Collaboratives

APPENDIX A

COMPARISON GROUP AND WEIGHTING OF DATA

Thirty-five institutions that had received NSF grants under the NSF Collaboratives for Excellence in Teacher Preparation (CETP) were identified and questionnaires were sent to their principal investigators. We desired to ascertain the extent to which these institutions outperformed comparable institutions that had not received CETP grants. Consequently, we selected institutions that matched the CETP institutions according to a variety of criteria.

Comparison institutions for the CETP project were selected on the basis of data provided in the Integrated Postsecondary Education Data System (IPEDS), using calculations that most closely matched them with CETP institutions. The calculations were based on four criteria: (1) general institutional data, (2) enrollment, (3) financial data, and (4) the extent of institutional involvement in teacher preparation.

As would be expected, other CETP institutions appeared in the lists of potential comparison sites; these were eliminated. The specifics of the selection algorithm for the computer-generated comparison group are described below:

1. The selection program identified the CETP institution's type (AA/BA/BA+/Doctoral) and control (private/public). Institutions differing in type or control from the home institution are eliminated from the potential peer group.

2. The program also eliminates any institution that has not reported full-time student equivalency (FTE) or educational and general (E&G) expenditures.

3. The potential peer group is then narrowed to a group of institutions with the closest absolute FTE enrollment to the home institution's FTE enrollment.

4. The 10 institutions with absolute E&G expenditures per FTE (E&G/FTE) closest to the home institution's E&G/FTE are selected as the final peer group. (E&G expenditures include all expenditure categories that are directly related to the education mission of the institution. They do not include expenses such as cafeterias, resident halls, hospitals, or bookstores.)

Further, to account for the differences provided by historically black colleges and universities (HBCUs), a modification on the selection scheme was made. Comparison site institutions for HBCU CETP institutions were first selected on the basis of their status as an HBCU. After a list of HBCUs was created, then the same calculations described above were made.

In some cases, there was a single matching institution; in other cases, there were multiple matches. A total of 50 matching non-CETP institutions were identified and questionnaires were sent to the director of teacher preparation at each such institution. We oversampled comparison institutions anticipating low response rates.

Weighting of Data

Of the 35 questionnaires sent to PIs at CETP institutions, 33 were returned. Of the 50 questionnaires sent to directors of teacher preparation at non-CETP institutions, 27 were returned.

Although it would have been possible to weight the non-CETP and CETP institutions to reflect the original matching, this would have resulted in loss of many of the CETP institutions. Thus, we grouped the CETP and non-CETP institutions in categories related to their Carnegie classifications. Four groups were identified:

- •Group 1 consists of M-1, M-2, and BAC-2 institutions. There are 19 CETP and 13 non-CETP institutions in this group.
- •Group 2 consists of community colleges. There are 3 CETP and 3 non-CETP institutions in this group.
- •Group 3 consists of R-1, R-2, DOC-1, and DOC-2 institutions. There are 11 CETP and 5 non-CETP institutions in this group.
- •Group 4 consists of tribal colleges. There are 2 CETP and 6 non-CETP institutions in this group.

All CETP institutions were assigned a weight of 1.0. Non-CETP institutions within each group were assigned equal weights, which totaled to the number of CETP institutions within the group. For example, in group 4, each non-CETP institution received a weight of 1/3.

Comparisons of CETP and non-CETP institutions were performed within and across groups. Weighting was necessary only for the across-group comparisons (that is, comparisons of the weighted average of CETP responses with the weighted average of non-CETP responses). Although differences between CETP and non-CETP institutions were evident, they generally were not statistically significant. This is primarily a result of the small sample sizes. In addition, there is also the possibility that responding non-CETP institutions are not representative of the group of sampled non-CETP institutions. We conjecture that response rates would have been highest among those non-CETP institutions with the most successful programs.

APPENDIX B
CETP PROGRAM OUTCOMES AND INDICATORS

Relevant NSF GPRA Goal:

GPRA Goal 3: A diverse, globally-oriented workforce of scientists and engineers.

- Strengthen the capabilities of current and future educators of science, mathematics, engineering and technology at all levels in both content and teaching methods.
- Use all aspects of NSF activity to enhance diversity in the science and engineering workforce

CETP Program Goals:

Goal 1:

To improve significantly the science, mathematics, and technology preparation of future K-12 teachers and their effectiveness as educators in these areas.

Goal 2:

To engage fully the departments of science, mathematics, engineering, technology, and education and their faculties in the preparation of teachers.

Desired Program Outcome	Quantitative Indicator	Qualitative Indicator
A: Outcome for Faculty SMET faculty and K-12 teachers are actively involved in the preparation of teachers along with education faculty.	1. Increased numbers of SMET faculty are involved in teacher preparation and reform of math/science courses and labs. 2. Increased numbers of education faculty are involved in teacher preparation. 3. Increased numbers of K-12 teachers are integrally involved in teacher preparation.	4. SMET faculty play a significant role in developing/revising courses and labs for prospective teachers.[51] 5. K-12 teachers play a significant role in developing/revising courses and labs for prospective teachers.

[51] Judgments regarding significance of the role of SMET faculty (and K-12 teachers) will be made by external evaluators, including an external consultant, based on multiple sources of evidence collected via site visits (e.g., review of curriculum committee/design team membership, interviews with faculty, interviews with teachers).

Desired Program Outcome	Quantitative Indicator	Qualitative Indicator
B: Outcome for Students Future K-12 teachers are prepared to teach mathematics and science effectively.	1. Increased number of graduates planning to teach elementary, middle, or high school (as applicable to CETP program) with an undergraduate major in mathematics or science. 2. Increased numbers of students persist and complete preparation to teach mathematics and science. 3. Subject area assessment scores of CETP graduates are significantly higher than national and/or local norms, as measured by Praxis II.[52] 4. Classroom performance assessment scores of CETP graduates are significantly higher than national and/or local norms, as measured by Praxis III.	5. Faculty report improvements in CETP students' knowledge of mathematics and science subject matter relative to preservice students (a) prior to the CETP or (b) not involved in a CETP. 6. Cooperating teachers, supervising teachers, or mentors in the field report improvements in CETP students' mathematics and science subject matter knowledge and pedagogical skills relative to (a) preservice students prior to the CETP or (b) preservice students not involved in a CETP. 7. Principals report improvements in CETP students' subject matter knowledge and pedagogical skills relative to (a) preservice students prior to the CETP (from the same institution) or (b) preservice students not involved in a CETP. 8. Beginning teachers who participated in a CETP report feeling enthusiastic, motivated, and competent to teach mathematics and science.

[52] Praxis data (or other standardized achievement data) will be used to the extent feasible.

Desired Program Outcome	Quantitative Indicator	Qualitative Indicator
C: Outcome for Underrepresented Students CETP projects have recruited, retained, and graduated increased proportions of underrepresented students prepared to teach mathematics and science.	1. Increased numbers of underrepresented students are recruited to the CETP teacher preparation program. 2. Increased numbers of underrepresented students persist and complete preparation to teach mathematics and science. 3. Increased numbers of underrepresented students are among the graduates who receive certification to teach mathematics and science. 4. The number of graduates from underrepresented groups planning to teach mathematics or science is proportionate to (or has gotten closer to) the number of underrepresented K-12 students within the geographic area served by the project.	5. CETP sponsors special programs and support services to recruit, retain, and graduate underrepresented students. 6. CETP provides financial incentives for recruiting and retaining underrepresented students. 7. Underrepresented students benefiting from CETP financial support report their intention to teach mathematics and science. 8. New and revised courses take into account the needs of underrepresented students.[53]

[53] As identified in the literature on undergraduate reform, including *Shaping the Future* (NSF 96-139). Specific instructional strategies will vary, depending on the type of underrepresented students served and the approach selected by particular projects.

Desired Program Outcome	Quantitative Indicator	Qualitative Indicator
D: Outcome for Learning Infrastructure CETP projects have altered the manner in which teacher preparation is provided to prepare future K-12 teachers to teach mathematics and science effectively	1. Increased number of new/revised courses that reflect standards of best practice in both curricula and pedagogy over the life of the project. 2. Increased number of mathematics and science credit hours required for education degree or comparable degree (in institutions where science and mathematics requirements were minimal prior to the CETP). 3. Increased hours of fieldwork (i.e., classroom experiences, internships, and research experiences) that includes a SMET focus.	4. CETP curricula meet standards of best practice in teacher preparation and are consistent with the new national standards in mathematics and science, according to expert review. 5. CETP courses, labs, and fieldwork meet standards of best practice in teacher preparation, according to direct observation. 6. Faculty, administrators, and students report changes in course content and pedagogy that are consistent with the CETP's vision of reform.

Desired Program Outcome	Quantitative Indicator	Qualitative Indicator
E: Outcome for Collaboration CETP projects are involved in productive collaborative activities with partner institutions.	1. Increased number of partners actively involved in CETP activities with little or no attrition. 2. Formal and informal meetings of faculty and partner institutions occur regularly (at least quarterly or every semester) to promote collaboration and a shared vision of reform. 3. At least three parallel courses or labs across two or more partner institutions. 4. Increased number of community college students entering CETP teacher preparation. 5. Improved articulation between community colleges and 4-year institutions.	6. Significant collaborative work has occurred between education faculty and SMET faculty.[54] 7. Expanded multidisciplinary community of faculty with shared vision of reform. 8. Partners' reports of the quality of collaborative activities are consistent with one another. 9. Significant collaborative work has occurred between partner institutions in terms of course development and revision. 10. Scale-up of pilot initiatives extends to other partner institutions. 11. K-12 education staff have been actively involved in making teacher preparation more responsive to the needs of today's students and the teaching context of K-12 schools. 12. K-12 schools have provided beneficial field experiences for prospective teachers.

[54] Judgments regarding significance of collaborative work will be made by external evaluators, including an external consultant, based on multiple sources of evidence collected via site visits (e.g., review of committee/design team membership, interviews with faculty, interviews with administrators).

