Evaluating the Impact of Supplementary Science, Technology, Engineering and Mathematics Educational Programs

December, 2006

A Report By

The Connecticut Academy of Science and Engineering

For

The Connecticut General Assembly
Education Committee

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This study was initiated at the request of the Education Committee of the Connecticut General Assembly on May 19, 2006. The project was conducted by an Academy Study Committee with the support of Richard C. Cole, Project Study Manager and Terry Clark, Project Assistant of the Connecticut Academy for Education in Mathematics, Science & Technology, Inc. The content of this report lies within the province of the Academy's Human Resources Technical Board. The report has been reviewed by Academy Members Andrew G. De Rocco, PhD, and Alan C. Eckbreth, PhD, Academy President. Martha Sherman, the Academy's managing editor, edited the report. The report is hereby released with the approval of the Academy Council.

Richard H. Strauss
Executive Director

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EXECUTIVE SUMMARY

STUDY OBJECTIVES

The Education Committee of the Connecticut General Assembly asked the Connecticut Academy of Science and Engineering (CASE) to conduct a study to identify the best practice characteristics of supplementary science, technology, engineering, and mathematics (STEM) programs outside the formal education environment, or Out-of-School Time (OST). The Education Committee also noted an interest in learning about existing cost-benefit analysis procedures and teacher training activities for OST STEM-related programs. OST programs and activities represent a critical set of supplemental learning assistance — non-school support for children and families that can enhance and promote learning and development by complementing school-day efforts.

At the initial Study Committee meeting on June 26, 2006, the Committee agreed that to achieve the goals of this study it would develop a framework from which the General Assembly can reliably measure the effectiveness of programs seeking funding, rather than to develop a program and cost-benefit analysis for any specific program. The Committee decided to look at "indicators" in a broad, generalized sense and then consolidate them into what is feasible with a "Connecticut Context."

The study's "Findings and Suggestions" are based on a review of the relevant evaluation and continuous improvement literature, and interviews with Michelle Doucette Cunningham, Project Administrator, Connecticut After School Network; Elizabeth Brown, Legislative Director, Connecticut Commission on Children; Dr. Agnes Quinones, Unit Coordinator, Child/Family/School Partnerships, Connecticut State Department of Education; Dr. Kathleen O'Keefe, Education Program Manager, The Medtronic Foundation; Dr. Brenda Shumate Wojnowski, President, Inventive Education, Inc., National Inventors Hall of Fame®; Dr. David G. Haase, Director, The Science House and Professor of Physics at North Carolina State University; and other key professionals involved in the design and use of evaluation and continuous improvement strategies in after-school programs.

While there is an emerging body of research about what does and does not work in OST STEM-related programs, there are several important caveats. Most studies and publications in these areas are not empirical; they simply summarize recommendations provided by expert panels and individuals, termed "proxy research" by Elizabeth Brown. Research conducted at colleges and universities, as noted by Dr. Haase, has revealed that it is very difficult to establish specific cost-benefit comparisons for OST STEM-related programs that have a great degree of reliability and predictability. The results from two cost-benefit analysis studies included in this study reinforce Dr. Haase's observation. Finally, while there are national standards for training OST leaders and personnel generally, expert training in STEM-related programs is for the most part nonexistent. Specific organizations, such as Inventive Education, Institute for Exploration, and others do provide personnel training for those OST organizations that "purchase" their self-contained curricula or program offerings, but not for generalized, OST STEM educational programs.

SUMMARY OF FINDINGS AND SUGGESTIONS

The following Findings and Suggestions are divided into those that relate to specific conclusions drawn from identified best practices and those that extrapolate research findings into a "Connecticut Context." While some findings are generic to OST programs, all are pertinent to STEM programs.

Findings drawn from best practices research

1. OST STEM programs should makes efforts to coordinate activities and strengths with other after-school environments involving young people, and should not necessarily strive to be "all things to all students."

2. OST programs are not merely extensions of the school day and successful programs do not replicate the school day.

3. OST program gains are greatest and are sustained longest when they are aligned with the school-day curriculum and reinforced with additional help during the regular school instructional program.

4. The time when programs are scheduled—before or after school or during the noon hour—does not appear to have a significant influence relative to the success of a program. However, students who participate in OST programs the most consistently and for the longest period of time experience the greatest gains in math as assessed by standardized achievement tests.

5. At-risk students are helped greatly when they receive intervention with complex mathematics and science concepts and with school- and family-based motivational issues.

6. Programs were more effective at some grade levels than at others. The largest effect in mathematics was at the high school level, followed by middle school programs.

7. OST mathematics, science, and technology programs lend themselves to problem solving because fun, hands-on activities that students already enjoy can easily be incorporated into a less rigid, learning environment. In particular, programs that combine mathematics instruction and social activities show the greatest gains. In addition, the underlying academic content must be paired with effective instructional strategies and delivered by instructors who have a deep understanding of the subject matter.

8. Coordination between OST and formal education is complicated, requiring adequate resources, extensive collaboration between school systems and community organizations, and continuing communication at the highest levels of school and community leadership.

9. Teens are more attracted, in general, to program approaches that infuse technology into all program activities, rather than having a "technology component" in the program which focuses primarily on teaching technology skills.

10. There is no incontrovertible research available about generalized best practices for training of staff for STEM-related OST programs, other than use of highly qualified classroom teachers.

