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AUTHOR Bruckerhoff, Charles; Bruckerhoff, Theresa
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ABSTRACT

This is the year-end evaluation for fiscal year 1998 of the Connecticut Statewide Systemic Initiative (SSI), known as Project CONNSTRUCT. The Connecticut Academy for Education in Mathematics, Science, and Technology is the fiscal agent for the SSI grant from the National Science Foundation. Data collection methods for this evaluation included interviewing key participants, observing activities and events organized or sponsored by the Academy, conducting surveys, analyzing student assessment data, and collecting relevant documents. The accomplishments of the Academy in this 7th year of operation include: (1) establishment of accountability procedures; (2) organization of a statewide technical assistance program to help school districts; (3) publication of mathematics and science program evaluation guides; (4) progress toward completion of an assessment project for science achievement; (5) organization and coordination of professional development services for teachers; and (6) solicitation of proposals from major technology corporations for partnerships to design an educational information management system. Information from a variety of sources indicates that the Connecticut Academy is making significant progress toward its goals for educational improvement and teacher professional development. Some issues for future program development are discussed. (SLD)

Connecticut Academy for Education in Mathematics, Science, & Technology

Project CONNSTRUCT

Year-End Evaluation

May 1998

by

Charles Bruckerhoff, Ph.D.
Principal Evaluator

and

Theresa Bruckerhoff
Research Associate

Connecticut Academy for Education in Mathematics, Science, & Technology Project CONNSTRUCT

Year-End Evaluation

EXECUTIVE SUMMARY

This is the year-end evaluation for fiscal year 1998 of the Connecticut Statewide Systemic Initiative (SSI), also known as Project CONNSTRUCT. The Connecticut Academy for Education in Mathematics, Science, and Technology is the fiscal agent for the Connecticut SSI, and has its headquarters in Middletown, CT. CONNSTRUCT is a Cohort I SSI state, receiving its first NSF SSI grant in 1991. In 1998, the initiative received a grant from the National Science Foundation (NSF) for approximately $1.4 million. Thus far, the initiative has received approximately $9 million from NSF for the purpose of reforming mathematics and science education in Connecticut.

The Connecticut Academy for Education retained Curriculum Research & Evaluation (CRE) in order to conduct this external, qualitative evaluation of CONNSTRUCT for the year-end report. The data collection methods included interviewing key participants from all aspects of the initiative; observing activities and events organized or sponsored by the Academy; conducting surveys; analyzing student assessment data; and collecting relevant documents. CRE has served as the external evaluator for the Connecticut Academy since its first year of operations.

In this seventh year, the Academy's main accomplishments include the following:

- established accountability procedures in all aspects of its organization;
- organized a substantial statewide technical assistance program that provided specialized professional development services to school districts, especially all four urban centers in Connecticut, including Bridgeport, Hartford, New Haven, and Waterbury;
- published the *Connecticut K-12 Mathematics Program Evaluation Guide* and the *Connecticut K-12 Science Program Evaluation Guide*;
- made significant progress toward completion of the Connecticut Academy Science Assessment Project (CASAP) for statewide voluntary assessment of students' science achievement in the 3rd, 5th, and 8th grades;
- organized and coordinated services with professional development service providers statewide; and
- solicited proposals from major technology corporations in the State to establish a business partnership to design and to implement an educational information management system for district- and school-based improvement.

At the year-end, documentation from a variety of sources indicates that the Connecticut Academy is making significant progress toward its three goals for the year. These goals

address concerns for increasing school districts' capacity to improve the performance of all students; for restructuring teacher preservice and professional development programs in Connecticut colleges and universities; and for building citizens' belief in, and support of, high performance standards for all students.

The main issues that surfaced in the analysis of data are, in reality, the finer points of systemic reform. In other words, successful implementation of a statewide data management system to support building and district-level decision making will require new development of ideas and practices relative to personnel and work contracts. Closing the gap in achievement that currently exists between higher achieving school districts and the lowest, such as Hartford, will not only require substantially greater investments in professional development and other resources, but also will require more time than is acknowledged publically by officials in Washington, DC as well as in Connecticut. Finally, changing institutions of higher education to create more effective teacher preparation programs is proving to be a particularly difficult element of systemic reform for many reasons, not the least of which is the perception that its curricula and programs are untouchables.

Throughout its seven years of existence, CONNSTRUCT has suffered no setbacks. Indeed, this year, like each of the preceding years, is characterized by success. It is the kind of remarkable development that causes directors of other SSIs and officials in Washington, DC to look on the Connecticut SSI with wonder. Nonetheless, every major player in the Academy's partnership will say without hesitation that, despite the great gains that have been made here, there is a tremendous amount of work yet remaining in order to improve the teaching and learning of mathematics and science for all children in Connecticut. A challenge for the Connecticut SSI is to define for itself mainly the process that exhibits this initiative as a systemic reform, as well as its products and effects.

Curriculum Research & Evaluation, 237 Singleton Road, Chaplin, CT 06235✦860-455-1229✦Fax 860-455-0011✦cre@connix.com

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INTRODUCTION

Fiscal year 1998 marks the seventh year of CONNSTRUCT's implementation in Connecticut. Project CONNSTRUCT is the Connecticut Statewide Systemic Initiative (SSI). Connecticut is a Cohort I SSI state that received its original award in 1991 from the National Science Foundation (NSF) for statewide improvement of mathematics and science education.[1] Since its inception, CONNSTRUCT has received uninterrupted support of approximately $1.2 million per year from NSF.

This is the second year of operations during which the Connecticut Academy for Education in Mathematics, Science, and Technology served as the primary administrative agent for the Connecticut SSI.[2] CONNSTRUCT's total award from the National Science Foundation for fiscal year 1998 is approximately $1.4 million. By the end of the current fiscal year, CONNSTRUCT will have received approximately $9 million dollars from NSF for the purpose of reforming mathematics and science education in Connecticut.

In 1996, CONNSTRUCT adopted the notion of a "Generational Improvement Plan" to signify that, within the span of one, twelve-year educational generation (1991 to 2003), Connecticut would "raise the quality and quantity of all students' engagement with mathematics, science, and technology."

In the current phase, CONNSTRUCT's systemic implementation plan lists three goals:

1. To increase school districts' capacity to improve the performance of all students over a broad array of indicators;
2. To restructure teacher preservice and professional development programs in Connecticut

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[1]The other Cohort I sites are: Delaware, Florida, Louisiana, Montana, Nebraska, North Carolina, Ohio, Rhode Island, and South Dakota. Connecticut and Louisiana the only Cohort I states to receive Phase II grants in fiscal year 1996.

[2]Project CONNSTRUCT and the Connecticut Academy for Education in Mathematics, Science, and Technology are the same entities. Participants refers to this organization as either CONNSTRUCT, the Connecticut Academy, or the Connecticut Academy for Education.

colleges and universities to reflect and to model national and state standards and the Connecticut curriculum frameworks; and
3. To build citizens' belief in, and support of, high performance standards for all students.

Also, the keys to CONNSTRUCT's success, with its implementation plan and its overall goal of creating educational excellence statewide in mathematics and science, are the following three objectives[3]:

1. To provide school districts with specific instruments and long-term technical assistance for standards-based teaching and learning of mathematics and science—issue: creating capacity;
2. To raise all students' performance through the implementation of technical assistance to each of the 166 school districts in Connecticut—issue: scaling up; and
3. To focus particular assistance on districts and particular schools where there is the greatest need to increase students' performance in mathematics and science relative to the State's goals, as shown by a variety of indicators, namely the CMT and CAPT, Advanced Placement, and Scholastic Assessment Test—issue: narrowing the gap.

Documentation from a variety of sources—including observation of activities, interviews with key participants, and formal test data—indicates that CONNSTRUCT has succeeded in accomplishing each of these objectives. During its seventh year, the Connecticut Academy developed and distributed a number of high quality, timely, and very useful resources that already have proven their effectiveness, especially in facilitating the capacity building and in scaling up efforts of local K-12 school districts. Also, it made good on its promise to provide technical assistance, especially to the State's urban school districts.

One of the most significant developments of the Connecticut Academy is that it published and disseminated the *Connecticut K-12 Mathematics Program Evaluation Guide* and the *Connecticut K-12 Science Program Evaluation Guide*, which are known to participants as "M-PEG" and "S-PEG," respectively. A second very significant development during 1997-1998 was that CONNSTRUCT fulfilled its responsibilities regarding provision of long-term technical assistance to the school districts. Each of the urban centers received sustained, site-based, and site-sensitive professional development that was keyed to the State's curricular frameworks. This was provided by a team of respected specialists. All 166 school districts in Connecticut received some assistance with the content-specific program evaluation guides, scheduling and use of time, and other services provided by the Connecticut Academy's technical assistance program and the Connecticut Resource Network.

One of the most promising new developments is the Connecticut Academy Science Assessment Project (CASAP), under the very capable leadership of Dr. Sig Abeles, former Connecticut State Department of Education Science Consultant. This project will provide school districts statewide with the opportunity for voluntary assessment of science in the 3rd, 5th, and 8th grades. Also, the Connecticut Academy solicited and received proposals from major technology corporations for development of an innovative statewide data warehouse system. This system will furnish an informed, integrated approach to decision-making at

[3]In the implementation plan, these items are called "cross-cutting issues," which helps to link the Connecticut plan for systemic reform with language from NSF.

district and building levels with regard to curriculum, student assessment, and professional development. Finally, the Connecticut Academy published and distributed its *Recommendations for Improving the Preparation of New Teachers in Mathematics and Science*. This document is intended to stimulate dialog and to foster substantive change in the State's institutions of higher education—including two-year and four-year colleges—so that teacher preparation and professional development is consistent with state and national standards for mathematics and science education.

This is the qualitative, year-end evaluation by Curriculum Research & Evaluation of Project CONNSTRUCT's 1997-1998 operations. The report begins with a brief discussion of the methodology. Next, there is an overview of CONNSTRUCT's systemic reform initiative, followed by a description of the scope of work that CONNSTRUCT outlined for the current year. The report of results emphasizes the impact CONNSTRUCT's technical assistance program has had on the local school districts, especially the urban centers—namely, Bridgeport, Hartford, New Haven, and Waterbury. Next, there is a discussion of themes and issues, including a challenge for the CONNSTRUCT's future development. Lastly, there is a brief summary and recommendations for improvement.