Desired Program Outcome	Quantitative Indicator	Qualitative Indicator
F. Institutionalization of Reform CETP projects have laid the groundwork for institutionalization of changes made to teacher preparation.	1. New and revised courses and educational programs have had formal departmental and program approval (number that have/have not). 2. Revised promotion and tenure guidelines and policies emphasizing importance of professional activities related to the reform of teacher preparation are in place. (Document number of promotion/tenure decisions affected.) 3. Substantial levels of external funding and/or institutional funds have been committed to support the continuation of efforts begun via the NSF CETP. 4. Levels of external funding and/or institutional funds committed to support the continuation of efforts begun via CETP are sufficient.[55]	5. CETP provides professional development for faculty in developing/revising courses and teaching in a manner consistent with the CETP's vision of reform. 6. There is evidence of increasing levels of disciplinary departmental "buy-in" to reform in teacher preparation and undergraduate courses affecting potential teachers. 7. There is evidence that administrators support faculty efforts to reform curricula and pedagogy and to engage in collaborative activities (e.g., release time, reduction of teaching load). 8. CETP staff have planned for the continuation and development of the CETP model after the final year of NSF funding. 9. Mechanisms are in place to follow up and support CETP graduates.

[55] Judgments regarding sufficiency of funds will be made by external evaluators, including an external consultant, based on multiple sources of evidence collected via site visits (e.g., interviews with PI, faculty, and administrators).

Desired Program Outcome	Quantitative Indicator	Qualitative Indicator
G. Outcome for Broader Community CETP projects serve as a model of teacher preparation reform and influence state certification/licensing requirements for mathematics and science teaching.	1. CETP projects have had an impact on making state certification or licensing requirements more rigorous with respect to mathematics and science. Increased numbers of: 2. Conferences/workshops on teacher preparation reform (sponsored by the CETP). 3. Institutions attending CETP-sponsored conferences/workshops. 4. Institutions "adopting" CETP reforms. 5. Institutions requesting CETP materials. 6. Institutions visiting the CETP. 7. Publications, written products, and professional presentations by CETP faculty on teacher preparation reform.	8. The CETP is serving as a model for teacher preparation reform. 9. Effective modes for electronic dialogue on teacher preparation reform (e.g., listservs, Web sites) have been developed.

CETP Principal Investigator and Campus Lead Survey

Funding for CETP

1. Which of the following have contributed funding to your CETP project? [Check all that apply.]
   - ❍ Original 5-year NSF CETP award
   - ❍ Continuation NSF funding
   - ❍ Other NSF funding
   - ❍ Internal institutional resources
   - ❍ Eisenhower elementary and secondary funds
   - ❍ US Department of Education curriculum and framework grant
   - ❍ Other US Department of Education funds
   - ❍ Other federal funds
   - ❍ State funds
   - ❍ District/local funds
   - ❍ Foundation funds (e.g., Kellogg, Pew Charitable Trusts) or private agency source
   - ❍ Other source of funds not listed above

2. What has been the total level of funding for the CETP project since it began? Include all the funding you indicated above, but DO NOT include in-kind contributions. Give your best estimate.

   Estimated total funding: $_____

3. What will be the likely sources of funding for the CETP project after the period covered by the NSF CETP award? [Check all that apply.]
   - ❍ This institution
   - ❍ Current source(s) of external support
   - ❍ New NSF funding
   - ❍ Other new source(s) of external support
   - ❍ Don't know

Scope of the CETP Project

4. As it is currently implemented, what is the scope of the CETP project? [Check all that apply.]
   - ❍ Within one track or component of the teacher preparation program
   - ❍ Across multiple tracks of the teacher preparation program, but not all tracks
   - ❍ Across the entire teacher preparation program
   - ❍ Includes at least one department/discipline outside of the School/College of Education
   - ❍ Includes two or more departments/disciplines outside of the School/College of Education

Grade Level and Subject Focus of the CETP Project

5. As it is currently implemented, what is the K-12 level teacher preparation and disciplinary foci of the CETP project. [Check all that apply in each column.]

Disciplines	Elementary School	Middle School	Secondary School
Mathematics			
Science			
Other SMET discipline			
Education Methods			
Other (specify)			

Student Participation

6. Which of the following types of university students are the primary focus of the CETP project? [Check all that apply.]

Student Characteristics	Freshman	Sophomore	Junior	Senior	Post Bacca-laureate
Female					
Male					
American Indian or Alaska Native					
Asian					
Black or African American					
Hispanic or Latino					
Native Hawaiian or Other Pacific Islander					
White					
Students in need of a remedial curriculum					
Other (specify)					

7. In 1998-99, approximately how many undergraduates completed courses that were developed or revised as part of the CETP project or are currently enrolled in such courses? Give your best estimate.

   Estimated number: _____ students.

   Are there any double counts in this number? Yes____ No____

Faculty Participation

Questions #8 and #9 ask for estimates of the number of faculty who have had direct involvement in the CETP project. For the purpose of this data collection, direct involvement is defined ONLY as one or more of the following types of active involvement:

- Worked on the CETP proposal or helped plan the project
- Worked on annual reports for NSF
- Compiled and entered data for NSF's Impact Data Base (i.e., the data collected by QRC)
- Served as a member of a CETP committee or workgroup
- Developed or revised a CETP course or lab
- Taught a new or revised course that is part of the CETP project
- Supervised student teaching as part of the CETP project
- Worked with K-12 teachers as part of the CETP project
- Recruited students to the CETP program
- Presented the CETP program to administrators and other faculty
- Served as PI/co-PI of the CETP project
- Provided professional development as part of the CETP project
- Received professional development offered as part of the CETP project and implemented what was learned in the classroom
- Acted as the CETP evaluator
- Worked on other formal CETP project activity

8. Using the definition above, report the number of higher education faculty directly involved in the CETP project at your institution for each year indicated, by primary discipline. Give your best estimate.

Disciplines	Number of Faculty					
	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999
Education faculty that are considered part of the teacher preparation program						
Other Education faculty						
Chemistry faculty						
Physics faculty						
Earth/atmospheric/oceanic sciences faculty						
Biological and agricultural sciences faculty						
Mathematics/statistics faculty						
Computer sciences faculty						
Engineering faculty						
Other SMET disciplines' faculty						
TOTAL						

9. Again using the definition above, report the number of K-12 faculty and school administrators directly involved in the CETP project at your institution for each year indicated by primary discipline. Give your best estimate.

Disciplines	Number of K-12 Teachers and Administrators					
	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999
Elementary school teachers						
Middle school teachers						
Secondary mathematics teachers						
Secondary science teachers						
School administrators						
Other school staff						

10. In 1998-99, how many courses have been offered as "CETP courses/labs" in each of the following disciplines? Include courses/labs that have been newly developed or revised for the CETP project, whether or not they have been officially approved.

Discipline	Number of CETP Courses/Labs
Chemistry	
Physics	
Biological and agricultural sciences	
Earth/atmospheric/oceanic sciences	
Mathematics/statistics	
Computer sciences	
Engineering	
Other SMET discipline (specify):	
Education methods	
Interdisciplinary within SMET	
Interdisciplinary including SMET and Education	
Total Courses:	

11. Indicate whether each of the following course reform foci is part of the CETP project, how important each reform focus is to the CETP project, and how satisfied you are with its current status.

Course Reform Focus	Is this a part of your CETP project?	How Important? 1 = Not at all 2 = Somewhat 3 = Very			How Satisfied? 1 = Not at all 2 = Somewhat 3 = Very		
Content							
Curriculum integrates content across the sciences and mathematics	Yes → No	1	2	3	1	2	3
Content is aligned with standards-based curriculum in science and mathematics	Yes → No	1	2	3	1	2	3
Content represents diversity of opinion	Yes → No	1	2	3	1	2	3
Content is culturally sensitive	Yes → No	1	2	3	1	2	3
Course was created by multiple input across campuses	Yes → No	1	2	3	1	2	3
The link between content and method is made explicit	Yes → No	1	2	3	1	2	3
Course focuses content on key concepts or the "big ideas"	Yes → No	1	2	3	1	2	3
Course is organized around interdisciplinary themes	Yes → No	1	2	3	1	2	3
Student Learning							
Course fosters active learning	Yes → No	1	2	3	1	2	3
Learning is problem-based	Yes → No	1	2	3	1	2	3
Instruction focuses on understanding of a few central concepts	Yes → No	1	2	3	1	2	3
Teachers and students are seen as joint learners	Yes → No	1	2	3	1	2	3
Collaborative activities foster meta-cognition about teaching and learning	Yes → No	1	2	3	1	2	3
Reform processes promote positive attitude toward mathematics and/or sciences	Yes → No	1	2	3	1	2	3
Students use data to justify conclusions	Yes → No	1	2	3	1	2	3
Course Addresses the Needs of:							
Females	Yes → No	1	2	3	1	2	3
Males	Yes → No	1	2	3	1	2	3
American Indian or Alaska Native	Yes → No	1	2	3	1	2	3
Asian	Yes → No	1	2	3	1	2	3
Black or African American	Yes → No	1	2	3	1	2	3
Hispanic or Latino	Yes → No	1	2	3	1	2	3
Native Hawaiian/otherPacific Islander	Yes → No	1	2	3	1	2	3
White	Yes → No	1	2	3	1	2	3

Course Reform Focus	Is this a part of your CETP project?	How Important? 1 = Not at all 2 = Somewhat 3 = Very	How Satisfied? 1 = Not at all 2 = Somewhat 3 = Very
Pedagogy			
Course uses technology to enhance instruction and learning	Yes → No	1 2 3	1 2 3
If lower division, course is taught in a manner more typical of graduate courses (e.g., small seminars)	Yes → No NA	1 2 3	1 2 3
Course is taught by faculty from different disciplines and departments	Yes → No	1 2 3	1 2 3
Learning is evaluated via multiple methods	Yes → No	1 2 3	1 2 3
Learning is evaluated using new or revised ways of measuring student achievement (e.g., performance assessment)	Yes → No	1 2 3	1 2 3
Other type of course reform (specify):	Yes → No	1 2 3	1 2 3

Project Strategies

12. Indicate whether each of the following strategies is part of the CETP project, and if so, how important that strategy is to the CETP project and how satisfied you are with progress using the strategy.