Suggestions from successful programs that should be considered for incorporation into a "Connecticut Context"

1. Policymakers should evaluate the worthiness and characteristics of OST practices based on the context and expectations of existing legislation.
2. The General Assembly needs to be cognizant that at least 15 state agencies have some level of responsibility for Connecticut-based OST programs.
3. Policymakers need to consider establishing a set of clear and measurable expectations, including common data and reporting systems, definitions, eligibility criteria, and accountability. In this regard, the General Assembly should consider the degree to which small- to medium-sized OST program evaluation is cost-effective and realistic.
4. Available evidence (RAND Corporation) suggests that improving quality of offerings in existing OST programs should take precedence over rapid growth in supply.
5. OST STEM-related program support should be connected to and aligned with the **CONN***vene* Initiative, which is a statewide Pre-Kindergarten through baccalaureate degree (PreK-16) initiative to improve student interest and achievement in STEM to better meet Connecticut's 21st century economic development, quality of life, and workforce preparation needs.
6. The state should support additional research to determine the effectiveness of using results-based accountability to achieve state goals and objectives for OST programs receiving state funding.

The Study Committee has developed a Connecticut STEM-Related, Out-of-School Performance Indicators and Performance Measures Matrix to guide Connecticut legislators in making OST STEM-related investment decisions. The matrix tool correlates Connecticut Public Act "performance indicators" with the research-based findings from this study and potential OST STEM "performance measures" (Appendix A).

Note: The OST organization "performance measures" listed in the matrix are derived from Venture Philanthropy Partners work and the McKinsey Capacity Assessment Grid tool designed to help nonprofit entities assess their organization capacity.[1]

CONCLUDING REMARKS

It is suggested that the Education Committee of the Connecticut General Assembly has an opportunity to establish meaningful and realistic standards from which to measure the effectiveness of OST STEM-related programs. The execution of program development, support, and measurement should be undertaken in a "Connecticut Context" that includes the following:

1. knowledge of the best practice characteristics of STEM programs outside the formal education environment as identified in this study
2. use of the Results-Based Accountability framework model currently being piloted by the General Assembly's Work Group to establish population goals, relate program

performance to those population goals, and to use both to inform the budget process for after-school programs

3. consideration of supplementary OST programs as a component of a more comprehensive pre-kindergarten through undergraduate (PreK-20) school improvement initiative to build interest in and understanding of STEM disciplines

The Study Committee strongly supports the implementation of a cogent, multi-year plan that integrates all of the previously identified initiatives with Connecticut's comprehensive STEM PreK-20 improvement proposal, **CONN*vene***. If the "world is flat," as suggested by Thomas Friedman, then Connecticut must be concerned about its place on this new "learning landscape." To meet Connecticut's 21st century economic development and workforce needs, the state must have a talent pool that is world class, with increasingly higher skills and better training in science, technology, engineering, and mathematics. Rather than instituting many various tactics, Connecticut will be better served by a comprehensive strategy to achieve its early childhood/preschool, after-school, and PreK-20 goals.

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I. INTRODUCTION

The purpose of this study is to explore how others make judgments about the worthiness of programs and to identify the characteristics of best practice programs outside the formal education environment—in Out-of-School Time (OST) programs —in an effort to help guide Connecticut legislators in making investment decisions.

Why STEM OST programs? Mathematics, science, and technology proficiency have become critical life skills in this era of a "flat world." Knowledge of these disciplines, along with essential problem-solving and reasoning skills, are essential for success in many business and technical careers. A June 21, 2006, Educational Testing Service survey illustrates how both the general public and "opinion leaders" believe education in mathematics and science are key to the future success of this nation. Forty percent of the general public and 61% of opinion leaders identified math, science and technology skills as the most important ingredients in the nation's strategy to compete in the global economy. Underscoring the need to improve STEM education in this country, 71% of Americans believe that "our nation's public high schools are coming up short or falling behind in efforts to put students on the path to compete for highly technical scientific and engineering jobs with their counterparts from other countries."[2]

OST programs, including programs at Boys and Girls Clubs, YMCAs and 4-H Clubs, date back to the 1930s. These early programs were largely recreational in nature. In the 1980s and 1990s, a national movement, focused on "school-aged child care" with the goal of creating high quality child care in the after-school hours, began. As this effort matured, there was a general melding of the recreation-based programs with the school-aged child care endeavor. The OST movement is a result of efforts in the late 1990s and the early 21st century to better organize and advocate for children in the after-school hours. The movement has been led by groups such as the Mott Foundation, the Wallace Foundation, the After-School Alliance, and the National After-School Association.[3]

A review of current OST research literature clearly indicates that the field of after-school care and education is rapidly growing. Along with this growth, there is an emerging body of research about what works and what doesn't work.[4] While the body of research is still incomplete, there is accessible literature that can greatly assist programs.[5] However, most studies and publications available for review are not empirical, but instead summarize recommendations provided by expert panels and individuals.[6] Elizabeth Brown from the Connecticut Commission on Children refers to this as "proxy research."

In a 2001 landmark study by the RAND Corporation, researchers noted that the need for OST services became apparent so quickly that there was virtually no time to provide support for testing and evaluating the various aspects of the programs being offered. Program managers who are committed to high-quality care have thus been faced with the challenge of attempting to measure their STEM activities against almost nonexistent standards.[7]

For many OST programs and their overworked staff, the added accountability responsibility is the "straw that broke the camel's back." Across the country, there is a cry from programs

for help in deciding what to measure and how to measure it. Although there is no formal consensus regarding realistic outcomes for all OST programs, one of the unintended benefits of the release of the first national 21st Century Community Learning Centers impact evaluation has been increased attention to the question "To what degree should OST programs be held accountable for results?"[8]

II. CONNECTICUT CONTEXT

Researchers at the Harvard Family Research Project (HFRP), RAND Corporation, Perry Early Childhood Study, and others strongly recommend that judgments about the worthiness of OST programs must begin with a realistic understanding of the context and expectations for the evaluation. This reflection indicates a need to gain an understanding of the state's prior legislation and expectations relative to OST program - Connecticut Context (Appendix B) in an effort to develop tools that will work best in the state.