METHODOLOGY

The Connecticut Academy retained the services of Curriculum Research & Evaluation (CRE) for the qualitative assessment of CONNSTRUCT's operations in the seventh year. CRE has conducted external evaluations of CONNSTRUCT since its beginning in 1991 and, thus, is privileged to have an historical perspective on the Connecticut SSI. This year, there has been an increased emphasis on management by objectives throughout all aspects of the Academy, including the external evaluation. Thus, on a monthly basis, CRE submitted reports of its field study operations to the Academy for internal review and assessment.

CRE designed the external evaluation for the current year, which includes development of data collection instruments and protocol. The purpose of this evaluation is to collect and interpret data indicating the level of Connecticut SSI's success in reaching its specified goals, implementation of activities, and assessment of outcomes as stated in its scope of work for 1998. CRE also worked with the Academy's Data Collection Facilitator, representatives of the Connecticut State Department of Education, and Academy personnel in order to identify relevant school district improvement and student performance data from CONNSTRUCT's core, inner, and outer ring school districts.

Methods of data collection included the following: interviews with key participants and officials at the Academy, its partners, and officials that represent participating school districts throughout Connecticut; analysis of student achievement data; surveys; observation of key events sponsored by the Academy, including Board of Directors meetings, various program committee meetings, and strategy sessions; and collection of documents.

CONNECTICUT'S SYSTEMIC REFORM

CONNSTRUCT has students in the 166 school districts of Connecticut at the very center of its systemic reform initiative, with special emphasis on the State's urban centers—including Bridgeport, Hartford, New Haven, and Waterbury. Hence, every element and operation of this statewide project contributes substantially and continuously to significant improvement of children's learning in mathematics and science. The core element of this reformed statewide system of education in mathematics, science, and technology is the deliberate, full-scale organization of standards-based curriculum content, instructional practices, and assessment tools and procedures. The sustaining elements of CONNSTRUCT are its continuous employment of highly qualified people, its broadly based partnerships with public and private organizations, and its reliance on a developmental approach to educational leadership.

Since CONNSTRUCT's beginning in 1991, the Connecticut State Department of Education has been a key partner. The State's mathematics curriculum consultants, Steve Leinwand and Mari Muri, and the State's science curriculum consultant, Steve Weinberg, continue their service as the grant's co-principal investigators. This is in association with the executive director, Richard Cole, and the past presidents, Eunice Groark and Robert Rosenbaum, who is also a principal investigator. Other key partners of CONNSTRUCT include the Connecticut State Department of Higher Education; representatives from business and industry whose national and international headquarters are located in Connecticut; the Connecticut Business and Industry Association (CBIA); private funding agencies; two-year and four-year colleges and universities; professional development programs such as the Connecticut Pre-Engineering Project (CPEP) and the Project to Increase Mastery of Mathematics and Science (PIMMS); science-rich museums; and the Connecticut General Assembly.

As a result of this effective and longstanding partnership between public and private sectors, the priorities for educational policies, leadership, governance, and funding remain focused on improving children's performance—including their attitudes and achievement—at State and school district levels on standards-based mathematics and science. Two additional benefits of CONNSTRUCT's broadly based partnership are the statewide coordination of effort and the wise development and use of resources. Connecticut's program is recognized nationally as a model for the alignment of state and national standards for mathematics and science education.

The implications of CONNSTRUCT's operations at the school district level are the following: coherent and widely accepted goals for mathematics and science education that are consistent with the State's curriculum frameworks; strategic plans for the professional development of staff; and ongoing analysis of data from the Connecticut Mastery Test (CMT), which does not include science, and the Connecticut Academic Performance Test (CAPT), which includes science, for decision-making regarding curriculum development and instructional programming.

At the school building level, CONNSTRUCT provides a wide variety of professional development services to classroom teachers and building principals. All of these are keyed to the State's mathematics and science curricular frameworks and are contingent upon the expressed needs of the classroom educators and their administrators. Current topics include the following: collaborating of faculty, interdisciplinary curriculum planning and instruction;

identifying students' needs; involving parents in the education of their children; setting annual student performance goals; using performance-based assessment instruments; and consolidating resources for improving students' achievement.

In the classrooms, the locus of direct impact, CONNSTRUCT supports student learning that is consistent with the State's curricular frameworks. Typically, a student's mathematics and science education includes daily participation in one or more projects involving age-appropriate, inquiry-oriented tasks. Teachers guide their students' in collaborative, as well as individualized learning situations that involve technology and other appropriate instructional materials for solving realistic problems. Periodically, there are formal assessments of students' achievement—most notably, the CMT for the 4th, 6th, and 8th grades, and the CAPT for the 10th grade.

SCOPE OF WORK FOR 1997-1998

The Connecticut Academy's Scope of Work for 1997-1998 included the following six drivers:

1. Increase student performance scores in the four urban districts.
2. Maintain focus on higher education, science assessment, and district implementation of curriculum frameworks. Disseminate information about the Connecticut Academy's work to parents statewide.
3. Identify and coordinate resources—including time allotted for teaching and professional development—and disseminate information from the Third International Mathematics and Science Study (TIMSS).
4. Continue support of professional development activities targeted toward the new State curricular frameworks; encourage out-of-school learning; support Family Math, Family Science, and Equals programs; and distribute Family Toolkits to parents in the four urban districts.
5. Expand the work on a data warehousing and mining system.
6. Provide training to school administrators on data-based decision-making.

The Scope of Work has specific, site-based objectives for each of the urban school districts, including coordination of district strategies with CONNSTRUCT strategies and expected outcomes. There is also specific detail regarding the technical assistance that CONNSTRUCT would provide to the "inner ring" districts[4] and all of the other school districts ("outer ring") in the State.

[4]These are smaller cities in Connecticut, such as New Britain and Bloomfield, that are near the urban centers or are located in rural areas, and experience many of the same social and educational issues as Hartford, for example.

CONNECTICUT ACADEMY'S ORGANIZATIONAL STRUCTURE AND STAFF[5]

In 1992, the Connecticut State Legislature designated the Connecticut Academy as the State's advocate and broker for high standards in the teaching and learning of mathematics, science, and technology. The Connecticut Academy has a set of bylaws specific to the organization and is governed by a Board of Directors, whose officers are voted into positions by members of the Board. The current officers are the following:

President—Charles Bruce, IBM Corporation
Immediate Past President—Eunice Groark
Vice-President—Carl Seefried, Olin Corporation
Secretary—Nicholas Caruso, Connecticut Association of Boards of Education
Treasurer—Ann Pollina, Dean of Faculty at Westover School

The Connecticut Academy has an Executive Committee made up of five regular members and four ex officio members, including:

Executive Committee—Andrew De Rocco, Commissioner of Higher Education
Executive Committee—Roseanne Hornyak, School Administrator
Executive Committee—Albert Snow, Science-Rich Institutions
Executive Committee—Robert Rosenbaum, Past President
Executive Committee—(open)

Ex Officio Member—Theodore Sergi, Commissioner of Education
Ex Officio Member—Denise Merrill, Connecticut General Assembly
Ex Officio Member—Steve Leinwand, Principal Investigator, CSDE Math Consultant
Ex Officio Member—Richard Cole, Executive Director

The staff at the Connecticut Academy includes the following:

Executive Director	Richard Cole
Director of Administration and Programs	Terri Clark
Director of Urban Technical Assistance	Gemma Joseph Lumpkin
Coordinator of Technical Assistance	Christopher Shepard
Coordinator of Technology Services	Glen Jensen
Accountant	Ann Naughton
Administrative Assistant	Barbara Wester
Student Intern	Oshadi Kelly
Student Intern	Janine Robinson

A major strength of the Connecticut Academy is that, throughout its seven years of development, there has been consistent, high quality leadership and staffing. Documentation shows that the organization followed its bylaws for all changes of personnel relevant to the Board of Directors. During the past seven years, there has been no turnover in the executive leadership, other than the planned changes of the Board's officers. Also, most current partners were part of the Connecticut Academy from the first year, adding a small number of new

[5]To read a public statement of the Connecticut Academy, visit its Web site developed by Glen Jensen at www.ctacad.org.

private sector partners. The largest change in staff occurred at the end of Phase I, when several individuals, who had been with the Connecticut Academy since its earliest days, sought employment elsewhere. As could be expected, the transition to new staffing was difficult. However, due to the timing of the change and hiring of other highly qualified and committed personnel, there was no disturbance in the project's operations.

Mr. Richard Cole continues in the position of Executive Director, and has the overall responsibility for management and direction of the Connecticut Academy. As the Director of Administration and Programs for a second year, Ms. Terri Clark manages the Academy's numerous, day-to-day operations and plays a lead role in developing new and existing programs. The work assignments of Gemma Joseph Lumpkin, Christopher Shepard, Glen Jensen, Ann Naughton, and Barbara Wester are somewhat more specific, and entail very demanding schedules. The evaluator asked Mr. Cole if there was one thing that stands out as a significant accomplishment in year seven. He paused for reflection and then said, "Yes, there is one thing that's made CONNSTRUCT successful and that is the dedication and the quality of the people working to improve education in Connecticut. These people I have working with me have made this all happen. They are truly outstanding."

ASSESSMENT OF IMPACT ON URBAN SCHOOL DISTRICTS

Organization and Staffing of Technical Assistance

The Director of Urban Technical Assistance for the Connecticut Academy is Ms. Gemma Joseph Lumpkin. This is the second year of the technical assistance program and Ms. Lumpkin's second year of work at the Connecticut Academy. Her task is to organize and to manage a team of specialists to work in collaboration with school district and building administrators, teachers, partners, and parents in order to provide intensive, technical support. In this comprehensive, ongoing process for systemic change, the technical assistance team manages resources and services to meet the school districts' needs with regard to achieving excellence in mathematics, science, and technology education for all students. The Director of Urban Technical Assistance works in association with the Director of Programs and Administration for the Connecticut Academy, Ms. Terri Clark. Also, there is additional support for the technical assistance program provided by the Coordinator of Technical Assistance, Mr. Christopher Shepard, and the Coordinator of Technology Services, Mr. Glen Jensen.