Strategy	Is this a part of your CETP project?	How Important 1 = Not at all 2 = Somewhat 3 = Very	How Satisfied 1 = Not at all 2 = Somewhat 3 = Very
With respect to students			
Recruiting the following students into teaching mathematics and/or science :			
Females	Yes → No	1 2 3	1 2 3
Males	Yes → No	1 2 3	1 2 3
American Indian or Alaska Native	Yes → No	1 2 3	1 2 3
Asian	Yes → No	1 2 3	1 2 3
Black or African American	Yes → No	1 2 3	1 2 3
Hispanic or Latino	Yes → No	1 2 3	1 2 3
Native Hawaiian/otherPacific Islander	Yes → No	1 2 3	1 2 3
White	Yes → No	1 2 3	1 2 3

Strategy	Is this a part of your CETP project?	How Important 1 = Not at all 2 = Somewhat 3 = Very	How Satisfied 1 = Not at all 2 = Somewhat 3 = Very
With respect to students			
Recruiting the following students into teaching mathematics and/or science :			
Females	Yes ➔ No	1 2 3	1 2 3
Males	Yes ➔ No	1 2 3	1 2 3
American Indian or Alaska Native	Yes ➔ No	1 2 3	1 2 3
Asian	Yes ➔ No	1 2 3	1 2 3
Black or African American	Yes ➔ No	1 2 3	1 2 3
Hispanic or Latino	Yes ➔ No	1 2 3	1 2 3
Native Hawaiian/otherPacific Islander	Yes ➔ No	1 2 3	1 2 3
White	Yes ➔ No	1 2 3	1 2 3
Addressing retention in mathematics and/or science courses of :			
Females	Yes ➔ No	1 2 3	1 2 3
Males	Yes ➔ No	1 2 3	1 2 3
American Indian or Alaska Native	Yes ➔ No	1 2 3	1 2 3
Asian	Yes ➔ No	1 2 3	1 2 3
Black or African American	Yes ➔ No	1 2 3	1 2 3
Hispanic or Latino	Yes ➔ No	1 2 3	1 2 3
Native Hawaiian/otherPacific Islander	Yes ➔ No	1 2 3	1 2 3
White	Yes ➔ No	1 2 3	1 2 3

Project Strategy	Is this a part of your CETP project?	How Important 1 = Not at all 2 = Somewhat 3 = Very			How Satisfied 1 = Not at all 2 = Somewhat 3 = Very		
With respect to students							
Arranging research experiences in science and mathematics for prospective teachers	Yes ➔ No	1	2	3	1	2	3
Providing students with student teaching experiences early in their preparation	Yes ➔ No	1	2	3	1	2	3
Providing students with student teaching experiences that are compatible with the philosophy of teaching that is the foundation of the CETP projects	Yes ➔ No	1	2	3	1	2	3
Working with the student teacher and the "supervising" or "cooperating teacher" on a regular basis	Yes ➔ No	1	2	3	1	2	3
Facilitating a mentor relationship with graduated beginning teachers and staff in their schools	Yes ➔ No	1	2	3	1	2	3
Following up students after they are certified, hired, and placed	Yes ➔ No	1	2	3	1	2	3
With respect to faculty							
Developing and implementing professional development for faculty	Yes ➔ No	1	2	3	1	2	3
Collaborating with faculty across different disciplines and departments in teaching SMET courses	Yes ➔ No	1	2	3	1	2	3
Collaborating with faculty across the education department in revising and/or teaching courses that involve preservice teachers	Yes ➔ No	1	2	3	1	2	3
Collaborating with faculty across different disciplines and departments in revising and/or teaching courses that involve preservice teachers	Yes ➔ No	1	2	3	1	2	3
Collaborating with faculty across different institutions in revising and/or teaching courses that involve preservice teachers	Yes ➔ No	1	2	3	1	2	3
Influencing promotion and tenure guidelines and merit decisions to include components on teaching effectiveness and scholarship on teaching and learning	Yes ➔ No	1	2	3	1	2	3
Influencing the hiring process to include components on teaching effectiveness and scholarship on teaching and learning	Yes ➔ No	1	2	3	1	2	3

Project Strategy	Is this a part of your CETP project?	How Important 1 = Not at all 2 = Somewhat 3 = Very			How Satisfied 1 = Not at all 2 = Somewhat 3 = Very		
With respect to funding							
Working with administrators to reallocate internal institutional funds for the CETP project	Yes ➔ No	1	2	3	1	2	3
Seeking external funding to support the CETP project	Yes ➔ No	1	2	3	1	2	3
With respect to collaboration and outreach							
Collaborating with K-12 staff in revising and/or teaching courses that involve preservice teachers	Yes ➔ No	1	2	3	1	2	3
Working with K-12 school staff in making appropriate field placements	Yes ➔ No	1	2	3	1	2	3
Working with community colleges (e.g., articulation agreements)	Yes ➔ No	1	2	3	1	2	3
Disseminating the CETP project to broad national community through peer-reviewed and/or commercial channels	Yes ➔ No	1	2	3	1	2	3

Project Management and Implementation Issues

13. What incentives have the administration provided to support faculty participation in the CETP project? (Click all that apply.)

- ❍ Release time
- ❍ Reduced course load
- ❍ Summer salary or stipend
- ❍ Teaching/research assistants
- ❍ Support staff
- ❍ Recognition or non-monetary award
- ❍ Institutional grant
- ❍ Other incentive: _____

14. To what extent has each of the following been a barrier to the implementation of the CETP project?

	Barrier 1 = Not a barrier at all 2 = Somewhat of a barrier 3 = Major barrier		
Building adequate faculty participation in reform ("faculty buy-in") in the School/College of Education	1	2	3
Building adequate faculty participation in reform ("faculty buy-in") in the disciplines	1	2	3
Level of faculty teaching responsibilities	1	2	3
Level of faculty research commitments	1	2	3
Lack of faculty incentives	1	2	3
Lack of faculty interest	1	2	3
Faculty resistance to change	1	2	3
Promotion and tenure guidelines that emphasize research over teaching effectiveness	1	2	3
"Breaking new ground" in launching the reform agenda	1	2	3
Preparation of faculty to teach reformed courses	1	2	3
Administrative support for reform	1	2	3
Disciplinary/departmental "territorialism"	1	2	3
Level of funding for reform	1	2	3
Getting new/revised courses approved and officially "on the books"	1	2	3
Student attrition from reformed courses	1	2	3
Measuring and documenting project impact	1	2	3

Other barrier to implementation: _____

_____

Role of NSF

15. Which of the following statements best describes the role that NSF CETP funding had in undergraduate reform at your institution? (Click only one.)

- ❍ Teacher preparation reform would not have been possible without the NSF CETP award; it was ***the*** enabling factor
- ❍ The NSF CETP award was one of several enabling factors that came together to bring about teacher preparation reform
- ❍ The NSF CETP award provided additional momentum to teacher preparation efforts that had already begun at the institutional level
- ❍ The NSF CETP award essentially "validated" teacher preparation reform efforts

Dissemination

16. Some CETP projects have begun to disseminate the CETP reform efforts. Indicate whether any of the following have occurred, and give the approximate number of institutions involved. (Check all that apply.)

- ❍ Individuals or teams from other institutions have visited this campus to meet with faculty and/or administrators involved in the CETP project or to observe courses and/or labs that have been developed/revised as part of the CETP project.

  How many institutions? _____

- ❍ Individuals or teams from other institutions have attended symposia, workshops, or conferences sponsored by the CETP project.

  How many institutions? _____

- ❍ Individuals or teams from other institutions have requested curricula or other products from the CETP project.

  How many institutions? _____

- ❍ Other institutions are "adopting" components of this CETP project.

  How many institutions? _____

- ❍ Individuals have visited the CETP project Web site.

  How many hits? _____

- ❍ CETP project has provided evaluation materials to the electronic CETP resource library.

  Yes? _____
  No? _____
  Don't know? _____

Comments

17. What has been the primary outcome of the CETP project thus far for **preservice teachers?**

18. What has been the primary outcome of the CETP project thus far for **faculty**?

19. What has been the primary outcome of the CETP project thus far on the **teacher preparation program** at this institution?

20. What has been the primary outcome for **K-12 students**?

21. What has been the primary effect of the CETP project on **state certification requirements and/or on local hiring practices**?

22. What aspects of the CETP project do you think can be **duplicated** (or adopted with modifications) by other institutions?

THANK YOU FOR YOUR TIME AND YOUR INPUT!

Director of Teacher Preparation Survey

Funding for the Reform Project

1. Which of the following have contributed funding to your reform project? (Click all that apply.)

- ❍ NSF funding
- ❍ Internal institutional resources
- ❍ Eisenhower elementary and secondary funds
- ❍ US Department of Education curriculum and framework grant
- ❍ Other US Department of Education funds
- ❍ Other federal funds
- ❍ State funds
- ❍ District/local funds
- ❍ Foundation funds (e.g., Kellogg, Pew) or other private agency source
- ❍ Other source of funds not listed above

2. What has been the total level of funding for the reform project since it began? Include all the funding you indicated above, but DO NOT include in-kind contributions. Give your best estimate.

   Estimated total funding: $_____

Scope of the Reform Project

3. As it is currently implemented, what is the scope of the reform project? (Click all that apply.)

- ❍ Within one track or component of the teacher preparation program
- ❍ Across multiple tracks of the teacher preparation program, but not all tracks
- ❍ Across the entire teacher preparation program
- ❍ Includes at least one department/discipline outside of the School/College of Education
- ❍ Includes two or more departments/disciplines outside of the School/College of Education

Grade Level and Subject Focus of the Reform Project

4. As it is currently implemented, what is the K-12 grade level and subject focus of the reform project (Click all that apply in each column.)

	Grade Level		
Disciplines	**Elementary**	**Middle School**	**Secondary**
❍ Entire scope of subjects			
❍ Mathematics			
❍ Science			
❍ Other SMET discipline			
❍ Non-SMET discipline			
❍ Other : Please Specify _____			

Student Participation

5. Which of the following types of students are the primary focus of the reform project? (Click all that apply.)

	Level of Students				
Characteristics of Students	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Post Baccalaureate**
Females					
Males					
Students of racial/ethnic minorities, excluding Asians					
Students in need of a remedial curriculum					
Other type of students (specify) _____					

6. In 1998-99, approximately how many undergraduates have either completed courses that were developed or revised as part of the reform project or are currently enrolled in such courses? Give your best estimate.

   Estimated total number of students: _____

   Are there any double counts in this number? Yes_____ N0_____

Faculty Participation

This question asks for estimates of the number of faculty that have been directly involved in the reform project. For the purpose of this data collection, direct involvement is defined ONLY as one or more of the following types of active involvement:

- Worked on the reform proposal or helped plan the project
- Worked on annual reports for NSF
- Compiled and entered data for NSF's Impact Data Base (i.e., the data collected by QRC)
- Served as a member of a reform committee or workgroup
- Developed or revised a reform course or lab
- Taught a new or revised course that is part of the reform project
- Supervised student teaching as part of the reform project
- Worked with K-12 teachers as part of the reform project
- Recruited students to the reform program
- Presented the reform program to administrators and other faculty
- Served as PI/co-PI of the reform project
- Provided professional development as part of the reform project
- Received professional development offered as part of the reform project and implemented what was learned in the classroom
- Acted as the reform evaluator
- Worked on other formal reform project activity

7. Using the definition above, report the number of higher education faculty directly involved in the reform project at your institution for each year indicated by primary discipline. Give your best estimate.