Connecticut Public Act 85-584 created the Connecticut Commission on Children (COC) in 1985. The non-partisan Commission is required to promote public policies in children's best interest by

- providing information and conducting research regarding the status of children and children's programs in the state
- enlisting the support of leaders in business, health, and education, state and local governments and the media to improve policies and programs for children
- reviewing coordination and assessing programs and practices in all state agencies as they affect children
- serving as a liaison between government and private groups concerned with children
- making recommendations for children annually to the General Assembly and to the governor

In 2003, Section 1(c) of Public Act No. 03-206, *An Act Concerning After-School Programs,* required the Commissioner of Education, in consultation with the Commissioner of Social Services and the Executive Director of the Commission on Children, to establish an after-school advisory committee. This committee was required to report on and make recommendations with respect to, but not limited to, the following topics:

1. identification of existing state, federal and private resources to support and sustain after-school programs
2. methods and practices to enhance coordination and goal setting among state agencies to achieve efficiencies and to encourage training and local technical assistance with respect to after-school programs
3. identification of best practices
4. methods of encouraging community-based providers
5. professional development
6. measures to address barriers to after-school programs
7. a private and public governance structure that ensures sustainability for after-school programs.

According to the March 2004 report on PA03-206, the Connecticut After School Advisory Committee found that successful, high-quality programs contribute to

1. Protecting children and strengthening families and communities.
2. Diverting youth from the juvenile justice system.
3. Improving attitudes toward school and attendance rates.
4. Closing the achievement gaps between groups of children, leading to higher grades and test scores as well as development of useful, marketable skills (e.g., computer, literacy, critical thinking, problem solving, leadership, teamwork), and helping students and families bridge the digital divide.
5. Reducing teen pregnancies, teen violence, substance abuse and other risk behaviors.
6. Increasing early development of health-promoting knowledge, behaviors and attitudes.
7. Decreasing dropout rates and increasing numbers of students pursuing further education or training.
8. Supporting working families and fostering student and family self-esteem, self-confidence and cultural awareness.
9. Increasing community involvement.
10. Involving families in their children's learning, helping them more effectively guide their development into successful adulthood.

OST programs extend their responsibility to families and schools by including supportive learning environments that are informed by student grade-level expectations, in addition to providing children with a safe environment, healthy recreation and appropriate social development support. In many towns, private providers have voluntarily formed formal and informal relationships with local education agencies or an individual school or PTA/PTO to provide after-school programs for the children in the school district or children attending a particular school.[9]

The Connecticut School-Age Care Alliance (CSACA) was founded in 1989 as a professional organization to meet the needs of those professionals working in the field of school-age child care. On June 8, 2005, CSACA joined with the Connecticut After School Network ("the Network") to better meet the needs of the out-of-school time field. The Network is a statewide coalition of policymakers, educators, child care providers, youth development workers, program developers, advocates and state agency workers.

The Network's mission is to lead, educate and advocate for excellence in the after-school field by building professionalism, strengthening program quality and increasing availability and affordability. As of November 2006, approximately 1,600 after-school programs belonged to the Network. The Network has profited from a policy climate in the state that reflects solid interest in after-school issues. The Speaker of the state House of Representatives announced that after-school would be a top legislative priority in 2006.[10]

During the 2006 legislative session, the Commission on Children supported the "Safe and Smart Community Grant" legislation to help finance quality OST programs in school/community partnerships to provide safe, enriching environments for working families and improve overall child and youth outcomes such as increased academic achievement and decreased juvenile crime.

Public Act No. 06-135, *An Act Implementing the Provisions of the Budget Concerning Education,* allocated $5 million for after-school programs through the budgets of the Connecticut Department of Social Services (DSS) and the Connecticut State Department of Education (SDE). The purpose of the $5 million program is to ensure quality OST opportunities for children and youth while their parents work and school has ended, with a goal of bolstering social skills and cognition and to decreasing loitering, drug and sexual experimentation.

Another important piece of the "Connecticut Context" includes the 2006 Public Act No. 06-182, which convened a Youth Future Committee led by the director of the Office of Workforce Competitiveness, in conjunction with the Connecticut Employment and Training Commission. The committee consists of a broad constituency of legislative and government agency leaders. The committee's responsibilities include the following:

- develop guidelines for the delivery of services relating to health, safety, and education that incorporate best practices based on defined, developmentally appropriate, positive outcomes for youth
- improve communication among agencies that administer programs serving youth
- assess existing funding resources, networks, and returns on investments to maximize the development of community-level services that assist in achieving state goals and objectives with respect to youth policy
- collaborate with public and private partnerships in order to facilitate positive outcomes for youth

Key to this legislation is the definition of "positive outcomes," which include, but are not limited to

- improvement in school attendance, and academic and technical proficiencies
- improvement in the percentage of youth obtaining a high school diploma or its equivalent
- increases in the percentage of youth who enroll in and complete postsecondary school educational and training programs, and employment programs that build skills
- full employment for youth not enrolled in educational programs
- opportunities to be engaged in public service; have stable and safe housing and access to quality mental and physical health providers; and have opportunities to develop leadership and mentoring skills

By January 1, 2008, the director of the Office of Workforce Competitiveness is required to report to the General Assembly on the progress made by the state and by each city or town in achieving the positive outcomes for youth, and the total state expenditures dedicated to achieving such positive outcomes.