The Connecticut Academy's technical assistance team is organized and staffed as follows:

Bridgeport
- Mathematics Facilitator: Dr. Louise Herot
- Science Facilitator: Dr. Sig Aebles

Hartford
- Mathematics Facilitator: Dr. Tim Craine
- Science Facilitator: (open)

New Haven
- Mathematics Facilitator: Dr. David Pettigrew
- Science Facilitator: (same)

Waterbury
- Mathematics Facilitator: Ms. Kathy Bavelas
- Science Facilitator: Dr. Sadu Nanjundiah

Each of the site-based technical assistance facilitators has a team of specialists, who provide services consistent with the goals of the Connecticut Academy and the specific needs of the school district or building. Also, the particular facilitator, Director of Urban Technical Assistance, and the team of specialists work in close association with a school district's curriculum directors, consultants, and curriculum consultants from the Connecticut State Department of Education.

For example, Dr. Louise Herot, Mathematics Facilitator for the Bridgeport city schools, has a team of seven specialists that she managed in the current year to help that school district accomplish its specific objectives for mathematics education. The size of each team varies, depending on tasks that must be accomplished and availability of personnel with requisite expertise. Thus, Dr. Sig Abeles, Science Facilitator for Bridgeport, relied upon two specialists for his work in that city during fiscal year 1998. The Connecticut Academy did not appoint a science facilitator for the Hartford schools because that school district's position of science coordinator remained unfilled until spring 1998.

Each of the technical assistance facilitators and specialists received a contract that described the services they were hired to perform in specific, objective terms; professional fees; and the length of the contract period. The Connecticut Academy's system of statewide technical assistance involved a large number of individuals and encompassed a great variety of specific tasks—devoted to systemic reform at school building and district levels. Hiring, management, and supervision of this work force entailed significant attention. Finally, success with the technical assistance program required considerable contributions from the Connecticut Academy's accountant, Ms. Ann Naughton.

The technical assistance facilitators met on a monthly basis with the Director of Urban Technical Assistance and other officials from the Connecticut Academy. These meetings were for obtaining formal progress reports from each district for discussing issues specific to the sites, for sharing solutions and resources, and for planning further development and scaling up the technical assistance program.

Interview data from district curriculum coordinators, building principals, and teachers indicates that the technical assistance program is highly valued by local educators. It helps them target their specific needs, especially in regard to implementing the new State curricular frameworks; interpret CMT and CAPT assessment results; and receive up-to-date content knowledge and curriculum materials. Everyone who served in this technical assistance program received high praise from the local participants. There were no complaints. There were requests from every school district for many more services from the Connecticut Academy's technical assistance team.

Ms. Lumpkin described the approach taken by the technical assistance program as emphasizing on-site, one-on-one, classroom-by-classroom work. During this year, the team discovered that this intensive co-teaching was the most effective overall method for accomplishing their mission. Ms. Lumpkin also said that the central issue is: How to do this one-on-one professional development with so many teachers in Connecticut? The solution is to develop a management system and to organize the team of specialists. For the Academy, there is another important concern at the building level. The other important issue about professional development is: How to put instructional leadership at the top of the list of duties for building principals? According to Ms. Lumpkin, that task will be the key to success for the technical assistance program next year. Data indicates that the scope of work for the technical assistance program was great, but the Connecticut Academy realized genuine success in its first year.

Mr. Richard Cole, the Executive Director of the Connecticut Academy, said that Ms. Lumpkin has made great inroads with the four core districts in this first year. In his opinion, the "technical assistance process is maturing in the districts. We succeeded in getting the attention of the superintendents on 'benchmarking,' especially in Bridgeport, New Haven, and Waterbury." Nonetheless, every school district has its own peculiar educational environment issues that require special attention by any outside agency expecting to have a positive impact on the situation. Thus, an important key to success in this process is the effective partnership between the Academy, the Connecticut State Department of Education, and the officials in the local school districts.

Bridgeport

Feedback from building principals indicates that a new and better understanding of curriculum has resulted directly from the Academy's technical assistance program. Principals report that teachers' instruction, materials, and assessment practices are changed and are in alignment with the standards in mathematics and science. The details of teachers' and principals' plans demonstrate evidence of institutionalization, and, thus, "sustainability" of these important changes. Also, reform in the changes in curriculum, professional development, and use of resources is evident. District administrators report a strong relationship between the district, the Connecticut State Department of Education, and the Connecticut Academy.

The technical assistance process is working in Bridgeport. Officials at the Academy maintain that this is one of their most successful demonstration sites for the partnership model. Assistance from the Academy was welcomed by Bridgeport from the start of its reform of mathematics and science. There are highly qualified people in the district's curriculum coordinator positions and the senior staff positions. There is substantial support in the budget and management of resources for the different schools. Documentation indicates that, in all of these areas, the goals of both the Bridgeport system and the Academy are parallel.

The Curriculum Coordinator for Bridgeport, Mr. Bill Glass, said the following about his work and the Academy's technical assistance program.

> "The only issue I have with the Academy's technical assistance program—and this is kind of self-serving, but I'll say it anyway—is that we would like as much on-site service as we can get. Our math scores are climbing, as we have put emphasis on mathematics. Our science scores are low. Now, we are upgrading our science curriculum. That's a massive job. It would be great if we could get more on-site assistance for generic applications in science K-12. We are very pleased with the Academy's help, but we badly need more help."
>
> "Bridgeport's Board of Education is going above and beyond the call to help get money from outside sources. So, the Board's participation and success has been a springboard for additional funds. We have a close relationship with the Connecticut State Department of Education. In fact, we will work with anybody and everybody on this."
>
> "That's the big picture here, and 'all is well.' However, we need as much assistance as we can get because improving kids' mathematics and science achievement is a big job in a city like Bridgeport. We have a vision of where we want to be in the next few years, and we want to partner with others who will help us get there. The Academy is an important player for us."

The main issues in Bridgeport are the following: overall communication between participants, staff development for building principals, and help teachers increase their expectations for students' achievement. These concerns are repeated in each of the other districts.

Mathematics

The Bridgeport system received technical assistance that included professional development, materials and equipment acquisition, curriculum development, and lesson planning. The Technical Assistance Facilitator, Dr. Louise Herot, reported there were few substantive changes made in the plans for Bridgeport. She indicated that there were some modifications. For instance, one of the specialists, Dr. Michael Hibbard, was not available, so the workshops were conducted by others. One change involved a delay in training and implementation of *Math Connections*. The delay was caused by the cancellation of planned workshops that would have introduced the teachers to the program and would lead to its adoption.

In coordination with the district personnel, the technical assistance facilitator planned 18 workshops for K-6 teachers (4 were canceled), 6 for teachers of grades 7-8, and 7 for high school (4 were canceled). These workshops occurred after school, during in-service on released time, and as classroom demonstrations. Also, in partnership with the district, the Academy provided manipulative materials and graphing calculators for teachers' classroom use so they would have the materials and equipment demonstrated in the workshops.

Concerning curriculum development, the technical assistance facilitator organized three meetings in order to begin writing a new mathematics curriculum for grades 7 and 8. The Academy provided copies of the *Connecticut K-12 Mathematics Program Evaluation Guide* and participated in the local discussions. Additionally, the facilitator provided assistance at more than 30 meetings with district personnel regarding the curriculum planning and referring to the programs outlined above. The topics of these meetings had a broad range—from specifically determining which schools, topics, and presenters would be used most beneficially, to providing general assistance in how to write a strategic plan.

Comments from district personnel indicate that all teachers from grades 7 and 8 are now routinely using the graphing calculators. Also, teachers in at least one of the target elementary schools are now using manipulatives consistently. The mathematics curriculum for grades 7 and 8 is near completion. Finally, staff members have adopted an "action plan" demonstrated by the technical assistance facilitator to improve understanding and to facilitate the planning process.

During the year, the only issues that surfaced concerned communicating with district level administrators and scheduling professional development for the high school. Unfortunately, lack of communication with the administration caused cancellation of a number of workshops and other collaboratively planned events between the Bridgeport teachers and the Academy. However, this problem has been solved. At the high school it was difficult logistically for the technical assistance facilitator to bring teachers together in one place for professional development. Also, the three high schools are pursuing different objectives, thus teachers were not permitted to attend workshops that did not directly apply to their school's goals.

To address some of the issues in Bridgeport, Dr. Herot recommends regular meetings of the various agencies involved in providing assistance to the district, including consultants from the Connecticut State Department of Education, PIMMS, and so on. If adopted, this process would lead to better communication between agencies, better coordination of programs, and greater clout in gaining commitments from the highest levels of the district.

Science

Personnel at the Academy and at Bridgeport cooperated in supporting the work of Dr. Sig Abeles, the Technical Assistance Facilitator for Science in Bridgeport. Members from both groups have been fully involved in the development of new curricula, of professional advancement, and of assessment activities. The plan of action used by Dr. Abeles stressed meeting with Bridgeport's science supervisors and teachers in order to help them achieve significant progress toward accomplishing mutually agreed upon objectives.

While it is still early, according to Dr. Abeles, the technical assistance program in Bridgeport appears to have found favor with many science teachers. Attendance at workshops has been good. The Scholars in Residence program has motivated teachers to voluntarily attend additional workshops and field trips. Thus far, however, there is no evidence to indicate what impact this work is having on student performance overall. The Riverside assessment is an exception. The results of the Riverside assessment for the 8th grade have shown positive results in learning science for that year. These results may be attributable to the involvement of the Academy, since the 8th grade teachers participated in its professional development activities. However, the Academy's development of the science assessment instrument will, once implemented, enable Bridgeport, for the first time, to link changes in the science curriculum with changes in students' performance.