	Number of Faculty					
Disciplines	**1993-94**	**1994-95**	**1995-96**	**1996-97**	**1997-98**	**1998-99**
Education faculty that are considered part of the teacher preparation program						
Other Education						
Physical sciences						
Earth/ATM/Oceanic sciences						
Biological and agricultural sciences						
Mathematics/statistics						
Computer sciences						
Engineering						
Other SMET disciplines						
Other non-SMET disciplines						
Total:	_____	_____	_____	_____	_____	_____

8. Again using the definition above, report the number of K-12 faculty and school administrators directly involved in the reform project at your institution for each year indicated by primary discipline. Give your best estimate.

	Number of School Staff					
Disciplines	**1993-94**	**1994-95**	**1995-96**	**1996-97**	**1997-98**	**1998-99**
Elementary school teachers						
Middle school teachers						
Secondary mathematics teachers						
Secondary science teachers						
School administrators						
Other school staff						

9. In 1998-99, how many courses have been offered as "reform courses/labs" in each of the following disciplines? Include courses that have been newly developed or revised for the reform project, whether or not they have been officially approved.

Discipline	Number of Courses/Labs
Chemistry	
Physics	
Biological and agricultural sciences	
Earth/atmospheric/oceanic sciences	
Mathematics/statistics	
Computer sciences	
Engineering	
Other SMET discipline (specify):	
Education methods	
Interdisciplinary within SMET	
Interdisciplinary including SMET and Education	
Total Courses:	

10. Indicate whether each of the following course reforms is part of the reform project, how important each type of reform is to the reform project, and how satisfied you are with its current status.

Course Reform	Is this a part of your reform project?	How Important 1 = Not at all 2 = Somewhat 3 = Very			How Satisfied 1 = Not at all 2 = Somewhat 3 = Very		
Content							
Curriculum integrates content across the sciences and mathematics	Yes ➔ No	1	2	3	1	2	3
Content is aligned with standards-based curriculum in science and mathematics	Yes ➔ No	1	2	3	1	2	3
Content represents diversity of opinion	Yes ➔ No	1	2	3	1	2	3
Content is culturally sensitive	Yes ➔ No	1	2	3	1	2	3
Course was created by multiple input across campuses	Yes ➔ No	1	2	3	1	2	3
The link between content and method is made explicit	Yes ➔ No	1	2	3	1	2	3
Course focuses content on key concepts or the "big ideas"	Yes ➔ No	1	2	3	1	2	3
Course is organized around interdisciplinary themes	Yes ➔ No	1	2	3	1	2	3
Student Learning							
Course fosters active learning	Yes ➔ No	1	2	3	1	2	3
Learning is problem-based	Yes ➔ No	1	2	3	1	2	3
Instruction focuses on understanding of a few central concepts	Yes ➔ No	1	2	3	1	2	3
Teachers and students are seen as joint learners	Yes ➔ No	1	2	3	1	2	3
Collaborative activities foster meta-cognition about teaching and learning	Yes ➔ No	1	2	3	1	2	3
Reform processes promote a positive attitude toward mathematics and/or sciences	Yes ➔ No	1	2	3	1	2	3
Students use data to justify conclusions	Yes ➔ No	1	2	3	1	2	3
Course addresses the needs of students underrepresented in SMET (i.e., females and racial/ethnic minorities, excluding Asians)	Yes ➔ No	1	2	3	1	2	3
Pedagogy							
Course uses technology to enhance instruction and learning	Yes ➔ No	1	2	3	1	2	3
If lower division, course is taught in a manner more typical of graduate courses (e.g., small seminars)	Yes ➔ No NA	1	2	3	1	2	3
Course is taught by faculty from	Yes ➔	1	2	3	1	2	3

different disciplines and departments	No						
Learning is evaluated via multiple methods	Yes ➔	1	2	3	1	2	3
	No						
Learning is evaluated using new or revised ways of measuring student achievement (e.g., performance assessment)	Yes ➔	1	2	3	1	2	3
	No						
Other type of course reform:							

Project Strategies

11. Indicate whether each of the following strategies is part of the reform project, and if so, how important that strategy is to the reform project and how satisfied you are with progress using the strategy.

Project Strategy	Is this a part of your reform project?	How Important 1 = Not at all 2 = Somewhat 3 = Very			How Satisfied 1 = Not at all 2 = Somewhat 3 = Very		
With respect to students							
Recruiting underrepresented students into teaching mathematics and/or science (i.e., females, racial/ethnic minorities, excluding Asians)	Yes ➔ No	1	2	3	1	2	3
Addressing the retention of underrepresented students in mathematics and/or science courses (i.e., females and racial/ethnic minorities, excluding Asians)	Yes ➔ No	1	2	3	1	2	3
Arranging research experiences in science and mathematics for prospective teachers	Yes ➔ No	1	2	3	1	2	3
Providing students with student teaching experiences early in their preparation	Yes ➔ No	1	2	3	1	2	3
Providing students with student teaching experiences that are compatible with the philosophy of teaching that is the foundation of the reform projects	Yes ➔ No	1	2	3	1	2	3
Working with the student teacher and the "supervising" or "cooperating teacher" on a regular basis	Yes ➔ No	1	2	3	1	2	3
Facilitating a mentor relationship with graduated beginning teachers and staff in their schools	Yes ➔ No	1	2	3	1	2	3
Following up students after they are certified, hired, and placed	Yes ➔ No	1	2	3	1	2	3
With respect to faculty							
Developing and implementing professional development for faculty	Yes ➔ No	1	2	3	1	2	3
Collaborating with faculty across different disciplines and departments in teaching SMET courses	Yes ➔ No	1	2	3	1	2	3
Collaborating with faculty across the education department in revising and/or teaching courses that involve preservice teachers	Yes ➔ No	1	2	3	1	2	3
Collaborating with faculty across different disciplines and departments in revising and/or teaching courses that involve preservice teachers	Yes ➔ No	1	2	3	1	2	3

Collaborating with faculty across different institutions in revising and/or teaching courses that involve preservice teachers	Yes ➔ No	1	2	3	1	2	3
Influencing promotion and tenure guidelines and merit decisions to include components on teaching effectiveness and scholarship on teaching and learning	Yes ➔ No	1	2	3	1	2	3
Influencing the hiring process to include components on teaching effectiveness and scholarship on teaching and learning	Yes ➔ No	1	2	3	1	2	3
With respect to funding							
Working with administrators to reallocate internal institutional funds for the reform project	Yes ➔ No	1	2	3	1	2	3
Seeking external funding to support the reform project	Yes ➔ No	1	2	3	1	2	3
With respect to collaboration and outreach							
Collaborating with K-12 staff in revising and/or teaching courses that involve preservice teachers	Yes ➔ No	1	2	3	1	2	3
Working with K-12 school staff in making appropriate field placements	Yes ➔ No	1	2	3	1	2	3
Working with community colleges (e.g., articulation agreements)	Yes ➔ No	1	2	3	1	2	3
Disseminating the reform project to broad national community through peer-reviewed and/or commercial channels	Yes ➔ No	1	2	3	1	2	3

Project Management and Implementation Issues

12. What incentives have the administration provided to support faculty participation in the reform project? (Click all that apply.)

    - ❍ Release time
    - ❍ Reduced course load
    - ❍ Summer salary or stipend
    - ❍ Teaching/research assistants
    - ❍ Support staff
    - ❍ Recognition or non-monetary award
    - ❍ Institutional grant
    - ❍ Other incentive: _____

13. To what extent has each of the following been a barrier to the implementation of the reform project?

	Barrier 1 = Not a barrier at all 2 = Somewhat of a barrier 3 = Major barrier		
Building adequate faculty participation in reform ("faculty buy-in") in the School/College of Education	1	2	3
Building adequate faculty participation in reform ("faculty buy-in") in the disciplines	1	2	3
Level of faculty teaching responsibilities	1	2	3
Level of faculty research commitments	1	2	3
Lack of faculty incentives	1	2	3
Lack of faculty interest	1	2	3
Faculty resistance to change	1	2	3
Promotion and tenure guidelines that emphasize research over teaching effectiveness	1	2	3
"Breaking new ground" in launching the reform agenda	1	2	3
Preparation of faculty to teach reformed courses	1	2	3
Administrative support for reform	1	2	3
Disciplinary/departmental "territorialism"	1	2	3
Level of funding for reform	1	2	3
Getting new/revised courses approved and officially "on the books"	1	2	3
Student attrition from reformed courses	1	2	3
Measuring and documenting project impact	1	2	3

Other barrier to implementation: _____

_____

Dissemination

14. Some reform projects have begun to disseminate the reform efforts. Indicate whether any of the following have occurred and give the approximate number of institutions involved.

Individuals or teams from other institutions have visited this campus to meet with faculty and/or administrators involved in the reform project or to observe courses and/or labs that have been developed/revised as a part of the reform project.

How many institutions? _____

Individuals or teams from other institutions have attended symposia, workshops or conference(s) sponsored by the reform project.

How many institutions? _____

Individuals or teams from other institutions have requested curricula or other products from the reform project.

How many institutions? _____

Other institutions are "adopting" components of this reform project.

How many institutions? _____

Individuals have visited the reform project website.

How many hits? _____

Reform project has provided evaluation materials to the electronic reform resource library.

Yes? _____
No? _____
Don't know? _____

Comments

15. What has been the primary outcome of the reform project thus far for **preservice teachers?**

16. What has been the primary outcome of the reform project thus far for **faculty**?

17. What has been the primary outcome of the reform project thus far on the **teacher preparation program** at this institution?

18. What has been the primary outcome for **K-12 students**?

18. What has been the primary effect of the reform project on **state certification requirements and/or on local hiring practices**?

19. What aspects of the reform project do you think can be **duplicated** (or adopted with modifications) by other institutions?

THANK YOU FOR YOUR TIME AND YOUR INPUT!

CETP Faculty Survey

Participation

1. Indicate whether you were involved in the CETP project in any of the following ways last year (1997-98) and whether you are currently involved (1998-99).