Concurrent with after-school legislation, on February 7, 2006, Governor M. Jodi Rell signed Executive Order 13 creating the Governor's Early Childhood Research and Policy Council. The Council comprises 31 representatives spanning the fields of business, education, charities and government. The Council combines a high-level think tank approach with an action agenda on financing options to support the work of the governor's Early Childhood Education Cabinet, established pursuant to Public Act 05-245 and convened last year to form a school readiness strategic plan.

Recognizing the dramatic challenges to Connecticut's future citizenry, workforce, and economic security, and acknowledging that state government does not (on most occasions) raise or educate children, the role of state government is therefore four-fold:

- to develop and utilize data to identify the needs of at-risk children and, with communities, establish community-specific plans for engagement
- to establish standards of program quality and best practices
- to allocate and award funds based on expected specific outcomes
- to evaluate progress on child/family outcomes and continue funding what works

The Connecticut General Assembly's interest and investment in OST signals a need to learn, over time, which OST investments are working, how they can be improved, and whether they should be expanded. It is suggested that the state should evaluate the worthiness and characteristics of best practices based on the context and expectations of existing or future legislation. The General Assembly also should be cognizant that 15 state agencies have some level of responsibility for OST programs (Appendix B). Furthermore, it is suggested that the General Assembly address the question of what it is for which OST programs should realistically be held accountable. This is especially important for programs that focus on STEM, which is the focus of this study.

III. GENERAL OUT-OF-SCHOOL (OST) EVALUATION THEORY AND METHODOLOGIES

The following summarizes results of a survey of OST evaluation theory and methodologies that are either being used or discussed by public policy and organizational leaders throughout the country to measure the effectiveness of after-school initiatives, including those that are STEM-based.

- Distinguish between performance indicators and performance measures. *Performance indicators* quantify results with population-level data (i.e., local, regional, state, national, etc.). Indicators measure the degree to which a population-level group (i.e., Connecticut) is trying to achieve an initiative that will act on many "fronts" through many organizations. An example of an indicator would be, "Closing the achievement gaps between groups of children, leading to higher grades and test scores, as well as development of useful, marketable skills"—from Public Act No. 03-206. *Performance measures*, on the other hand, reflect only the degree to which an OST activity meets the specific needs of identified clients, such as raising the mathematics scores by 15% of elementary school children in grades three through five in a particular community. Holding an OST program responsible for moving an indicator of results is unfair; each program is simply a small player in a much more complex environment.

- Assess outcomes that the program is addressing. It is important to focus research and evaluation efforts on the specific outcomes (performance measures) on which the OST program focuses. For example, if the program has a strong academic component, it's appropriate to measure academic improvement. However, if the program only focuses on improving interest in science or some aspect of technology or engineering, improvements in attitudes and behaviors toward those areas would be expected, rather than specific improvements in some form of academic testing.

- The world of out-of-school time outcomes is extensive. As noted above, the possible outcomes for OST programs are wide ranging. Programs should not be limited to only measuring academic achievement or student ad parent satisfaction. Measured outcomes should be matched with program goals, giving serious consideration to the types of outcomes the program could be affecting.

- Look at how others have assessed particular elements; don't reinvent the wheel. It is likely that assessments for a particular program component have already been developed. Review the research to see how other programs have measured outcomes and possibly adapt existing methodologies. Appendix C provides a Harvard Family Research Program project listing of OST STEM evaluations that have been conducted. These evaluations are for specific commercial or nonprofit provider programs and do not represent a general overview of the impact of supplementary STEM programs

- A word of warning about assessing academic achievement. OST programming research has identified some linkage to improved academic achievement. However, these linkages are not always apparent. If the OST program includes academic components, assess the components as specifically as possible. For example, if the program focuses on

mathematics, then assess mathematics understanding, comfort and comprehension as well as achievement in math classes.

There may never be a single set of performance measures for which all OST programs can be held accountable, but it is suggested that there are at least three important points that all OST programs should take into consideration when selecting performance measures for evaluation:

1. The range of performance measures currently used to assess OST program outcomes reflects the diversity of OST programming. The selection of which performance measures are best suited to any single program or initiative should be inextricably tied to the program's goals, strategies and activities. Being intentional about a theory of change—a way of articulating a program's primary goals, strategies and activities—can help to determine what measures to use to assess progress toward achieving program goals.
2. Availability of data sources is a consideration when selecting and developing performance measures. Many programs rely on parent, participant, and staff reporting as data sources, using program-generated surveys and questionnaires to collect data. This is a less costly option than using standardized academic and behavioral assessments that may require training to administer, but have less validity than standardized testing and assessment tools.
3. Performance measures should, in part, be selected because they will yield useful information for program improvement as well as to fulfill accountability requirements. A litmus test for a good evaluation, and consequently the list of performance measures selected, is to ask the question, "Will the information collected be useful to the program and its stakeholders?" The answer should be a resounding "yes."[11]

Formative evaluations are conducted during program implementation in order to provide information that will strengthen or improve the program being studied. Formative evaluation findings typically point to aspects of program implementation that can be improved for better results, such as how services are provided, how staff are trained, or how leadership and staff decisions are made.

Summative evaluations are conducted either during or at the end of a program's implementation. They determine whether a program's intended outcomes have been achieved. Summative evaluation findings typically judge the overall effectiveness or "worth" of a program, based on its success in achieving its outcomes, and are particularly important in determining whether a program should be continued.