As an example of the technical assistance provided to the Bridgeport teachers, Dr. James Tucci provided 9th grade general science teachers with programs in optics and mechanics. Background information and materials were included. For optics, experiments with plane mirrors were demonstrated. In mechanics, experiments with pulleys and levers were demonstrated. All were with handouts. Also, there was a complete discussion with the teachers of Newton's Laws of Motion and how they relate to forces, energy, and momentum. Dr. Tucci reported that the teachers' and administrators' response has been excellent. The issue that Dr. Tucci encountered in the workshop regarding the new science curriculum in the Bridgeport schools—i.e., the teachers are at all different stages of familiarity with it and use of it. Thus, teachers were eager for help with the particular material they were covering, a situation which was difficult for the technical assistance facilitator to address in a short time.

The major change to plans for technical assistance involved the addition of a Scientists in Residence Program. This change was requested by the system after discussion with the technical assistance facilitator. Bringing individuals into the classroom who had expertise in science and individuals with different approaches to teaching was seen as a beneficial opportunity for students and teachers. Through the Scientists in Residence Program, teachers would gain additional background in science content and methods of science teaching being consistent with the changes introduced through recent curriculum development.

To accomplish this task, the technical assistance facilitator worked with the secondary school science coordinator for Bridgeport, Dr. Rose Meyers, to contact a number of consultants. Eventually six consultants agreed to serve as Scientists in Residence. Currently, these specialists are providing professional development for teachers and classroom activities for students in the Bridgeport Public Schools. The technical assistance facilitator expects this program to continue and to expand in the next year.

At the elementary school there were plans for implementing an existing science assessment

program at each grade level. However, the Academy's development of its science assessment program caught the attention of the elementary science coordinator, Dr. Ken Martinelli, who chose to use the Academy's assessment tools for the Bridgeport Public Schools. Currently, Dr. Martinelli serves as a member of the advisory committee for development of the Academy's science assessment instrument.

According to Dr. Abeles, communication "up the ladder" is the main issue with providing technical assistance to the Bridgeport Public School system. In this regard, Bridgeport is like every other large, urban system. The Academy assists Bridgeport in a partnership with the Connecticut State Department of Education and Brown University. Despite the efforts of the Academy, including the technical assistance program, information is not reported regularly to the superintendent of schools. Consequently, the superintendent of schools is unaware of the systemic reform activities in the district's science program and, unfortunately, does not realize that anything is happening in the field of science. To remedy this situation, members of the Academy's partnership decided to schedule formal meetings where representatives from the Academy would meet with the curriculum consultant from the Connecticut State Department of Education and members of the Bridgeport school administration.

Thus, the main problem in this first year has been lack of communication with the higher levels of the Bridgeport Public School System. As a result of poor communication and misunderstanding, a number of science workshops—along with mathematics workshops—were canceled. In some instances, these cancellations occurred at the last minute, frustrating everyone involved in these events. A related problem concerns effective communication with parents in the Bridgeport metropolitan area. The technical assistance facilitator plans to focus attention on increasing the flow of information about science education to both the school officials and the parents.

Hartford

Hartford is a special case in the Connecticut SSI for a number of reasons—mainly that its students usually score lowest on the CMT and CAPT and that the State Legislature controls the district. In spring 1997, a Board of Trustees, appointed by Governor John Rowland, replaced the Hartford Board of Education. As a final act, amid substantial disagreement, the outgoing Board of Education hired a new Superintendent of Schools, Dr. Patricia Daniel. Information appears almost daily in *The Hartford Courant* indicating that the new superintendent's "honeymoon" period moved quickly into a rocky first year. Reports show that, despite reassurances from Dr. Daniel, both the Connecticut State Department of Education and the Hartford Board of Trustees are disappointed with her performance.

Interview data suggests Hartford has a good plan for implementing the standards-based curriculum, particularly in mathematics. There is also evidence that some progress has been made to implement the plan, especially in high school mathematics for 9th through 12th grades. Currently, the Academy will focus on one building, Bulkeley High School, because there is adequate support in that building from the administration and teachers.

There is also an action research program underway with college faculty participation who work on a one-to-one basis with 9th and 10th grade teachers. The focus of this research program is on implementing the standards. Thus far, results indicate that modest gains have been made. However, the plans for this program called for five teachers, but only two

teachers volunteered to participate.

Building principals at Weaver High School and Bulkeley High School have endorsed the partnership with the Academy, with its focus on restructuring the mathematics curriculum. The 5th to 8th grade mathematics curriculum was progressing substantially, until the mathematics coordinator for the Hartford Public Schools had to take a leave of absence for health reasons. Nevertheless, despite that loss, teachers in these grades continued sharing successful strategies for teaching mathematics. Thus, the whole-scale implementation that had been planned for the year did not occur, although some gains were made.

The Connecticut Academy also provides support to the Math Education Center. Mr. Richard Barton directs and works with the mathematics technical assistance facilitator on curriculum implementation. At Bulkeley and Weaver High Schools, Mr. Barton also works directly with students, who need assistance with the 9th grade standards-based integrated mathematics program of study. This is an in-school program that provides tutoring during class periods to small groups of students.

At the Kindergarten through 5th grade levels, emphasis was on developing science curriculum. The strategy called for the educators to spend less time dealing with administrative issues and more time working directly in the classroom. The Director of Urban Technical Assistance said that participation from school exceeded expectations. Thus, currently there are six schools that are expected to complete their work for the year with the science facilitator.

According to the Director of Urban Technical Assistance and the Mathematics Technical Assistance Facilitator, a main issue in Hartford is raising the teachers' expectations for their students. Another issue is the delay in making a formal announcement of changes in the graduation requirements for students. Staff, students, and parents have not been alerted to the changes, which affect this year's incoming freshman class. A third issue is improving the students' attitudes regarding mathematics and science and their appreciation of the CAPT assessment in these content areas. There is also the issue of dealing with teachers' discontent at the high school level, due to a variety of factors related to the mathematics curriculum restructuring. Finally, there are questions about the compatibility of the new superintendent of schools with the district, particularly since the State has assumed control of the district.

During 1998, work with the Hartford Public School District has been the Academy's greatest challenge. Officials at the Academy expected much more progress than can be reported at this time. They are frustrated by the slow pace of things, despite how adept school district officials are with the rhetoric of systemic reform. Yet, under their direction curriculum development and policy changes occur very slowly. Additionally, as measured by the CMT and CAPT, students' achievement scores show slow improvement and continue to register as the lowest in the State. However, Academy officials and their partners have not given up on Hartford. Expressing this positive sentiment, Richard Cole said, "It's the slow, the tiny, the incremental movements that we have to rely on to keep our positive thinking, especially with Hartford." The Academy and its partners have plans and ideas for systemic education reform in Hartford, but progress toward the goal is taken one careful step at a time.

Mathematics

The Mathematics Technical Assistance Facilitator, Dr. Tim Craine, reports that he is

particularly encouraged by the work of the middle school planning committee. This committee has met under the direction of the district's mathematics coordinators, Mr. Jimmie Hill and Ms. Pamela Barker-Jones. There are indications that a stronger mathematics program will result from their work in the 5th - 8th grades—namely, the students will be better prepared for the CMT, the CAPT, and to have success in the high school integrated mathematics program. At the middle school level, in April a placement test was administered to all 8th grade students. Results of this test, along with teacher recommendations, will be used to determine placement of these students in 9th grade courses.

However, implementing the high school integrated mathematics program has not proceeded smoothly. At the first marking period for the year, documentation indicated that approximately two thirds of the 9th grade mathematics students earned D's and F's. The technical assistance facilitator attributed these unsatisfactory results among the students to several variables—including poor attendance, inadequate preparation at the middle school level, poor study habits, and lack of motivation. Dr. Craine will mark these poor results as benchmark data from which to make plans for further development of the mathematics program.

The high school mathematics teachers' perception of the situation is somewhat different from that of the technical assistance facilitator. From the teachers' perspective, a majority of Hartford students are seriously lacking in basic computational skills, which prevents them from realizing success with higher level mathematics courses and the new integrated mathematics program. Also, these teachers are skeptical of a mathematics curriculum that gives priority to developing the students' facility with problem solving over symbol manipulation and to emphasizing students' collaborative activity over independent work.

Another issue at the high school level is placing students in appropriate courses. The main source for this problem is the district's old course numbering system, which is confusing for everyone. Furthermore, as indicated above no one has yet received a formal notice from the district's central office about the changes in graduation requirements. Because of the delays in changing the course numbering system and in announcing the graduation requirements, the technical assistance facilitator has recommended delaying the full-scale implementation of the integrated mathematics program.

Science

In fall 1997, the Connecticut Academy did not assign a Science Technical Assistance Facilitator to the Hartford Public Schools, since the school district had not hired a district science curriculum coordinator. In spring 1998, the district hired Mr. Robert Borello as the science curriculum coordinator.

Nonetheless, the district purchased science kits for K - 6th grades. According to Ms. Barker-Jones, the purpose was to acquire these materials so that every K - 6th grade classroom would have access to at least one kit before the end of the current academic year. She indicated that the district's budget is approximately $100,000 short of what it needs to obtain these kits. The Director of Hartford's Comprehensive Program for Mathematics and Science Achievement (CPMSA), Ms. Frances Sanchez, has embarked on a mission to raise this money from the district's corporate partners through a program which she named ASK (Adopt a Science Kit).

Aside from the budget issue, Ms. Barker-Jones indicated that the district needs assistance with teachers' professional development, especially at the elementary level. There is a need for inservice work during the school day in order to demonstrate the kits to teachers and in order to improve the teachers' level of comfort with teaching science. Also, the district needs professional development programs, outside of the regular school day. According to Ms. Barker-Jones, at least prior to hiring the new science curriculum coordinator, the central issue at the district was finding someone who had the time to hire the professional development specialists. She indicated that, if the Connecticut Academy provided that service, it would be a great relief to the district staff.

Despite these circumstances, the elementary teachers are using the science kits which were purchased last year. The condition is perhaps best characterized as a "mechanical stage of development," as, typically, the teachers open the science kits and use them immediately. This is less ideal than attending a professional development workshop, studying the materials and processes, grasping the fit within the general curriculum, and then using the science kits with their students. Without guidance and sustained study, the teachers will find it difficult to make the time on their own to discover the underlying principles in content and pedagogy and to see the connections for interdisciplinary teaching.