Type of Involvement in CETP	Involved last year 1997-98	Currently Involved 1998-99
With respect to the curricula and teaching		
Developed or revised a CETP course or lab on your own	Yes →	Yes
	No	No
Developed or revised a CETP course or lab in collaboration with faculty from your own discipline	Yes →	Yes
	No	No
Developed or revised a CETP course or lab in collaboration with faculty from disciplines and/or departments other than your own.	Yes →	Yes
	No	No
Taught a CETP course or lab on your own (i.e., was not team-taught)	Yes →	Yes
	No	No
Team-taught a CETP course or lab with faculty from your own discipline	Yes →	Yes
	No	No
Team-taught an CETP course or lab with faculty from disciplines and/or departments other than your own	Yes →	Yes
	No	No
With respect to professional development		
Provided professional development (e.g., colloquium, demonstration, workshop) as part of the CETP project	Yes →	Yes
	No	No
Presented paper/research related to undergraduate reform taking place via the CETP project	Yes →	Yes
	No	No
Attended professional development sponsored by the CETP project	Yes →	Yes
	No	No
Implemented teaching strategies, applied concepts, or used skills picked up in CETP-sponsored professional development	Yes →	Yes
	No	No
With respect to research and grantsmanship		
Wrote proposal for funding to support scholarship on teaching and learning	Yes →	Yes
	No	No
Wrote proposal for funding to continue the CETP project after the period of NSF funding	Yes →	Yes
	No	No

Conducted research on efforts to improve teaching effectiveness and student learning	Yes ➔ No	Yes No
Wrote article for peer-reviewed publication(s) related to undergraduate reform taking place via the CETP project	Yes ➔ No	Yes No
Presented paper or served on a panel at a professional conference (e.g., AERA)	Yes ➔ No	Yes No
With respect to collaboration and outreach		
Served as a member of a committee within your department to plan, coordinate, or implement reform of teacher preparation	Yes ➔ No	Yes No
Served as a member of an interdisciplinary committee within your institution to plan, coordinate, or implement reform of teacher preparation	Yes ➔ No	Yes No
Served as a member of an interdisciplinary committee with CETP partner institutions to plan, coordinate, or implement reform of teacher preparation	Yes ➔ No	Yes No
Involved in a collaborative relationship with pre-college educators (e.g., teacher enhancement, bridge programs)	Yes ➔ No	Yes No
Involved in a collaborative relationship with industry/business (e.g., soliciting input on SMET programs, quality of graduates)	Yes ➔ No	Yes No
Involved in some other CETP project activity: (specify)	Yes ➔ No	Yes No
_____		
_____		

2. What incentives have you received related to your participation in the CETP project? (Click all that apply.)
   - ❍ Release time
   - ❍ Reduced course load
   - ❍ Summer salary or stipend
   - ❍ Teaching/research assistants
   - ❍ Support staff
   - ❍ Recognition or non-monetary award
   - ❍ Institutional grant
   - ❍ Other incentive: _____

Course Reform

3. In 1998-99, how many undergraduate courses did you teach that were offered as "CETP courses/labs" in each of the following disciplines? Include courses that have been newly developed or revised for the CETP project, whether or not they have been officially approved.

	Number of **lower division** CETP courses	Number of **upper division** CETP courses
Education Courses:		
Education course concentrating on the teaching of elementary subjects, including mathematics and science		
Education course concentrating on the teaching of secondary math		
Education course concentrating on the teaching of secondary science		
Education course concentrating on pedagogy (e.g., inquiry-based instruction, cooperative learning, performance assessment)		
Disciplinary Courses:		
Mathematics		
Physical sciences		
Earth/ATM/Oceanic sciences		
Biological and agricultural sciences		
Computer sciences		
Engineering		
Interdisciplinary within SMET		
Interdisciplinary including SMET and non-SMET		
Other discipline, please specify: _____ _____		
Total Courses:		

4. Indicate whether each of the following course reforms was part of any of the CETP courses you listed above, how important each type of reform is, and how satisfied you are with the way it is working.

Course Reform	Is this a part of your CETP course?	How Important 1 = Not at all 2 = Somewhat 3 = Very			How Satisfied 1 = Not at all 2 = Somewhat 3 = Very		
Content							
Curriculum integrates content across the sciences and mathematics	Yes ➔ No	1	2	3	1	2	3
Content is aligned with standards-based curriculum in science and mathematics	Yes ➔ No	1	2	3	1	2	3
Content represents diversity of opinion	Yes ➔ No	1	2	3	1	2	3
Content is culturally sensitive	Yes ➔ No	1	2	3	1	2	3
Course was created by multiple input across campuses	Yes ➔ No	1	2	3	1	2	3
The link between content and method is made explicit	Yes ➔ No	1	2	3	1	2	3
Course focuses content on key concepts or the "big ideas"	Yes ➔ No	1	2	3	1	2	3
Course is organized around interdisciplinary themes	Yes ➔ No	1	2	3	1	2	3
Student Learning							
Course fosters active learning	Yes ➔ No	1	2	3	1	2	3
Learning is problem-based	Yes ➔ No	1	2	3	1	2	3
Instruction focuses on understanding of a few central concepts	Yes ➔ No	1	2	3	1	2	3
Teachers and students are seen as joint learners	Yes ➔ No	1	2	3	1	2	3
Collaborative activities foster meta-cognition about teaching and learning	Yes ➔ No	1	2	3	1	2	3
Reform processes promote a positive attitude toward mathematics and/or sciences	Yes ➔ No	1	2	3	1	2	3
Students use data to justify conclusions	Yes ➔ No	1	2	3	1	2	3
Course addresses the needs of students underrepresented in SMET (i.e., females and racial/ethnic minorities, excluding Asians)	Yes ➔ No	1	2	3	1	2	3

Pedagogy

Course uses technology to enhance instruction and learning	Yes → No	1	2	3	1	2	3
If lower division, course is taught in a manner more typical of graduate courses (e.g., small seminars)	Yes → No NA	1	2	3	1	2	3
Course is taught by faculty from different disciplines and departments	Yes → No	1	2	3	1	2	3
Learning is evaluated via multiple methods	Yes → No	1	2	3	1	2	3
Learning is evaluated using new or revised ways of measuring student achievement (e.g., performance assessment)	Yes → No	1	2	3	1	2	3

Other type of course reform:

_____

_____

5. a. In all, approximately how many students have completed the course(s) you developed or revised as a result of your participation in CETP program? _____

   b. Approximately what percentage of these students was female? _____%

   c. Approximately what percentage of these students was from underrepresented groups excluding Asians? _____%

   d. Approximately what percentage of these students were education majors who have declared an interest in preparing to teach? _____%

   e. Approximately what percentage of these students were math majors who have declared an interest in preparing to teach? _____%

   f. Approximately what percentage of these students were science majors who have declared an interest in preparing to teach? _____%

   g. Approximately what percentage of these students were math/science majors who have declared an interest in preparing to teach? _____%

6. Did this course(s) receive formal departmental and program approval? (Click one.)

   ❍ Yes

   ❍ Some did and some did not

   ❍ No

7. Is this course(s) now required for a teaching credential? (Click one.)

- ❍ Yes
- ❍ Some are and some are not
- ❍ No

Project Impact

8. Are activities related to the reform of teacher preparation currently weighted differently in promotion and tenure decisions than they were before the CETP project?

	Factor is Weighted		
	Less than before CETP	About the same as before CETP	More than before CETP
In promotion decisions			
Innovative teaching			
Curricular reform			
Scholarship on teaching and learning			
In tenure decisions			
Innovative teaching			
Curricular reform			
Scholarship on teaching and learning			

9. To what extent has the CETP project contributed to the following outcomes for students?

	Impact				
	Major Negative impact	Some Negative impact	No impact	Some Positive impact	Major Positive impact
Better teaching of education courses					
Better teaching of mathematics courses					
Better teaching of science courses					
Improved curriculum in education courses					
Improved curriculum in SMET courses					
More students completing introductory SMET courses					
More students completing follow-on SMET courses or structured SMET sequences					
More students completing SMET degrees					
Increased opportunities for preservice students to be involved in research experiences					
Quality of preservice students' research experiences					
Attitudes towards SMET disciplines					
Understanding of SMET concepts					
Mastery of SMET and related skills					
Confidence in applying SMET skills					
Current CETP students' knowledge of mathematics and science relative to that of preservice students prior to the CETP					
CETP students' knowledge of mathematics and science relative to that of non-CETP students.					
Subject area assessment scores of CETP graduates as measured by Praxis II. [1]					
Access for these students to SMET :					
Female					
Male					

[1] Praxis data (or other standardized achievement data) will be utilized to the extent feasible.

American Indian or Alaska Native					
Asian					
Black or African American					
Hispanic or Latino					
Native Hawaiian/Other Pacific Islander					
White					
Understanding of the interconnectedness of SMET disciplines					

Your Background

10. Are you. (Click one.)

    ❍ Female ❍ Male

11. What is your primary departmental affiliation? _____

12. Which of the following best describes your academic rank at your college/university? (Click one.)

    ❍ Not applicable: no ranks system at college/university

    ❍ Not applicable: no ranks for my position

    ❍ Professor

    ❍ Associate Professor

    ❍ Assistant Professor

    ❍ Instructor

    ❍ Lecturer

    ❍ Adjunct

    ❍ Other: _____

13. What was your tenure status at the time you participated in the CETP project? (Click one.)

    ❍ Not applicable: no tenure system at college/university

    ❍ Not applicable: no tenure system for my position

    ❍ Not on tenure track

    ❍ On tenure track but not tenured

    ❍ Tenured

14. Ethnicity. (Click one.)

    ❍ Hispanic or Latino

    ❍ Not Hispanic or Latino

15. Race. (Click one or more.)

    ❍ American Indian or Alaska Native

- ❍ Asian
- ❍ Black or African American
- ❍ Native Hawaiian or Other Pacific Islander
- ❍ White

16. Disability status. (Click one or more.)
    - ❍ Hearing Impairment
    - ❍ Visual Impairment
    - ❍ Mobility/Orthopedic Impairment
    - ❍ Other (please specify) _____
    - ❍ None

Comments

17. What has been the primary outcome of the CETP project thus far for **preservice teachers?**

_____
_____
_____
_____
_____

18. What has been the primary outcome of the CETP project thus far for **faculty**?

_____
_____
_____
_____
_____

19. What has been the primary outcome for **K-12 students**?

_____
_____
_____
_____
_____

20. What has been the primary outcome of the CETP project thus far on the **teacher preparation program** at this institution?