The Harvard Family Research Project (HFRP), RAND Corporation, Mid-Continent Research for Education and Learning (McREL) and others have called for a more robust and empirical research base upon which to measure effectiveness of "cause and effect" for OST programs. Yet, all of these nationally recognized organizations warn that this may well be out of reach for the many small, community-based organizations that provide meaningful opportunities for children. The three most recognized program evaluation design options are described in the following table.[12]

	Main Feature	Benefits/Trade-Offs
Experimental Design	Random assignment of individuals to either treatment (i.e., an after-school program) or control groups (i.e., no after-school program); groups are usually matched on general demographic characteristics and compared to each other to determine program effects.	The strongest design choice when interested in establishing a cause-effect relationship. Experimental designs prioritize the impartiality, accuracy, objectivity, and validity of the information generated. They allow for casual and generalizable statements to be made about a population or impact on a population by a program.
Quasi-Experimental Design	Features non-random assignment of individuals to treatment and comparison groups, as well as the use of controls to minimize threats to the validity of conclusions drawn. Types include comparison group pretest/post-test design, time series and multiple time series designs.	Like the experimental designs, quasi-experimental designs for evaluation prioritize the impartiality, accuracy, objectivity, and validity of the information generated. These studies look to make causal and generalizable statements about a population or about the impact of a program or initiative on a population.
Non-Experimental Design	No use of control or comparison groups; typically relies on qualitative data sources such as interview, observation, case studies, and focus groups. They use purposeful sampling techniques to get "information rich" cases.	Non-experimental designs are helpful in understanding participants' program experiences and in learning in detail about program implementation. No causal conclusions can be drawn using a non-experimental design.

TABLE 1: THREE MOST RECOGNIZED PROGRAM EVALUATION DESIGN OPTIONS

Over the past decade, "outcomes" has moved from being just a buzzword to becoming a full-fledged movement. As the outcomes movement and outcome-based accountability decision making have grown, many models or frameworks for applying this thinking have emerged. While evaluators and practitioners have benefited greatly from the development of various tools to guide outcomes thinking, understanding the unique advantages of each model and how to select the right one to meet the needs of a particular program or funder is challenging for many.

The Connecticut General Assembly has adapted the results-based accountability (RBA) framework developed by Mark Friedman of the Fiscal Policy Studies Institute. In August 2005, the General Assembly's Appropriations Committee created a Results-Based Budgeting Work

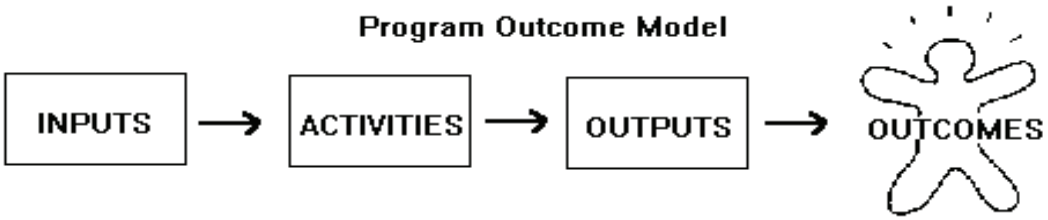
Group. The Work Group agreed to conduct a limited pilot project. During the 2005 legislative session, the pilot involved several sub-committees of the Appropriations Committee in a demonstration of how results-based accountability could be used to establish population goals, relate program performance to those population goals, and use both to inform the budget process. The first phase pilot of the RBA concept and methodology would pave the way for a broader implementation of RBA in the budget process in the second phase.[13] The two quality of life (population) results selected for the pilot were:

- All Connecticut children begin kindergarten healthy and ready for school success within their developmental potential.
- A healthy and productive Long Island Sound for Connecticut residents.

Results of this ground breaking work by the Work Group are applicable to OST programs as well.

Outcome Frameworks: An Overview for Practitioners (2004), published by Rensselaerville Institute's Center for Outcomes offers insights into which model might be appropriate to the particular needs of a program at a given point in time. It captures what the outcomes movement means, where it came from, the major models now in use, and the movement's probable future. The eight models described in Outcome Frameworks fall into three main categories: program planning and management, program and resource alignment, and reporting. In addition, most models can be used as an evaluation tool. [14] These models are illustrated in Appendix E.

The United Way of America, in their Measuring Program Outcomes: A Practical Approach, use the illustrated model below as an example of how to develop an outcomes or RBA approach. Programs need to identify their own outcomes and indicators, matched to and based on their own experiences and missions with the input of their staff, volunteers, participants, and others.



Resources dedicated to or consumed by the program	**What the program does with the inputs to fulfill its mission**	**The direct products of program activities**	**Benefits for participants during and after program activities**
e.g., ■ money ■ staff and staff time ■ volunteers and volunteer time ■ facilities ■ equipment and supplies **Constraints on the program** **e.g.,** ■ laws ■ regulations ■ funders' requirements	**e.g.,** ■ feed and shelter homeless families ■ provide job training ■ educate the public about signs of child abuse ■ counsel pregnant women ■ create mentoring relationships for youth	**e.g.,** ■ number of classes taught ■ number of counseling sessions conducted ■ number of educational materials distributed ■ number of hours of service delivered ■ number of participants served	**e.g.,** ■ new knowledge ■ increased skills ■ changed attitudes or values ↓ ■ modified behavior ↓ ■ improved condition ■ altered status

TABLE 2: UNITED WAY PROGRAM OUTCOME MODEL

IV. STEM-BASED EVALUATION EXAMPLES AND COST-BENEFIT ANALYSIS

The Harvard Family Research Project (HFRP) is a leader in OST research through their Out-of-School Time Learning and Development Project. As a part of this project, the HFRP website (www.gse.harvard.edu/hfrp/projects/afterschool/about.html) includes an online evaluation database with descriptions of various OST STEM program evaluations (Appendix C). The website also contains other rich resources such as publications relating to OST programming.