New Haven

The Academy's plan for technical assistance to the New Haven Public Schools included five primary areas:

- sustain professional development through "Mathematics Mondays" and "Science Saturdays;"
- distribute mathematics manipulatives and science kits to classroom teachers;
- provide ongoing support to classroom teachers by faculty at Southern Connecticut State University, teacher education students, and other consultants;
- develop intensive summer courses; and
- include a family involvement component that emphasizes technology, curriculum workshops, and student support.

The New Haven plan benefits building principals and teachers by supporting their school's goals for student improvement and supporting strong principal leadership in implementing the program. This year-long collaborative program in mathematics and science reform will lead to graduate courses for the elementary school teachers. These courses are laboratory-based and provide models for classroom practice. The family involvement component is supported by a $41,000 grant from the Enterprise Community through the City of New Haven. It is intended to promote parent support and awareness regarding the implementation of the State's new curricular frameworks, especially in mathematics and science. At the end of this first year, 80% of the teachers should be implementing standards-based instructional strategies; there should be a 10% increase on the students' CMT scores; and there should be a 50% increase in family involvement. Documentation indicates that the New Haven technical assistance program is well on its way toward accomplishing these objectives.

The New Haven Public School district has completed its work on the curriculum frameworks in both mathematics and science. The district had made substantial progress toward development of the new curricula when the Academy's mathematics and science Program Evaluation Guides were completed. These instruments were quickly adopted by the district

and used to facilitate the curriculum development and adoption processes. Everyone is pleased with the results, including officials at the Connecticut Academy.

Most of the Academy's work in New Haven has been concentrated on four elementary schools in the district. These function more or less as pilot schools. There are also plans to add a middle school to the program. The Director of Urban Technical Assistance, Ms. Gemma Joseph Lumpkin, works closely with the Technical Assistance Facilitator, Dr. David Pettigrew, and district officials on the site-based objectives. The Superintendent of Schools, Dr. Reginald Mayo, reports that he is very pleased with the work done by Ms. Lumpkin and the technical assistance team. He said, "It's not programs that make things happen, it's people. A good person is essential. Ms. Lumpkin is such a person. She knows what needs to be done, and she helps make those things happen."

New Haven has not had a science curriculum supervisor on the staff. However, the superintendent said that, in summer 1998, the district will hire a new science curriculum supervisor. Nonetheless, science professors from Yale University and Southern Connecticut State University worked on science projects and provided professional development workshops for teachers at the elementary schools. As a result of the professors' influence, the teachers in the four pilot schools successfully began using science kits. Currently, use of the science kits by teachers has expanded to eleven elementary schools in the district.

In New Haven, there were Saturday workshops and after school meetings for teachers from Helene Grant Elementary School, Lincoln Bassett Elementary School, Isadore Wexler Elementary School, and Vincent Mauro Elementary School. The main subject of these meetings was how teachers should use *Science and Technology for Children* (STC) kits. Participants received an introduction to the National Science Education Standards, and, they completed selected activities from the STC kits. Each of the four workshops introduced a kit from one grade level.

Teachers' participation was voluntary, including, as noted, attendance on Saturday mornings. Professor James Dolan, Chairman of the Physics Department at Southern Connecticut State University and principal instructor for the workshops, said that the "teachers participated very actively." Through these workshops, the elementary school teachers acquired extensive information about standards-aligned science curricula and gained direct experience in doing essential activities from the STC kits.

According to Professor Dolan, the teachers successfully completed the activities themselves—providing direct evidence that they are prepared to guide their classes through these activities. The latter point is especially important, he said, since rigorous design and testing of the STC materials shows that prior teacher experience is the key preparation for successful classroom applications. The one issue here is that there needs to be a higher level of teacher attendance for school-wide implementation to occur at all four elementary schools.

Data indicated that only the Lincoln-Bassett workshop had sufficient attendance to support full scale, school-wide implementation.

Additionally, Jack Crane, formerly of the Olin corporation, has worked with teachers and students on the annual New Haven science fair. As a result of his work over the past several

years, school district officials report that the science fair entries have increased in number (from 7 when he started to 34 this year) and the quality of students' exhibits has improved substantially. According to the superintendent, the partnership between the school district, universities in the New Haven area, and corporations has positioned the New Haven Public Schools nicely for ongoing development of mathematics and science programs consistent with the state's curricula frameworks and national standards.

For several previous years, Dr. Pettigrew offered professional development workshops and other programs with support from CONNSTRUCT and Eisenhower grants in order to introduce elementary teachers in the New Haven area to problem-solving and inquiry-based approaches to both mathematics and science. As a result of this earlier work, Dr. Pettigrew established a cadre of teachers in the four elementary schools who are capable of using the new methods and materials, and are also competent trainers of other teachers. Consequently, a number of these teachers now serve as practitioners for the technical assistance program, providing workshops to their peers.

There is co-teaching in high school mathematics classes by New Haven high school teachers and Southern Connecticut State University professors. The mathematics professor also gives staff development programs to other high school teachers in the district. The New Haven Public School District provides funds to support the high school teachers' release time. There is also co-teaching by elementary teachers and Southern Connecticut State University professors. The district considers this feature to be a highlight because this particular program has the elementary teacher and the professor working together in both the university and elementary school classrooms on a year round basis.

The superintendent reported that the New Haven Public School science budget has increased substantially in recent years. To illustrate the point, he said that the Olin Corporation and Yale University combined their resources for a total of approximately $40,000 in order to support this year's science fair. The superintendent continued with the following statement.

> "That ($40,000) was 75% of the New Haven Public Schools' science budget only five years ago. Today, the science budget is a bigger one and the pressure from organizations, like Project CONNSTRUCT, helped bring about that result. The pressure on the School Board came from this whole mix of partners and also from the parents in our community. They present a unified voice. Science is now a big thing with the parents."

Technical assistance providers reported that, due to the support noted above, the Academy may need to encourage district executive leadership to make the priority of science education efforts better known, especially at the different elementary schools.

Principals reported that the Connecticut Academy has provided the impetus for teachers to try new strategies in both science and mathematics. They noted that the Academy made available or facilitated the purchase of high quality resources—namely computers, software, and science kits. The principals' concerns focused on math workshops that were too general or focused too frequently only on patterns and use of manipulatives. In other words, the principals and teachers expressed a desire for greater variety in the topics for mathematics workshops.

Building principals also reported that students are enthusiastic about doing mathematics activities on the computer. The students now have opportunities during the school day, after school, on Saturdays, and during the summer to work on their computer skills. Additionally, the science workshops apparently have been the most beneficial offering to teachers. Principals reported that classrooms now reflect science projects completed by the students. Previously, there was much less evidence of students' involvement with science projects.

Finally, the building principals recommended that the Academy provide strategic workshops that address areas of the CMT where students' performance indicates they are weak in specific skills. The participating teachers need strategies to improve students' performance in these specific areas.

Waterbury

The Waterbury Public School District does not have a mathematics or science supervisor. Instead, the Research, Development, and Programs Supervisor, Ms. Diane Summa, is responsible for program development in all areas of the curriculum. On the one hand, this centralization of authority is useful, since there is only one person to speak with concerning curriculum and professional development issues. On the other hand, the scope of work for this one person is so great that it is difficult to manage all fronts.

The Academy's technical assistance program is described by Ms. Summa in the following ways.

> "The technical assistance team is excellent. These specialists validate what I try to do. The specialists make themselves comfortable with our system. Their personalities fit with the teachers and other staff members, and they have the expertise that we need. They cajole our people into accepting the changes. It's helping tremendously. We would not be where we are now without this help from the Academy. I couldn't do without them, because what the Academy offers is so necessary for our school district. There is a very positive relationship between Waterbury schools and the Academy. However, we need more money and more technical assistance to accomplish our objectives in the mathematics and science programs."

In Waterbury, as in each of the other urban centers, the Connecticut Academy emphasized technical assistance that would intensify the district's activity regarding full-scale development of standards-based curriculum, instruction, and assessment in mathematics and science. This year, an important step in the process was a formal discussion between the Academy's technical assistance team—including the Director of Urban Technical Assistance—and the Waterbury Board of Education to help the district adopt a policy aligned with the standards. Subsequently, the technical assistance team met with all of the building principals from middle school and high school levels to discuss their roles as instructional leaders in the standards-based programs. In addition, the technical assistance team acquainted these building principals with a recent analysis of CMT data, which would inform the administrators and facilitate their decision-making pertaining to curriculum and professional development.

Mathematics

In this first year of the Academy's technical assistance program in Waterbury, the Connecticut State Department of Education Mathematics Consultant, Ms. Mari Muri, provided

professional development to middle school teachers. Also, a Technical Assistance Consultant for Mathematics, Ms. Linda Ball, completed thirty days of professional development service focused on standards-based mathematics curriculum—including use of the graphing calculator—with those teachers. The teachers response to this workshop was positive. Ms. Ball is scheduled to provide follow-up activity with the teachers. She is also assisting with editing and refining the elementary curriculum guides in the Waterbury school district's central office.

The building principal at Wallace Middle School, where the professional development program transpired, reported that the students have improved their understanding of mathematics through identification of shapes and use of manipulatives. Also, when teachers use the calculator with students, it helped to ease the students' tension level when dealing with large numbers, particularly with multiplication and division activity. The principal reported that the impact on teachers was positive. They have more useful material to work with and new ways to present material that is relevant to mathematics instruction. The extended workshop gave all of the teachers a sense of confidence in their work and enabled them to share their ideas about classroom instruction. The only concern expressed by the principal was the desire for continuation of the Academy's technical assistance program for mathematics, through similar long-term workshops and enrichment activities.

A small group of teachers with representation from each of the levels—elementary, middle, and high school—attended the 1998 National Council of Teachers of Mathematics meeting in Washington, D.C. They reported their findings to their colleagues upon returning to the district. The Technical Assistance Facilitator, Kathy Bavelas, reported that these teachers are assuming responsibility for work on restructuring the mathematics curriculum. For example, at the middle school level, a curriculum development team meets on a regularly basis.