_____

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APPENDIX D

QUANTITATIVE ANALYSES

Background

The CETP database consists of surveys of principal investigators (PI) and faculty (FAC) at institutions that were awarded CETP grants, and surveys of chairs of teacher preparation programs (TPP) at institutions that were not awarded CETP grants but are similar in many ways to institutions that were awarded such grants. The TPP survey is almost identical to the PI survey in content. The CETP awards went to collaboratives—groups of institutions. There are 5 collaboratives, each containing 2 to 17 institutions. Each institution contributes one PI survey, and up to six FAC surveys. The TPP surveys come from institutions that are matched to the institutions in the collaboratives; however, there are many collaborative institutions that are not matched or are matched by more than one TPP institution. A TPP faculty was not prepared for each TPP institution because there were few incentives for them to respond, and there responses would not be relevant for the study.

Mean Values for PI Surveys

There were 34 PI questionnaires. Mean values were first calculated by collaboratives, with each institution within the collaborative receiving equal weight. For example:

- Question 1 asked whether the original 5-year CETP award contributed funding to the institution's CETP project. If 3 out of 5 institutions within collaborative A answered "Yes," 1 answered "No," and one response was deemed missing, then the correct mean for collaborative A would be 75%. If 2 out of 2 institutions within collaborative B had missing responses, then the mean for collaborative B would be missing.
- Question 8 asked for the number of education faulty in 1993-94 who were considered part of the CETP project. If 3 out of 4 institutions in collaborative C said 46, 0, and 24, and the other response was missing, then the mean value was (46+0+24)/3 = 23.33.
- Question 14 asked whether faculty "buy-in" in the college of education was not a barrier, somewhat of a barrier, or a major barrier. If 3 out of 4 institutions in Collaborative A responded to this question and 1 institution had a missing value, and the three responses were "not a barrier," "not a barrier," and "major barrier'" then the mean values for this collaborative were "not a barrier" = 66.7%, "somewhat of a barrier" = 0%, and "major barrier" = 33.3%.

After results were calculated by collaborative, they were equally weighted to produce an overall CETP mean. For example if in Question 1, the results for Collaboratives A, B, C, D, and E were 50%, 32%, missing, 6%, and 92%, then the average value was (50% + 32% + 6% + 92%)/4 = 45%.

Mean Values for FAC Surveys

The same general approach to calculating mean values was implemented for faculty surveys. In this case there were three steps:

1. Mean values were calculated for a faculty survey question by institution.
2. Institutional means were then averaged within collaboratives to produce a collaborative mean.
3. Next, the collaborative means were averaged to provide an overall mean value.

This three-step process assured that institutions with many faculty respondents and collaboratives with many faculty respondents did not overwhelm the responses from institutions and collaboratives with fewer faculty responses.

Mean Values for the TPP Survey and Matching PI Surveys

The purpose of the TPP survey was to provide a set of comparison responses to the PI survey. However, not all PI surveys could be matched because of nonresponse among the TPP survey. Sometimes, a given TPP survey matched more than one PI survey; sometimes, two or more TPP surveys matched one PI survey.

A list of weights for the PI surveys (all of these weights are 0 or 1) and a set of weights for the TPP surveys (which include many different numerical values, many of which are not whole numbers) was created. Means were calculated in the following manner: if there were 34 PI surveys, 25 of them with weights of 1 and the remaining with weights of 0, and if 10 of the 25 PI surveys with non-zero weights stated "Yes" to a question, 13 stated "No," and 2 responses were missing, then the mean value for "Yes" was 10/23 = 43.5%.

APPENDIX E

COMPARISONS BETWEEN COLLABORATIVES

Analysis of Variance

Variables characterizing CETPs from the PI and faculty surveys were analyzed to evaluate whether there was more variation between institutions in the same CETP than between the CETPs. Variables from the faculty survey (FCOLLAB, INVOLVE, TOTLCOLL, STUDOUT) were averaged across all faculty responses for the institution to obtain a single institution value for analysis. Means, with associated standard errors shown as error bars, are shown in Figures E-1 to E-10. Also shown are individual points, standard deviations (indicated by dotted lines) and comparison circles for all-pairs comparisons of CETPs by the Tukey-Kramer HSD method (see below).

A parametric analysis of variance (ANOVA) was calculated for each measure to test whether there were significant differences on the means of these measures between CETPs. None of the measures showed significant differences between CETPs on any of the reform measures at $p = .05$ or better. Table E-1 shows the R-square value for each comparison, which measures the percentage of the variation in the measure explained by CETP, and the achieved p-values for the ANOVA. The proportion of variation attributable to CETP is quite small. These findings support the conclusion that CETP-to-CETP variation is at most a small factor in variability on these measures, and that most of the variation is institution-to-institution.

The Tukey-Kramer HSD (honestly significant difference) method (Tukey, 1953; Kramer, 1956) was used to make pair wise comparisons of CETPs on each measure at an overall alpha level of .05, accounting for multiple comparisons. No significant differences between any CETP on any measure were found. The comparison circles shown in the figures are a visual representation of group mean comparisons. Means that are statistically significantly different either have circles that do not intersect or circles that intersect only slightly (in particular, the outside angle of intersection between the circles is less than 90 degrees). No pairs show this pattern among these variables.

Table E-1
R-square and achieved significance levels for tests of CETP differences

Variable	R-square	ANOVA *p*-value
CLIMATE	6.6%	0.7896
REACH	14.2%	0.3672
DISCIP	8.6%	0.6559
CREFORM	9.2%	0.6082
PREFORM	8.6%	0.6427
TREFORM	20.8%	0.1797
TOTREF	12.5%	0.4647
FCOLLAB	8.9%	0.6755
INVOLVE	18.5%	0.2768
TOTLCOLL	14.1%	0.4313
STUDOUT	19.6%	0.2650

CLIMATE: Climate for reforms
REACH: Extent of program reforms
DISCIP: Number of disciplines
CREFORM: Curriculum reforms
PREFORM: Improved teacher preparation programs
TREFORM: Teaching reforms
TOTREF: Total reforms
FCOLLAB: Collaborative activities on part of faculty
INVOLVE: Types of faculty involvement
TOTLCOLL: Total collaboration activities for faculty
STUDOUT: Access to improved preparation