One of the largest and best-known OST program evaluations looks at LA's BEST (Better Educated Students for Tomorrow) program. LA's BEST serves more than 18,000 students who are predominately Latin and economically disadvantaged in 105 elementary schools in Los Angeles. The program evaluation was conducted by UCLA's Center for Study of Evaluation during the past 10 years. While the program is not STEM- or academic-specific, it does provide data on how "mixed role programs" can provide a safe environment, enrichment and recreational activities as well as instructional support to elementary students. The outcomes found that participation in LA's BEST program correlated with fewer school days missed; positive achievement on standardized tests in math, reading, and language arts; positive attitude toward school and self; and improved grades. Significant results of the report included:

- Students must enroll in the program, as opposed to a drop-in option, and must participate on a regular basis.
- Fewer students with limited English proficiency chose to participate.
- Students who participated for at least four years showed more positive achievement on standardized tests than students who did not remain with the program long term.
- Higher levels of participation led to better subsequent school attendance, which in turn correlated with higher academic achievement on standardized tests.
- Many years of hit-or-miss involvement are not sufficient to promote academic improvement (attendance predicts performance).
- More time on a task (learning) results in higher levels of performance.
- Program does not closely imitate regular school, even though academic supports and enrichment are key elements of the activities – there is overlap with regular school-like activities, but not duplication.
- Children in program liked school more and were more engaged in school.
- Children reported higher aspirations regarding finishing school and going to college.
- Children preferred active as opposed to passive types of activities, including intellectual activities.
- In terms of the perceived strongest areas, free play time and recreational activities received the highest mean ratings. Next highest were homework assistance, safe physical environment, arts and performances, and opportunity to be creative.

- The attitude of parents and the enthusiasm they hold towards OST programs greatly affect the attitude and enthusiasm of their children. Parents affect how consistently students attend, whether or not they attend on time and the duration of their participation.

The evaluation summary of this report is available at www.lasbest.org.

The US Department of Education (USDE) contracted with Mathematica Policy Research, Inc., to evaluate the impact and implementation of the national 21st Century Community Learning Centers program (funded by both the USDE and the C. S. Mott Foundation). While the study has been controversial because of its findings, it does offer valuable information. Key findings from the first year of Mathematica's evaluation include limited academic impact among participants, improved parental involvement, low levels of student participation, and programs staffed predominantly by school-day teachers. Other research has shown that linking OST programs to the school day is beneficial, and staffing the program with school-day teachers is one way to accomplish this. The first year report can be found at: www.ed.gov/pubs/21cent/firstyear.

Researchers for the RAND Corporation, in their 2001 analysis, reviewed the effectiveness of OST programs and reported conclusions similar to those of the Mid-Continent Research for Education and Learning (McREL) team. Their report also identified program components that were associated with desired outcomes, including the following:

- a clearly stated mission that established high expectations
- an environment that was safe and healthy, both physically and emotionally
- a stable staff adequately trained to deliver the program and meet the needs of students
- inclusion of families and the community as partners in the program
- ongoing assessment of all aspects of the program

However, implications from the RAND Corporation report caution policymakers and program implementers to remain skeptical of claims about unmet demand for programs, as well as of claims that programs can meet multiple needs or produce positive impacts on an array of outcomes. The available evidence suggests that improving quality of offerings in existing programs should take precedence over rapid growth in supply. Designing and implementing effective programs takes careful planning and attention—and probably very significant funding. Furthermore, any push toward rapid expansion of slots for children should be tempered with an assessment of how that expansion might affect the quality of the programs offered.[15]

Summaries of other research indicate that key features of high-quality programs for elementary children include:

- positive relationships with staff
- positive relationships with peers
- opportunities to exercise choice and autonomy
- diverse activities

Key features of positive, high-quality developmental settings for middle and high school adolescents include:

- physical and psychological safety
- appropriate structure
- supportive relationships
- opportunities to belong
- positive social norms
- opportunities for skill building
- integration of family, school, and community efforts

A key feature of several studies (Vandell, Reisner, Brown, Dadisman, Pierce, Lee, and Pechman 2005) indicates that OST programs should collaborate among programs available to youth in a given school or community. Rather than being "all things to all students," each OST program may need to be more attentive to how its strengths are coordinated with other after-school environments in which young people in their area may be involved.

Empirical research reinforces to a degree what the OST field has found through "proxy research"; after-school programs can contribute to increased student achievement. But, perhaps most interesting, studies find that OST programs that help lead to improved achievement do not necessarily focus exclusively on academics. Accordingly, LA's BEST, RAND, National Inventors Hall of Fame® and other studies indicate that successful OST STEM programs do not replicate the school day. Instead, these programs are safety zones where students are able to explore new ideas and interests, develop long-term supportive relationships with adults and peers and receive homework help. [16]

The Five Key Characteristics of successful OST Programs:

1. **A broad array of enrichment opportunities:** For many participants, OST programs provide a first exposure to new learning opportunities. Enrichment activities introduce participants to experiences that could spark interests and expand their goals for their own schooling, careers and hobbies.
2. **Opportunities for skill building and mastery:** Each after-school project creates opportunities for participants to build or augment skills through structured activities held in places where children feel safe, secure, and nurtured, particularly youth who are vulnerable and at risk..
3. **Intentional relationship-building:** This process begins with projects fostering positive relationships with the host school and other community organizations, followed by steps to set a positive tone with staff through orientation, training, and the establishment of participant expectations and regular communication with school staff and families.
4. **A strong, experienced leader/manager supported by a trained and supervised staff:** OST site coordinators at high-performing projects possess experience in youth development and a strong connection to the community, the children, and the families

they serve. All site coordinators make efforts (and budget the time) to communicate through orientations at the beginning of the project year, ongoing staff meetings and supervision, and consistent feedback on what has worked and what has not.