As a result of conferences between the district's Research, Development, and Programs Supervisor, Ms. Diane Summa; the Academy's Director of Urban Technical Assistance, Ms. Gemma Joseph Lumpkin; and Ms. Bavelas, there was an increase in support for mathematics curriculum restructuring. One important outcome was the scheduling of a four-hour mini retreat for the six building principals at the secondary school level.

There is now an "adequate number" of calculators available for students' use in the middle schools. However, since class enrollments are running somewhat high (28 or 29 students), teachers are often working with a classroom set that does not give every student a calculator for personal use. That should change as the technical assistance team succeeded in getting money allocated in the school district's 1998-1999 budget for additional TI 80 calculators.

According to the technical assistance facilitator, a major concern for technical assistance to the Waterbury schools is that the middle school mathematics teachers need a lot of professional development to provide standards-based curriculum, instruction, and assessment. Apparently, a majority of the middle school teachers have general certification for K-8 teaching. This does not carry the specialization in mathematics, despite the fact that they are assigned to teach mathematics as a middle school specialty.

A major issue is the tendency in the Waterbury district for teachers to be transferred from

their mathematics assignments one year to a different assignment, such as language arts or social studies, the next year. Hence, the sustained training provided by the Academy's technical assistance team could have practical applications only during the year that the teachers receive the training. In the next year, there would be a new set of teachers with similar deficiencies in mathematics content knowledge and pedagogy.

There is a continuing need to improve the school administrators' appreciation of systemic change, particularly as it relates to the mathematics and science curricula. In other words, the principals, especially, as instructional leaders in their buildings, need to exercise their responsibility for standards-based education in mathematics and science to become institutionalized. There is also need for additional manipulative materials and relevant training for 6th, 7th, and 8th grade teachers. Additionally, the technical assistance team needs to extend its reach to the 9th and 10th grade mathematics teachers, who have resisted the integrated approach to teaching mathematics. Finally, there are substantive issues related to hiring practices for teacher and administrator appointments, purchasing materials, and budgeting.

Bridgeport's curriculum coordinator's request is relevant to each of the different urban centers participating in the Academy's technical assistance program. It cites, "We need as much help as we can get because improving kids' mathematics and science achievement is a big job." However, a factor of major importance is that the context for systemic reform is significantly different between the four cities. The Academy's site-based and site-sensitive team approach, augmented by the monthly consulting by technical assistance facilitators with the Director of Urban Technical Assistance, provides assurance that the building and district level problems have solutions that are well-informed by circumstances peculiar to the locality.

Science

Like New Haven and Hartford. The Waterbury school district,, does not have a science supervisor. This fact, in addition to a general perception that Waterbury's central office administration needs to exercise stronger leadership relative to mathematics and science programs, has hampered the efforts of the Technical Assistance Facilitator for Science, Dr. Sadu Nanjundiah. Consequently, the first year's work by the Academy's technical assistance team on Waterbury's standards-based science curriculum, instruction, and assessment is characterized by small steps and some frustration.

Despite these difficult conditions, Dr. Nanjundiah is undaunted. He reported that the science component of the district's K-12 curriculum is attended to by a highly competent and recognized high school science teacher, Mr. John Mangini. However, Mr. Mangini's work in this regard is voluntary, since he has no official title as a district leader of science curriculum development. In fact, when it comes to questions about policy and curriculum development for the district science program, Mr. Mangini can only "discuss" the issues with the school administration.

Nonetheless, the technical assistance team has implemented a number of significant initiatives. The focus of Waterbury's science curriculum restructuring effort is on the 6th, 7th, and 8th grades. The teachers at these levels have organized teams to review the science curriculum and to revise it so that it is consistent with the state curricular framework. In the opinion of the technical assistance facilitator, the teachers performed a highly satisfactory job complying with the State's recommendations for restructuring the science curriculum and instruction at

these levels. In the classrooms, the teachers have adopted more experimentation and rely less on the textbook approach to teaching science.

During the 1997 two-day summer workshops, there was almost 100% attendance by these middle school teachers. There was also participation by high school teachers. This large turnout is all the more revealing when considering that the teachers' participation was voluntary, including no opportunities for compensation. In addition, Dr. Nanjundiah, who provided the instruction for the workshops in association with Mr. Mangini, reported that the teachers' involvement in the workshops "went way beyond my expectations. There was no disaffection." Observations of a number of events in Waterbury have convinced Dr. Nanjundiah that the teachers in the district want the change to standards-based science education to occur. They have committed themselves to this change, and they have already made substantive alterations in the materials and approaches they use for science instruction. For instance, the teachers rely on a hands-on approach to teaching biology, earth science, and physical science. In addition, teachers use technology to enhance their instructional program in science.

Follow-up activity with these teachers for the school year included workshops on use of the overhead projector with graphing calculators. This work took place at each grade level in each of the different schools. The plan of action by the technical assistance team involved initial workshops to acquaint teachers with the technology. Subsequent workshops focused on demonstrating a variety of classroom applications. Then, the team provided teachers with opportunity to engage in brainstorming sessions to explore additional applications for the technology.

Mr. James Backus, a middle school science teacher from the Danbury school district and also one of the technical assistance team members, presented workshops on using the TI-82 and TI-83 graphing calculators in science classes. In addition, he trained teachers in the use of calculator-based labs to measure chemical reactions using temperature probes on the experiment. Mr. Backus reported that the Waterbury teachers were very pleased with the training and used many of the techniques during the school year in their own labs.

Thus, teachers express a strong commitment to the changes in science curriculum and instruction advocated by the Academy's technical assistance program. Their response is described by the science team as "enthusiastic." Building principals, on the other hand, have not signed onto the program, do not attend the workshops with their teachers, and do not voice support for the program.

Nonetheless, Dr. Nanjundiah indicated that the Waterbury technical assistance program for the first year will include all of the 6th, 7th, and 8th grade teachers from the middle school level. This program will be enhanced by using experienced teachers from a successful professional development program for middle school teacher leadership funded by NSF that was launched by Education Connection, the Regional Education Service Center (RESC), located in nearby Litchfield, CT. These peer mentors—Mr. James Backus is one of the mentors—will work with Waterbury teachers on a one-to-one basis. Through intensive collaborations among colleagues, Waterbury teachers will develop the content knowledge and pedagogical skills to deliver standards-based science curriculum and instruction. Thus, the technical assistance program in Waterbury, as in the three other urban centers, will proceed step-by-step, with

special attention to individual teachers.

Two major issues, thus far, have thwarted efforts of the technical assistance team for science in Waterbury. One is that Mr. Mangini's work is purely voluntary, since there is no science supervisor. The second is that the educational process in Waterbury has been politicized for decades. To explain the latter circumstance, when there is an election in Waterbury, school is canceled and many teachers serve as political campaign volunteers. Hence, when there are School Board elections, teachers who work on political campaigns may develop alliances with particular public officials at all levels of the political system who either win or lose the election. Consequently, some school teachers and administrators in the Waterbury school district may owe their positions to the political system.

SERVICES TO OTHER SCHOOL DISTRICTS

During year seven, one of the most significant and successful services provided by the Connecticut Academy to inner ring cities and towns and all of the other school districts in the State (the outer ring districts) has been the professional development and the distribution and of the new mathematics and science *Program Evaluation Guides*. The Connecticut Academy's Technical Assistance Coordinator, Mr. Christopher Shepard, assumed responsibility for coordinating this work. This initiative involved cooperation and assistance from the RESCs.

The overall purpose of the M-PEG and the S-PEG is to help district level curriculum teams, principals, and classroom teachers determine the extent to which a standards-based mathematics or science program exists in the district. Both instruments are totally consistent with the CAPT objectives, the Connecticut curricular frameworks in mathematics and science, and the reform efforts of professional societies in mathematics and science. The two guide books are complementary to one another.

To facilitate the M-PEG and S-PEG implementation processes, the Connecticut Academy distributed one copy of the guide to every district in the State. Along with the guide, the Academy offered a free, on-site, 90-minute introductory session to district staff. The response has been phenomenal. The professional educators' recognize that these guides provide the best—i.e., the most practically useful—resource they have seen to date for standards-based curriculum development in mathematics and science. In fact, school districts requested that the Academy provide them with additional M-PEG and S-PEG guides, and they were willing to pay the extra cost. The Academy also prepared "black line" masters, so that school districts could prepare their own copies of the guides for internal distribution and use.

The following is a list of cities and towns that participated in the Academy's training and implementation program for the M-PEG and S-PEG guides.

Bristol	Meriden	Norwich	Windham
Danbury	Middletown	Plainfield	
East Hartford	New Britain	Putnam	
Groton	New London	Stamford	
Killingly	Norwalk	Winchester	

In every instance, the process for curriculum development and evaluation in mathematics and science is proceeding with remarkable facility. In some districts, the curriculum coordinators

report that, although they are very familiar with the standards, the Guides are a valuable resource for reexamining and updating the curricula. Also, some districts may be emphasizing one curriculum area—e.g., mathematics—this year and, thus, will not be using the S-PEG for the time being. In another case, a district's curriculum committee lost its vitality in recent years, but, because of the new Guides and subsequent technical assistance from the Academy partnership, has now revived and renewed its commitment to curriculum and professional development for all K-12 staff.

The applications of the M-PEG and S-PEG varied from district to district throughout the State. However, the professional educators' reception of the Guides has been unanimously very positive. Clearly, with these Guides the Connecticut Academy has contributed one of its most valuable resources and services to the systemic reform of K-12 mathematics and science.

HIGHER EDUCATION

Since the earliest days of Project CONNSTRUCT, the Connecticut Academy has invested efforts to improve the preparation of future teachers in the State's colleges. Special attention has been given to four-year teacher preparation institutions and two-year community colleges that feed students for baccalaureate degrees. In the seventh year, the Academy continued this work with a modest budget in the Distinguished Professor in Residence Program. The main thrust of this year's program was the distribution, discussion, and implementation of the *Recommendations for Improving the Preparation of New Teachers in Mathematics and Science*, which had been developed in fiscal year 1997.