Figure E-1
Comparison of CLIMATE

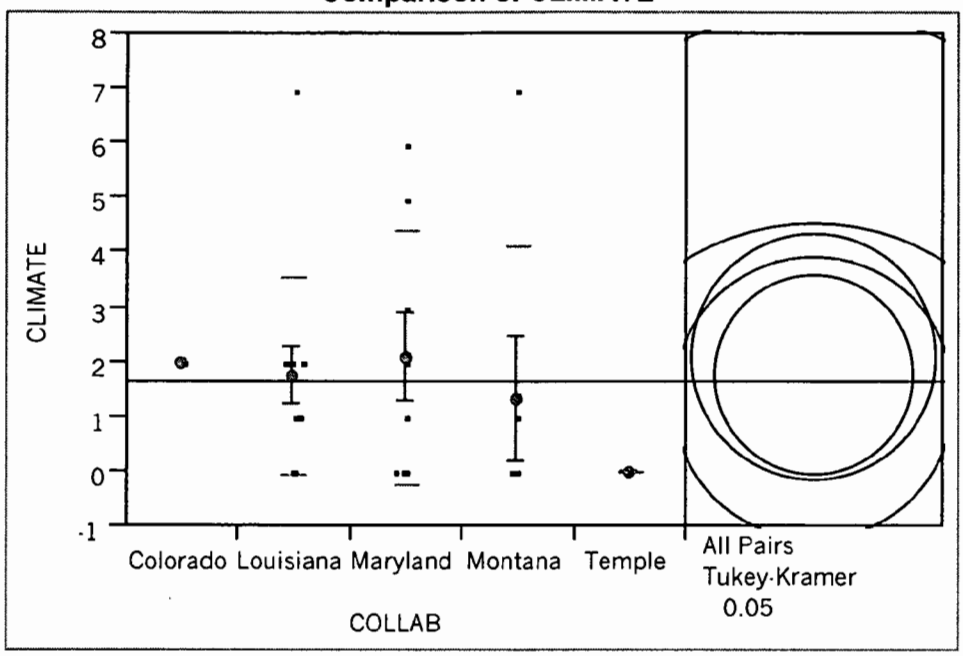


Figure E-2
Comparison of REACH

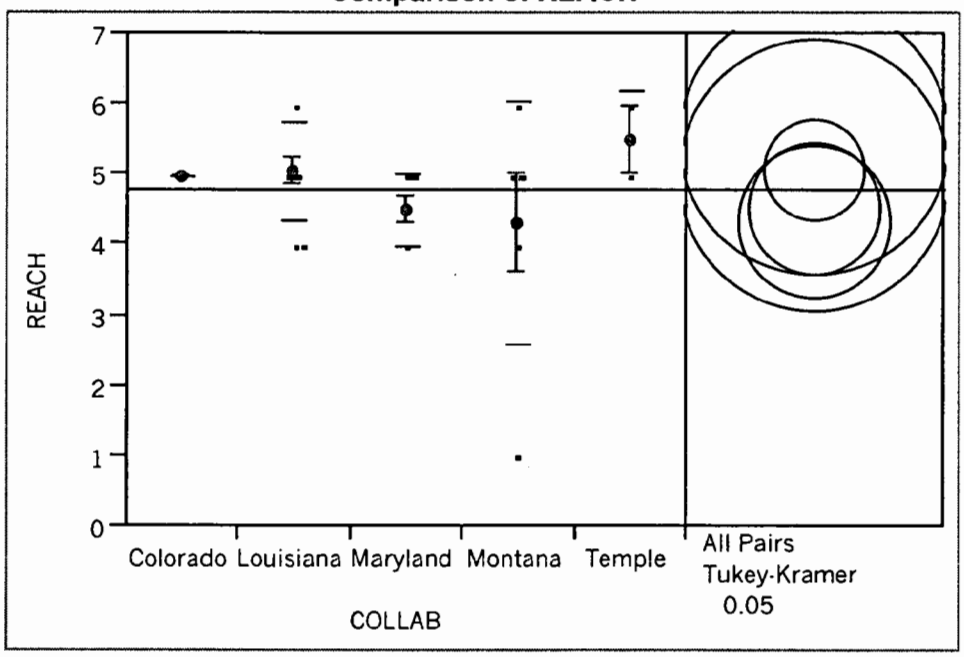


Figure E-3
Comparison of DISCIP

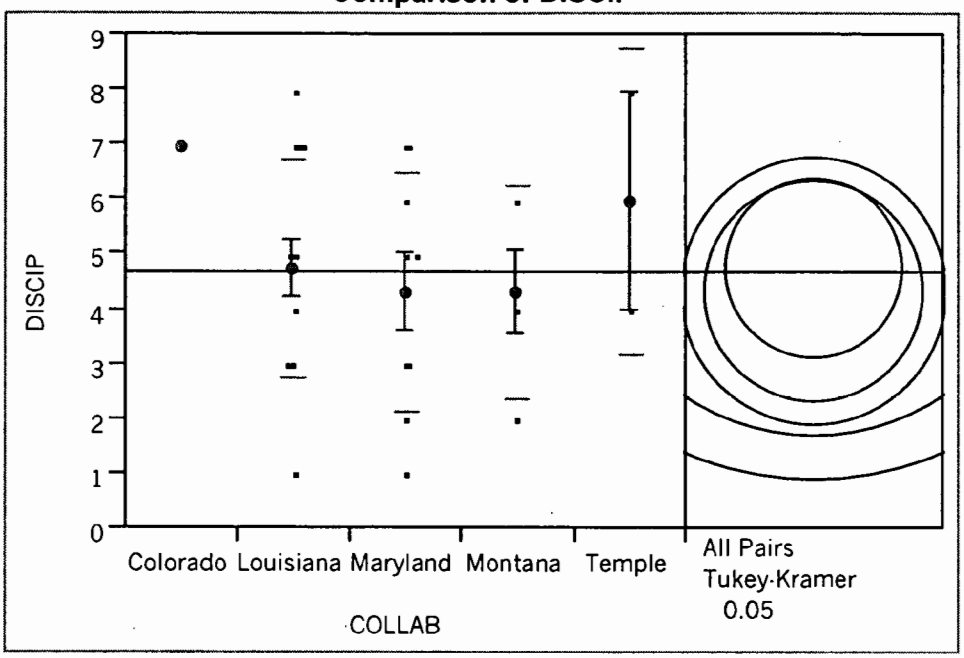


Figure E-4
Comparison of CREFORM

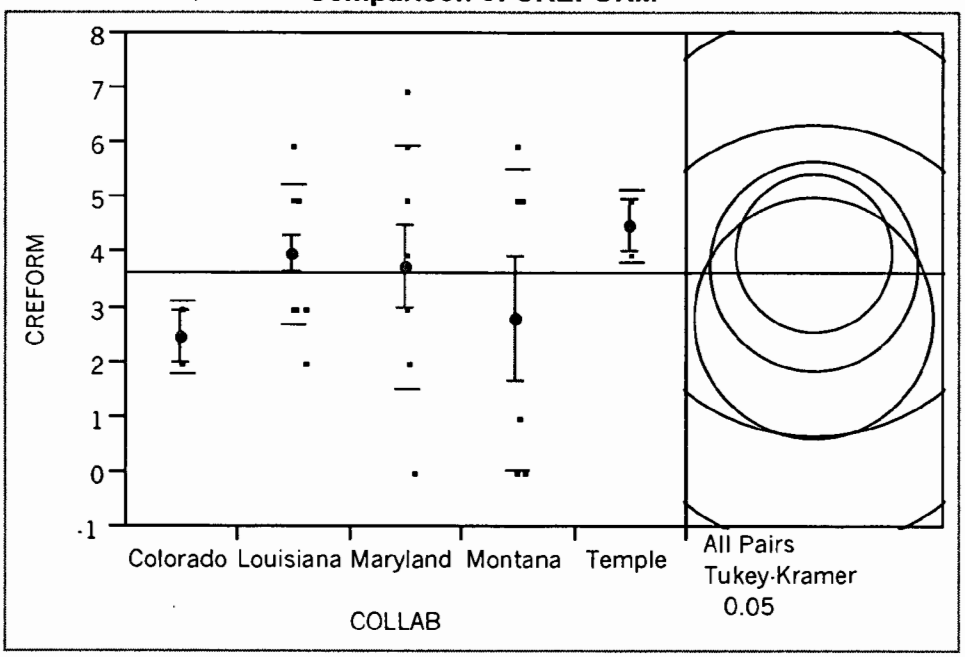


Figure E-5
Comparison of TREFORM

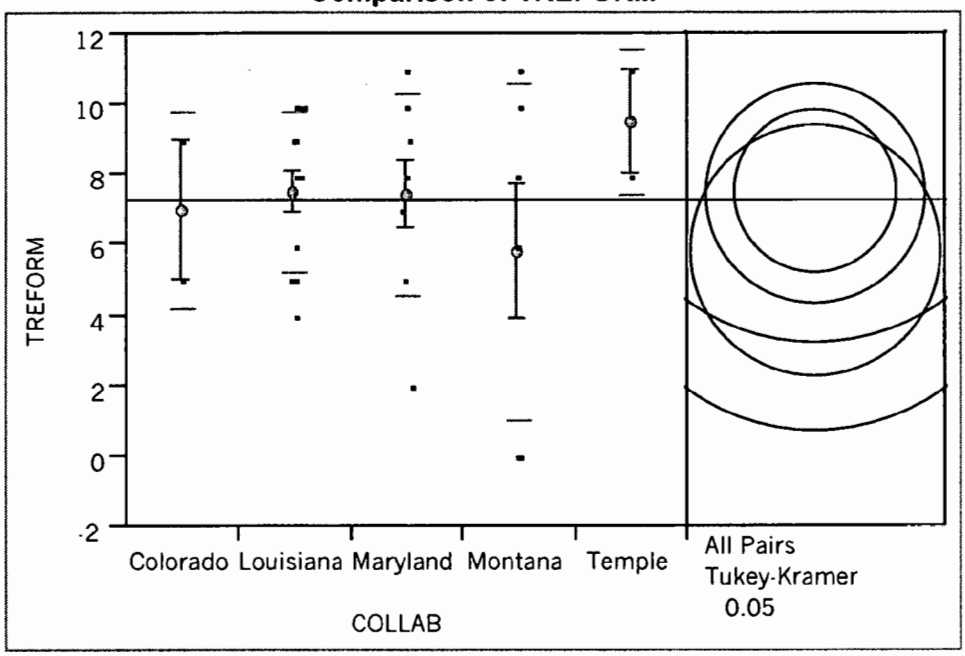


Figure E-6
Comparison of TOTREF

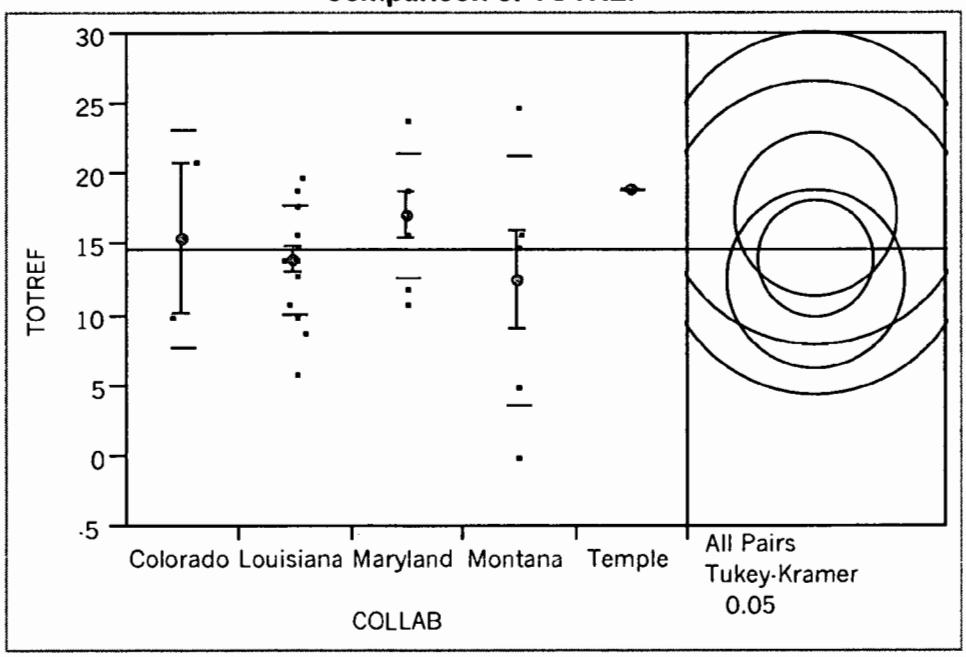


Figure E-7
Comparison of FCOLLAB

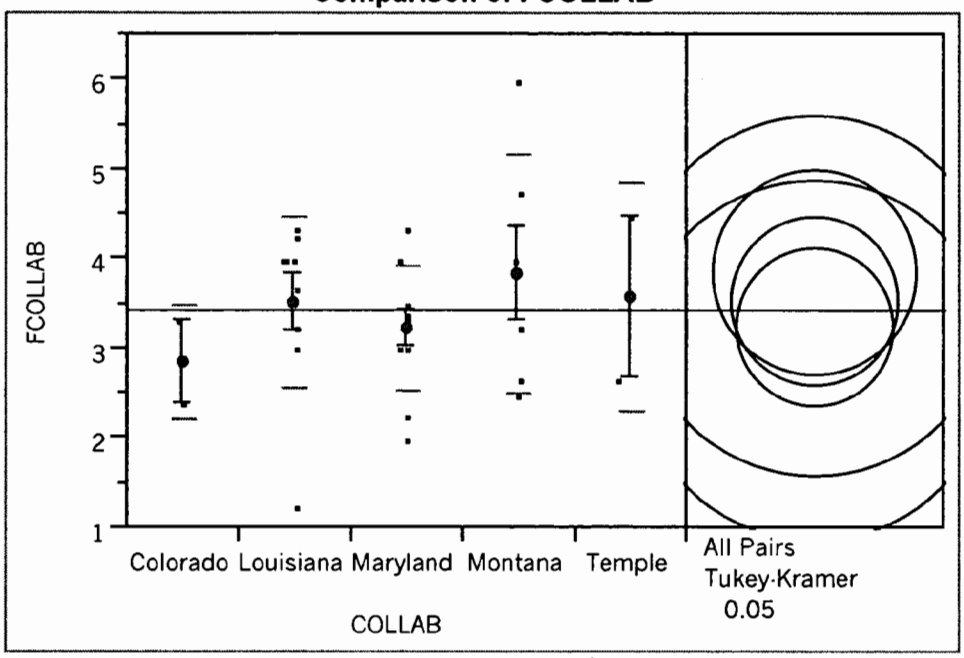


Figure E-8
Comparison of INVOLVE

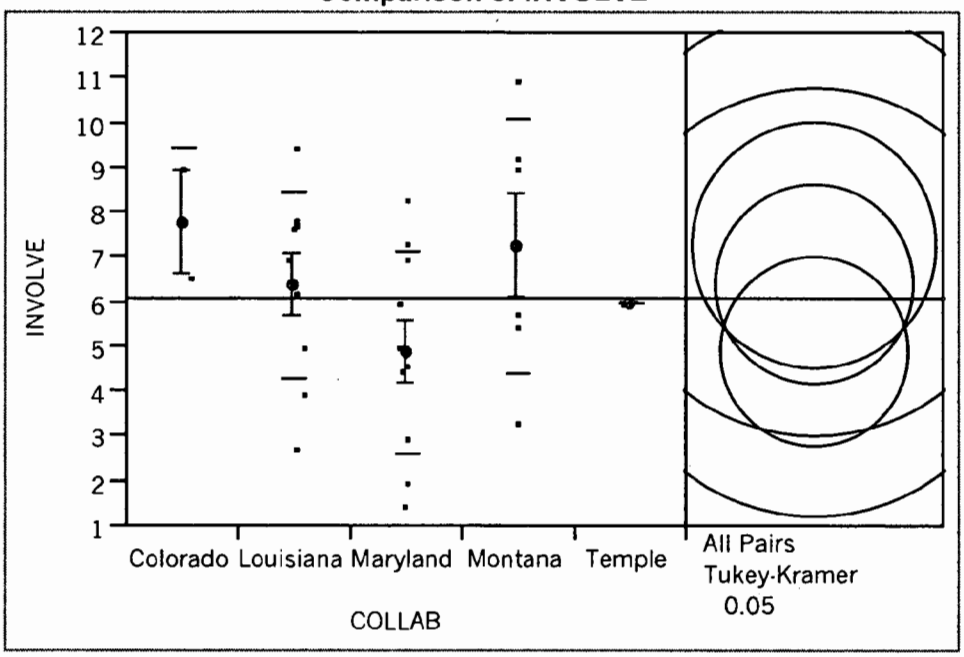


Figure E-9
Comparison of TOTLCOLL

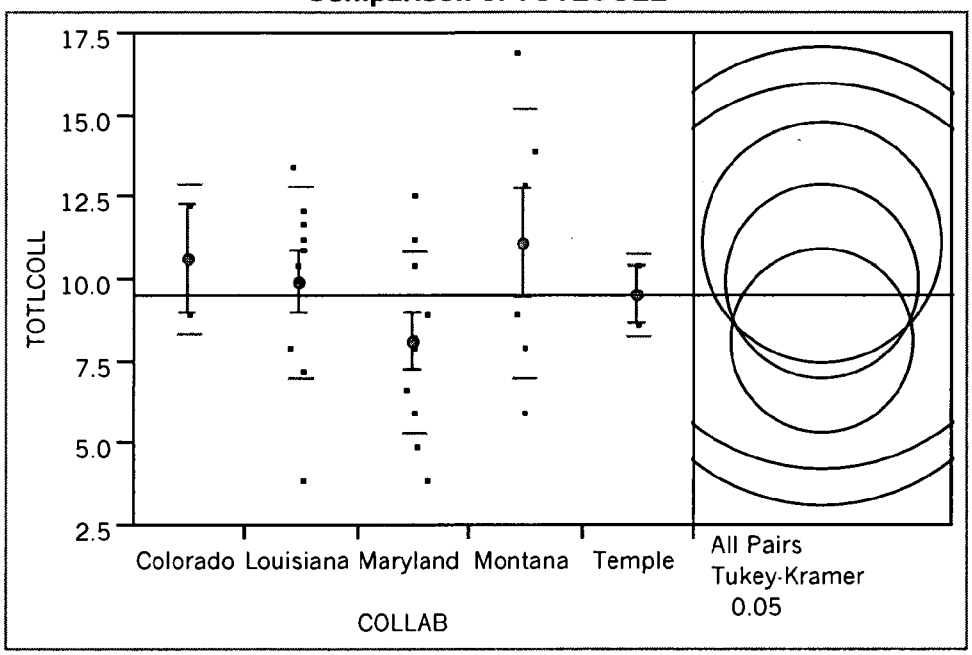
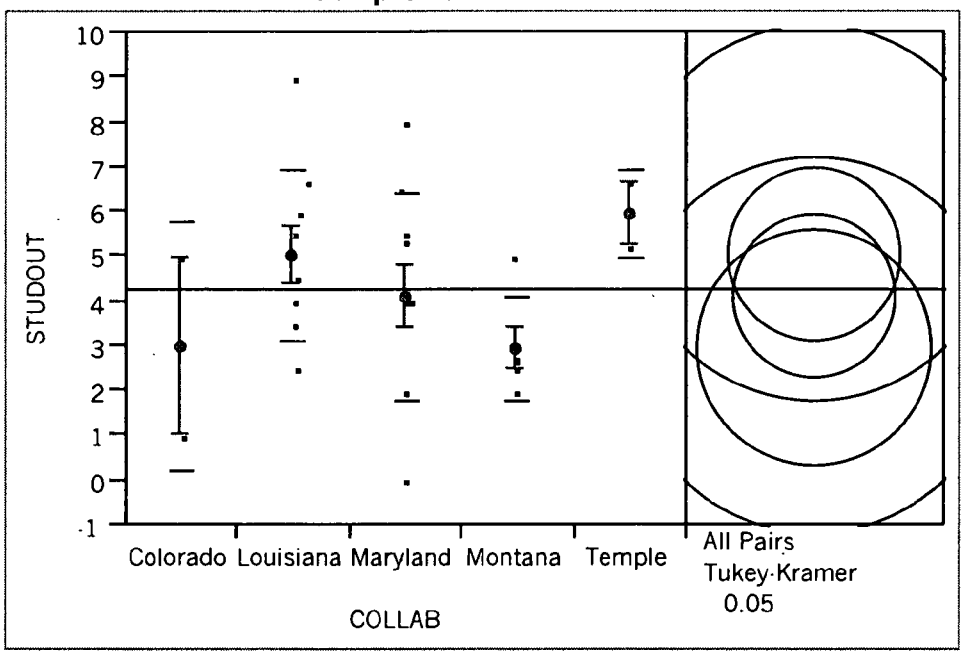


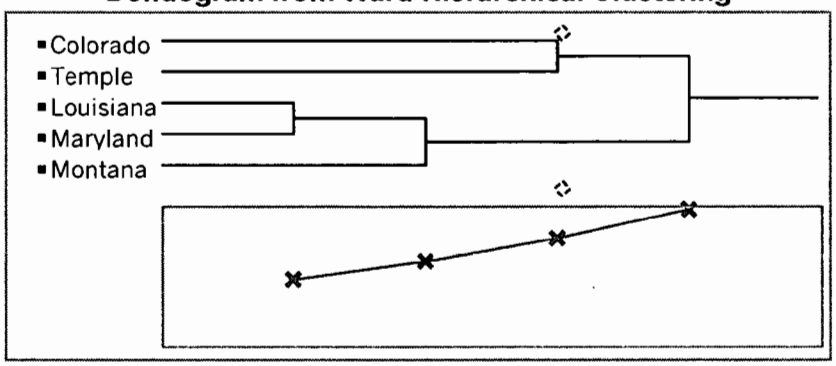
Figure E-10
Comparison of STUDOUT



Clustering

To evaluate whether a typology of CETPs could be constructed, a hierarchical clustering (using the Ward method; Milligan, 1980) was performed using the mean scores on variables reflecting project approach (DISCIP, INVOLVE, FCOLLAB, COURSES, REACH, CREFORM, TREFORM, PREFORM) for each CETP. The results of the clustering are shown in Figure E-11. Louisiana and Maryland form the first cluster and are joined by Montana. Colorado and Temple join last as a separate cluster. Several other clustering methods were tried (average, centroid, etc.); the only change was that Temple sometimes joined the Louisiana-Maryland-Montana cluster rather than joining Colorado.

Figure E-11
Dendogram from Ward Hierarchical Clustering



Correlations