5. **The administrative, fiscal, and professional-development support of the sponsoring organization:** The relationships between after-school projects and their sponsors build the foundation for project success and sustainability. In each successful partnership, the sponsor gives the site coordinator the autonomy and flexibility to manage the after-school project day-to-day, while providing administrative support to the project.

Economic Costs and Benefits:

A study by the Rose Institute pertaining to California's Proposition 49 concludes that after- school programs in California are cost-effective. The study indicates that the return to taxpayers ranges from $2.99 to $4.03 per every dollar spent on after school programs. The benefit to students attending after-school programs ranges from $2.29 to $3.04 for every dollar spent on after-school programs. Expenditures produce benefits in the areas of reduced child care costs, improved school performance, increased compensation, reduced crime costs, and reduced welfare costs. [17] A 2002 Center for Youth Development and Policy Research report suggests the national resulting return on every dollar invested in after school programs is $10.51.[18] Clearly the analysis of cost benefits for OST programs is a work in progress and does not yet provide concrete answers.

V. KEY ISSUES FROM BEST PRACTICES MATHEMATICS SCIENCE, TECHNOLOGY OST PROGRAMS

MATHEMATICS

According to the National Partnership for Quality After School Learning[19], there are three key ideas for supporting mathematics learning that should be considered:

1. *Encourage problem solving*. OST programs lend themselves to problem solving because fun, hands-on activities that students already enjoy can easily be incorporated into a less rigid, academically-structured environment.
2. *Develop and Support Math Talk*. When students talk about math, they are actively engaged in the learning process. Math talk helps them clarify their thinking, construct their own meaning, analyze and interpret mathematical ideas, develop reasoning and reflective skills, and stimulate interest and curiosity.
3. *Emphasize Working Together.* Research indicates that working together to solve problems often supports higher levels of performance than working independently. Working together is structured to ensure that all students contribute and participate in small-group tasks structured around issues that already interest children. The role of the leader is to facilitate learning, ask good questions, guide thinking around strategies, and help students understand that there is more than one way to approach a math problem.

In a meta-analysis (summary quantitative data that were abstracted from the actual research) of 33 effective OST mathematics programs, researchers at McREL found the following[20]:

- There were small but statistically significant effects on achievement in mathematics—on average, at-risk students who participated in OST programs scored more than six percentile points higher on math achievement than students who did not participate.
- The time when programs were scheduled—before or after school or during the noon hour—did not have a significant influence.
- The programs were more effective at some grade levels than at others. The largest effect in mathematics was at the high school level, followed by middle school programs.
- At-risk students are helped greatly when they receive intervention with complex concepts and with motivational issues.
- The greatest gains resulted from one-on-one tutoring.
- The effect on student achievement during one year was greatest for programs that served students for at least 45 hours; however, the effects dropped off considerably when the programs exceeded 100 hours in math.
- Programs that combine mathematics instruction and social activities show the greatest gains, however, the underlying academic content must be paired with effective

instructional strategies and delivered by instructors who have a deep understanding of the subject matter.

- OST program gains are greatest and sustained longer when they are aligned with the school-day curriculum and reinforced with additional help during the regular school instructional program.

SCIENCE

According to the National Partnership for Quality After School Learning, the most effective OST science programs incorporate the following eight principles:

- are for all students
- are age-level appropriate
- are connected to school curriculum and standards-based
- are active, interesting, and relevant to students
- reflect current research and practices
- integrate skills from different subjects
- incorporate staff training in science teaching
- are based on ongoing assessment of student needs and progress

National Inventors Hall of Fame® Club Invention™ After-School Program is an OST educational enrichment program for children in grades one through six. The program is designed to further formal school-day academics in a fun and informal after-school environment. Offered as both a stand-alone school enrichment opportunity and as a component of established after-school programs, Club Invention™ is an excellent example of an OST program that builds on students' school experiences. A 2004 Formative Program Evaluation Report on Club Invention™ After-School Program completed by the Bureau of Research Training and Services of the College of Education, Health and Human Services at Kent State University found the following favorable characteristics, which are mirrored in studies of other outstanding programs:

- Hands-on nature of the curriculum optimizes the student's ability to recall the activities and any experiences/knowledge associated with those activities.
- Use of everyday, household materials enables the student participants to recreate their experiences at home, thus continuing the process of discovery that began during their Club Invention™ encounter.
- Encourages growth, creativity, and inquiry, while challenging students to explore and experiment within their world in order to understand and imagine how they might make it better.
- Older students (fifth and sixth graders) are generally interested in staying with their own age and gender groups when working in teams and are not always willing to work with younger kids.

- Younger students would allow the older students to help them, would listen to their ideas, and would glean ideas from observing the older students' projects.
- Brainstorming component works well with students of different ages, and is especially successful in giving the younger students the freedom to think out loud.

Connecticut has a rich array of existing informal science and nature centers that provide OST STEM-focused programs independently, in collaboration with each other, and in partnership with other community-based OST organizations (Appendix D).

TECHNOLOGY

The Techbridge Program at Chabot Space & Science Center, Oakland, CA is a successful model that introduces girls to various applications of technology and encourages them to consider careers in technical and scientific fields.[21] Findings from focus groups indicate that girls are indeed interested in technology—what doesn't attract them is the way it is usually presented. For example, girls are interested in technology that serves a social benefit, but they don't perceive computer science as having this potential. The key to recruiting girls for this program turned out to be reassurance from friendly staff and a personal invitation from a trusted teacher. Promotional techniques like taking digital photos of the girls or passing out treats also helped create a "buzz" that got girls to take notice.[22] Experience demonstrates that long-term participation leads to significant benefits, so programs should stipulate that girls and their families make yearlong commitments.