From September 1997 through April 1998, there were a number of presentations of the *Recommendations* at various two-year and four-year colleges. The current Professor in Residence, Dr. Adrienne Kozlowski, organized meetings with interested faculty to initiate or, in some instances, to continue discussion of the *Recommendations*. The faculty response was generally lukewarm. The Task Force for implementation did not function as planned. Many of the meetings presented a basic overview of the document, with minimal discussion of the ideas by the faculty. In some instances, notably at Central Connecticut State University, the faculty engaged in discussions about the circumstances of preservice teacher education, especially in mathematics and science. However, there were no subsequent commitments to adopting or acting on the *Recommendations*.

There are varied reasons for the low-level response to the Academy's publications of the *Recommendations for Improving the Preparation of New Teachers in Mathematics and Science*. However, based upon a review of the Academy's work in higher education over the past several years and discussions with different officials, two explanations seem relevant. One is that the Professor in Residence Program may not be the best vehicle for accomplishing the Academy's objectives relative to higher education and, specifically, teacher preparation. For instance, the title might signify that the recipient is appointed to a supernumerary position, as is commonly found in universities, where the recipient is released from normal institutional responsibilities. In reality, the Academy's expectations for this position include substantial public service. Also, it is most likely difficult to find a person with higher education credentials who would be willing to work part-time with a small budget and who has the combination of strengths in scholarship, diplomacy, organization development, and personnel management. These strengths are required for statewide success with transforming preservice teacher education in mathematics and science.

On the basis of these results, the Connecticut Academy should reexamine the Professor in Residence Program as a main vehicle for pursuing systemic changes in the State's institutions of higher education.

RESOURCES

In fiscal year 1998, the Connecticut Academy in association with its partners—notably the Connecticut State Department of Education and the Regional Alliance for Mathematics and Science Education Reform—hosted a number of events concerning the interpretation and use of the TIMSS results. Guests to these events included district level representatives from around the state and officials from the State department. There were also representatives from neighboring states. The overall purpose of these meetings was to introduce the educators to the TIMSS data and to engage the participants in discussions of the implications for curriculum development, instructional processes, assessment, and professional development. The colloquium sessions emphasized audience participation, with a concerted effort to use the TIMSS findings to improve teaching and learning science and mathematics in Connecticut. The response of participants was positive. They specifically appreciated the tips on how to use the research and materials supplied in the sessions.

During the seventh year of operations, the Connecticut Academy continued its second, statewide Time Survey of all Connecticut principals and superintendents on their district's current use, and considerations for alternative use, of time in educational programs. The Academy's ongoing study of time is focused on the characteristic features of different districts' time scheduling and the effects on key variables, including student performance. As of this writing, the returns of the mail out surveys are running very high. (This year there are separate forms for principals and superintendents.) However, analysis of this data will not be completed until June 1998.

The Connecticut Academy has retained the services of Dr. David Hill, former director of the Texas SSI and Area Superintendent of Schools in Austin, Texas, to lead a program known as the Instructional Leadership Series. This program is currently in the planning stages and is scheduled for delivery in summer 1998. The Instructional Leadership Series is a long-term professional development program to train building principals and central office staff in continuous improvement strategies, tools to create and implement plans, management techniques, and team building strategies. The four main components of the series are: using data as information for guiding school improvement; aligning curriculum, instruction, and assessment to the standards; taking a fresh look at professional development; and aligning resources to support district student performance expectations. The Academy's technical assistance facilitators will participate in the training sessions. A pilot program for school district personnel includes a one day retreat during 1997-1998 and site-based follow-up activity through the 1998-1999 academic year.

In preparation for developing the Instructional Leadership Series, a steering committee from the Connecticut Academy attended a NSF conference on the subject in February 1998 in Washington DC. Included in this group were: Dan Trocolla, Danbury schools; Suzanne Murphy, Norwich schools; Jeffie Frazier, New Haven schools; David Hill; Steve Weinberg; Richard Cole; and Christopher Shepard.

The Academy continued to coordinate services of the Connecticut Resource Network, a

broadly based association of 79 agencies, organizations, professional development providers, science-rich institutions, professional associations, and institutions of higher education throughout the state. Christopher Shepard organized a technical assistance delivery team in partnership with the RESCs. This has been a particularly difficult collaboration to develop because of the varying strengths of the individual presenters and of the different environments or networks within which the RESCs operate, including their relatively recent history of professional development. Thus, for officials in both the Connecticut Academy and the various RESCs there was a substantial amount of "institutional learning" that had to take place this year.

However, the initiative realized success, and currently the RESCs' professional development agenda is focused on the same elements as the Academy. One of the important benefits of this collaboration with the RESCs is that the Academy discovered it had to improve upon its communication with different partners—especially the RESCs—because a number of the elements in the Academy's professional development plans are the responsibility of RESCs. In order to provide the services that are needed by school districts, a well-coordinated, efficient, and mutually beneficial partnership is required.

IMPLEMENTING CURRICULAR FRAMEWORKS

An important development in the Connecticut Academy's dissemination of the mathematics and science *Program Evaluation Guides* is that they have been distributed to all members of the new committee to design the third generation CMT and to all members of the committee to design the second generation CAPT for the State. As stated earlier, district level educators view the Guides as valuable tools for their efforts to create standards-based curriculum, instruction, and assessment in mathematics and science. There are now indications that the Guides will play an instrumental role in helping to build continuity and coherence in subsequent generations of the State's formal assessment instruments for mathematics and science. Consequently, Connecticut may soon have coherence within the K-12 institutions for public schooling and the various organizations that serve them, and also—perhaps more important—across all of the different entities. Development of this common "language" for mathematics and science education statewide is a significant accomplishment for systemic reform.

Prior to implementing the Guides, there was some concern among Academy officials that school district personnel would see the Guides and the State curricular frameworks as two different things. Indeed, as the Academy was writing the Guides, the Connecticut State Department of Education was writing the curricular frameworks. However, soon after implementing the Guides, the field observations indicated that the local school teachers and administrators recognized the Guides and the curricular frameworks as two parts of the same process.

In fiscal year 1999, when the Science Assessment Committee completes its work on the new science assessment instrument, there will most likely be a similar coalition of forces and stirring of interest to develop a seamless web for curriculum, instruction, and assessment for K-12 science education. Currently, science is not assessed by the State on the CMT, which is administered in the 4th, 6th, and 8th grades, but rather on the CAPT in the 10th grade.

DATA MANAGEMENT AND USE

During fiscal years 1997 and 1998, the Academy organized a number of meetings between its partners—including the Connecticut State Department of Education—and external consultants in order to examine the State's data management and use relative to K-12 public education. The Academy's particular interest in this regard has been to develop a system for effective data collection and management to support the informed use of data. This is especially important for student assessment data from the CMT and CAPT to be used by building principals and superintendents of schools for school-based decision-making, particularly for mathematics and science education.

A team of Academy Fellows developed district- and school- level performance questions for superintendents and building principals in order to ascertain student academic and system support performance. The seven categories of questions included: standards and curriculum, programmatic, faculty and professional development, students, parents, resources and deployment, and school. The Academy expects to use these preliminary questions when developing its data management and use system.

In spring 1998, the Connecticut Academy distributed a Request for Proposal to establish a business partnership to design and implement an educational information management system for district- and school-based improvement. The goal of the business partnership is to demonstrate the effectiveness of an information management system that uses data warehouse and data querying tools as a user-friendly, accurate, and cost effective way to identify trends and patterns in order to make informed educational management decisions. The initiative's objectives are to design, develop, install, and support an information management system that will allow school district and school building personnel to electronically query, from a single warehouse system, various educational data sets that currently exist on separate computer data bases in demonstration districts. The information management system will be Web-based, so the district will not be required to develop a hard-wire LAN or WAN network. The University of Connecticut will provide professional development for the first phase of the initiative's operations.

This information management system will transpire in three phases. The first will involve a multi-year project in three demonstration sites, including Bridgeport (urban school district) with eight schools participating, Avon (suburban school district) with all schools participating, and Lebanon (rural school district) with all schools participating. The second phase will entail a scale up and strengthening of the partnership between the vendor and the Academy. At this point, the vendor would contribute more financial resources to the initiative for applications and advertisement. Phase three will continue the scale up efforts initiated earlier and add more national as well as state development.

Currently, the Academy has received a number of responses to the RFP; at least two are deemed acceptable and competitive. The Academy's Board of Directors will make a selection soon.

Curriculum Research & Evaluation, 237 Singleton Road, Chaplin, CT 06235✦860-455-1229✦Fax 860-455-0011✦cre@connix.com

THEMES

CRE's analysis of data revealed a number of themes and issues relative to the Academy's seventh year of SSI in Connecticut. A discussion of five themes follows next.

Continued success with the Academy as fiscal agent

Documentation clearly indicates that the Connecticut Academy enjoys a strong, positive relationship with the Connecticut State Department of Education through the co-principal investigators, who are the State's curriculum consultants for mathematics and science and other officials at the Department. Also, the Academy maintains a strong relationship with the Connecticut State Department of Higher Education. Additionally, the Academy continues its long-term association with a large number of agencies, organizations, and corporations that have demonstrated their commitments to improving mathematics, science, and technology education in Connecticut.

Enhanced focus on Connecticut's neediest urban centers

Starting with the SSI's second phase of operations during fiscal year 1997, the Academy dramatically shifted its *modus operandi* from taking an active lead role in field operations to the effective management of field operations. In addition, the Academy changed its conditions of support to school districts from financial outlay for planned activities at the school district level—based on review of proposals—to provision of technical services from the Academy, based on district's identified needs for standards-based education. Now, there is a concentrated focus on Connecticut's urban core districts, which is managed by the Director of Urban Technical Assistance. As a result of this shift in operations, the Academy has in this first year developed a significant level and variety of technical assistance for urban school districts, including focus on the specific needs of local districts and buildings. The services are provided by highly competent specialists.