Pearson correlations were calculated between variables of interest, across institutions. As above, variables from the faculty survey were averaged across all faculty at a given institution, and the institution mean value was used for this correlation. The correlations are shown in Table E-2, and correlations that were statistically significantly different from zero are indicated with an asterisk.

Cronbach's alpha was calculated as .655 for this set of variables (based on standardized variables). Cronbach's alpha is the same as Kudder-Richardson 20 for variables taking on only two levels. Leaving out the two variables that are calculated as the sum of other variables (TOTREF, TOTLCOLL), Cronbach's alpha is found to be .369.

Table E-2
Correlations for Selected Variables

Variables	CREFORM	TREFORM	PREFORM	TOTREF	INVOLVE	FCOLLAB	CLIMATE	STUDOUT	TOTLCOLL
CREFORM	1.00	0.64*	0.00	0.64*	0.27	0.19	-0.36	0.33	0.26
TREFORM	0.64*	1.00	0.35	0.89*	0.25	0.09	-0.16	0.05	0.21
PREFORM	0.00	0.35	1.00	0.67*	0.07	0.11	0.20	-0.21	0.09
TOTREF	0.64*	0.89*	0.67*	1.00	0.14	0.17	-0.02	0.03	0.16
INVOLVE	0.27	0.25	0.07	0.14	1.00	0.72*	-0.38	-0.02	0.98*
FCOLLAB	0.19	0.09	0.11	0.17	0.72*	1.00	-0.30	-0.04	0.85*
CLIMATE	-0.36	-0.16	0.20	-0.02	-0.38	-0.30	1.00	-0.18	-0.38
STUDOUT	0.33	0.05	-0.21	0.03	-0.02	-0.04	-0.18	1.00	-0.03
TOTLCOLL	0.26	0.21	0.09	0.16	0.98*	0.85*	-0.38	-0.03	1.00

- = Significantly different from 0 ($p<0.05$).

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Kramer, C. Y. (1956). Extension of multiple range tests to group means with unequal numbers of replications. *Biometrics*, *12*, 309-310.

Milligan, G. W. (1980). An examination of the effect of six types of error perturbation on fifteen clustering algorithms, *Psychometrika*, *45*, 325-342.

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