Development of high quality products

This year the Connecticut Academy placed emphasis on the development of highly useful products that fully integrate with the State's curriculum frameworks and standards-based education—especially, the math and science PEGs. It also developed the CMT data analysis and introduction and use by school administrators, complemented by a leadership program for school administrators. The most promising new development is the Connecticut Academy Science Assessment Project (CASAP), which will be ready for a pilot phase in fall 1998. The Academy continues development of its other components and emphases, including higher education, time, and the Internet Web page.

Accountability for Academy personnel and operations

In fiscal year 1998, every technical assistance provider and service subcontractor received a contract (sometimes several contracts) for completion of specific duties, with time lines and fees noted. Academy staff exercised responsibility for objective-based management of all operations, including their own specific duties. Key technical assistance providers were required to submit written and oral reports of field operations to their supervisors on a regular basis.

Few leadership and staff changes

For the third time in seven years, the Connecticut Academy marked a change in its top leadership position. Ms. Eunice Groark, the former Lieutenant Governor, passed the reigns for President of the Academy to Chuck Bruce, Vice President, IBM Corporation. There has been little turnover among the regular staff at the Academy. A new administrative assistant was hired. Also, the Academy added a Coordinator of Technical Assistance and a Coordinator of Technology Services to its part-time staff. Two new student assistants were hired. Richard Cole continues as Executive Director and Terri Clark continues as Director of Administration and Programs. The co-principal investigators, Steve Leinward, Mari Muri, and Steve Weinberg, who are curriculum consultants from the Connecticut State Department of Education, remain committed to the SSI. Robert Rosenbaum continues work with the Academy as Past President.

ISSUES

The analysis of data also revealed a number of substantive issues. In all instances, these elements of systemic reform in Connecticut are not surprising, although they are nonetheless deserving of attention. The Academy is aware of these concerns and is responding. CRE provides this list to help clarify the issues and contribute to effective solutions.

- Development of the data management system will entail a new host of partnerships, spinoffs, and a special set of issues—some will be difficult to control, act upon, or resolve. Chief among the issues may be interaction with the teachers unions and building and district level hiring activity in a system characterized by data-based decision-making.

- Development of solid partnerships with the State's institutions of higher education for the purpose of restructuring college-level mathematics and science for preservice teacher education eludes the Academy. This has not been a high priority, but it is nonetheless an important concern for the long-term improvement of teaching and learning in mathematics and science.

- Demonstration of significant gains for students in all urban centers will be difficult to achieve for a great variety of reasons, not the least of which are the children's social context issues, including poverty and family history of low academic achievement. There are encouraging signs in Bridgeport and New Haven. However, the sober reality is that the gap between the 10th percentile, where no one wants students to be, and the 90th percentile, where everyone wants students to be, is significant.

- Responding to the context differences across the urban centers will require patience, diligence, and willpower from every Academy official and their technical assistance team members. The Director of Urban Technical Assistance and the Technical Assistance Facilitators know well that nothing remains the same for long in the school districts. They also know that nothing works quite as well when repeated, even in the same environment. There is a constant need for adaptation, revision, and improvement in all field operations. Thus, the Academy should develop a systematic procedure for collection and analysis of information, relative to the individual sites and across all sites, in order to identify and understand the emerging issues and respond convincingly to the changing circumstances. Also, this documentation will be valuable for purposes of overall assessment.
- Recently, there has been an upsurge in professional development activity statewide, particularly in regard to technology use in education. This means that the environment for

this work is more competitive than in the past. The Academy's mission and goals place it in the curious position of advocating systemic change and, at the same time, providing essential resources and services to school districts that facilitate the change process and sustain new programs. Thus, it is critical that the Academy develop a language for communicating the Academy's role, with special concern for its partnerships. This should be with the other service providers and also with its funding partners, whose resources may be distributed across a wide range of agencies.

- Hartford's cries for help do not go unheard at the Connecticut Academy. In fact, the Academy has and continues to bail out programs and individuals in the Hartford school system, so that the primary purpose of education—i.e., to educate the children of Hartford—continues. Nevertheless, Hartford faces a difficult challenge because it is the only city in state receivership and its students continue to perform at the lowest levels on the CMT and CAPT statewide. What should be the pressure points? Who should apply the pressure? When should the pressure be applied? These are the critical questions that the Academy should help the Hartford Board of Trustees answer—as soon as possible.

- The Connecticut SSI has done a significant job dealing with only the four urban centers—including Bridgeport, Hartford, New Haven, and Waterbury. However, there are 162 other cities and towns that need the Academy's services for systemic reform to occur. This year's release of the M-PEG and S-PEG resources marks a giant step in reaching out to these other communities. Now the Academy must provide substantive follow-up assistance to these first ring and outer ring of towns and cities, and it must monitor the effects.

RECOMMENDATIONS FOR 1999 AND BEYOND

The following recommendations are based on the analysis of data. CRE hopes that these items will help the Academy meet specific problems in the new year and beyond.

- Create more consistency in the Technical Assistance program, particularly when reporting within and across districts and, especially, the urban centers.

- The Academy's Distinguished Professor in Residence program should be significantly revised relative to its goals and objectives or should be transformed into a different program that would more effectively accomplish the purposes for which it was originally established.

- Establish an institute at the Academy for the professional development of practicing teachers and preservice teachers—including a clearinghouse, research findings, and other relevant resources, such as a guide for standards-based curriculum development in institutions of higher education.

- Establish a center at the Academy for the study of school data, particularly as it is used to understand issues and problems and to inform the curriculum and professional development decision-making processes in schools.
- Improve the accounting process and determination of the various forms of and use of non tax-based school support—including soft money—to different districts.

- Increase the impact on school districts, especially urban centers, by developing and exhibiting effective models and eventually impact every school at full capacity.

- Study and disseminate findings regarding how to provide school officials with assistance for hiring and for dismissal of teachers and administrators.

- Continue and increase the focus on Hartford.

Curriculum Research & Evaluation, 237 Singleton Road, Chaplin, CT 06235◆860-455-1229◆Fax 860-455-0011◆cre@connix.com

A CHALLENGE

An important question for everyone associated with this process of "systemic reform" is: *How do we know that something is systemic reform?* A clearly stated and accurate answer, one that emphasizes the process—the technique of development—remains illusive. In this regard, the image of the blind men groping an elephant and, then, describing the beast only on the basis of their touch is appropriate. What they wouldn't give for the sight of the thing? It's right there in front of them. In fact, they have it in their hands.

It has been seven years now since the Connecticut Academy for Education in Mathematics, Science, and Technology started its operations and formally introduced systemic reform to the citizens and educators statewide. As this report makes clear, throughout this time, and especially in this seventh year, the Academy has accomplished a number of truly remarkable achievements. In fact, the Connecticut Academy is recognized nationally as *the model* of statewide systemic reform. From the classrooms in school buildings and districts—urban, suburban, and rural—to the Connecticut State Department of Education, Connecticut has some of the brightest minds and most skilled professional educators and partners working day in and day out on this thing called statewide systemic reform of mathematics and science.

To put the case clearly and to lay down a challenge that lies ahead: after seven years, the Connecticut Academy should be able to create the clear and accurate statement of statewide systemic reform in mathematics and science education. The design should indicate what are the conceptual and practical elements of this system and how this system of education is substantively different in its functions and its development from the system it replaced. Thus far, requirements from Washington, DC, especially, have emphasized the what questions, with special reference to policies, guidelines, and measurement of students' achievement gains as firm indicators that significant change has occurred. As important and long overdue as those accomplishments may be, it is the process that should be of greatest interest now to the observer and practitioner alike. Whenever something new is made, curious people will look in amazement at the creation, but eventually someone will ask the important technical question: how was it made? Unless this question is answered, the thing remains mysterious.

Moreover, the Academy must write this defining statement. It should not wait for an outsider, who comes with a special set of biases and blinders, to tell the story of Connecticut's systemic reform. Nor should the Academy allow an outside agency to influence, unduly by its definition, the direction and pace of the Connecticut SSI.

Once these defining elements are known and understood, the Academy's operations—and everything educational in the state, at least pertaining to mathematics and science—will have no likeness whatsoever to mere tinkering with the status quo, window dressing, and the like. What is more, no one will doubt that a genuinely different, significantly more effective and efficient, and successfully long lasting system of education has emerged. Finally, if the day ever arrives when there is a significant turnover in the Academy's leadership, the Board of Directors, partners, and educators statewide will have the guidebook that they themselves wrote to explain how they made the Connecticut system of education in mathematics, science, and technology.

Curriculum Research & Evaluation, 237 Singleton Road, Chaplin, CT 06235◆860-455-1229◆Fax 860-455-0011◆cre@connix.com

BIOGRAPHICAL SKETCHES

Curriculum Research and Evaluation is a firm that is devoted to research and development of programs in the field of education. CRE's specialities are: (1) to provide services in order to evaluate the quality of education programs for private business and industrial companies, public and private funding agencies, and schools; and (2) to develop and guide the implementation of curriculum and instruction.

Charles Bruckerhoff is Principal Evaluator and Research Associate for Curriculum Research and Evaluation. He received his doctorate from the University of Wisconsin. His research interests are curriculum theory and development, philosophy of education, effects of public policy on the classroom teacher, and school restructuring. He is the author of *Between Classes: Faculty Life at Truman High* and has written articles on curriculum development, qualitative research, urban collaboratives, and disadvantaged youth.

Theresa Bruckerhoff is Operations Manager and Research Associate for Curriculum Research and Evaluation. She has a B.S. in Elementary Education and a M.S. in Curriculum and Instruction. She has sixteen years of teaching experience ranging from preschool to the middle school levels. She taught in gifted programs, special education programs, and is an experienced classroom teacher. Also, she has held executive board positions for child care centers and a nursery school. Currently, she studies state and national programs for teachers' professional development and school restructuring.

Diane Colwyn, CRE's editor, is President of Di Co Editorial Services, a firm specializing in many types of editorial projects. She has experience as an editor with a major textbook publishing company and, also, as a classroom teacher.

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Printed Name/Position/Title: Charles Bruckerhoff

Organization/Address: Curriculum Research & Evaluation
237 Singleton Rd
Chaplin, CT 06235-2223

Telephone: 860.455.1229

FAX: 860.455.0011

E-Mail Address: cre@connix.com

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