Programs that are successful purposely include the people who are involved in the girls' lives on a daily basis—teachers and parents/caregivers. For teachers, training, resources, and a proven curriculum are important. For parents, events that celebrate their daughters' achievements and workshops that offer academic and career guidance are vital. Three main ingredients for successful girls' after-school technology program are

1. *Keeping it fun.* Hands-on projects allow the girls to master a range of technical skills.
2. *Bolstering confidence.* Self-esteem grows out of working on projects that require problem solving and perseverance. Building a mechanical robot or soldering an LED kit may seem daunting at first to a girl who hasn't had the chance to tinker with tools or build with LEGOs. When the technology doesn't work right away, some girls are overcome by frustration and want to give up. But it is just such challenges that help girls believe in themselves.
3. *Managing the social dynamics.* Anyone who has worked with girls will tell you that relationships and group interaction are important to them. It is especially important to build a sense of community quickly and to break up any friendship cliques or racial divisions. Pay careful attention to social dynamics and partner girls in ways that help them feel comfortable, meet success with technology, and practice teamwork. Initially, girls may not want to move outside their comfort zone, but with practice they come to appreciate the opportunity to be part of a team.

According to a 2002 report from the California Community Technology Policy Group, in general, teens are more attracted to program approaches that attempt to infuse technology into

all program activities rather than having a "technology component" in the program which focuses primarily on teaching technology skills.[23]

Immersion Presents is a Connecticut-based after-school program currently working in 90 Boys and Girls Clubs and other OST organizations across the United States. Immersion Presents offers multi-media programs to engage young people in after-school adventures, giving them a better understanding of research, exploration and the natural environment.

The programs are designed to help young people succeed in science, mathematics and literacy while using state-of-the-art technology to explore the world's oceans. Based on the expeditions of world-famous oceanographer and explorer Dr. Robert Ballard, Immersion Presents creates dynamic materials and opportunities to promote interest in science and new career explorations. The programs are interactive, with activities delivered to participating Boys & Girls Clubs in print format, CD Rom, DVD, and via the Internet. [24]

VI. SUMMARY OF FINDINGS AND CONCLUDING REMARKS

The Study Committee suggests, as a result of its investigation, that Connecticut policymakers should consider how OST STEM-related programs can meet state and community needs based on a set of clear and measurable objectives that reflect the following research precepts:

1. Acknowledge that young people must develop skills beyond just STEM academics, and appreciate that OST programs are an excellent venue for this broader skill development.
2. Recognize that OST programs that sustain consistent student participation over a long duration of time experience the greatest gains in outcomes.
3. Increase support for high quality OST STEM-related programs for high school youth.
4. Expect that rather than being "all things to all students," an OST program may need to be more attentive to how its strengths are coordinated with other after-school environments in which young people are involved.
5. Encourage community-based OST STEM-related program providers to work cooperatively with local school districts to achieve mutually agreed to objectives.
6. Encourage more cross-sector collaboration and partnerships, both public and private, through common expectations and outcome measures.
7. Ensure that the OST organization provides a stable staff, adequately trained to deliver the program and meet the needs of students.
8. Avoid rigid funding, programmatic, or accountability structures that can inhibit innovation.
9. Consider the degree to which small- to medium-sized OST program evaluation is realistic.
10. Recommend independent systematic program evaluations for large, publicly funded programs.
11. Promote improving the quality of existing, proven OST programs rather than rapid growth in supply new offerings.
12. Consider other community-valued performance indicators to measure OST STEM success beyond simply Connecticut Mastery (CMT) and Academic Performance (CAPT) test results.
13. Develop and disseminate tools to collect and report information necessary to compare effectiveness of OST STEM programs.
14. Support the collection and analysis of program activity information and outcome data for use in decision making, monitoring, and funding of OST services.
15. Implement a comprehensive support structure to connect and align of OST STEM-related programs with the **CONN*vene*** Initiative, which is a statewide Pre-Kindergarten

through baccalaureate degree (PreK-16) initiative to improve student interest and achievement in STEM to better meet Connecticut's 21st century economic development, quality of life, and workforce preparation needs.

16. Hold the 15 state agencies with some level of responsibility for Connecticut-based OST programs accountable for accomplishing state expectations.
17. Develop effective forums and incentives to disseminate existing standards, guidelines, and best STEM practices, and new ones as they evolve or are discovered through research.
18. Support additional research, including cost-benefit analysis, to determine the impact of OST STEM-related programs relative to state goals and objectives.

CONCLUDING REMARKS

Connecticut has a rich history of support for OST programs with 15 state agencies involved in some way with funding and/or oversight. Legislation has been adopted to help finance quality OST programs in school/community partnerships to provide safe, enriching environments for working families and improve overall child and youth outcomes such as increased academic achievement and decreased juvenile crime. By January 1, 2008, the director of the Office of Workforce Competitiveness will report to the General Assembly on total state expenditures and the progress made by the state and by each city or town to achieve the positive outcomes for youth through OST programs. Concurrent with after-school legislation, Governor Rell has created the Governor's Early Childhood Research and Policy Council, comprising 31 representatives spanning the fields of business, education, charities and government, to form a school readiness strategic plan.

It is suggested that the Education Committee of the Connecticut General Assembly has an opportunity to establish meaningful and realistic standards from which to measure the effectiveness of OST STEM-related programs. The execution of program development, support, and measurement should be undertaken in a "Connecticut Context," and should include:

1. knowledge of the best practice characteristics of STEM programs outside the formal education environment as identified in this study
2. use of the Results-Based Accountability framework model currently being piloted by the General Assembly's Work Group to establish population goals, relate program performance to those population goals, and to use both to inform the budget process for After School Programs
3. consider supplementary OST programs as a component of a more comprehensive pre-kindergarten through undergraduate (PreK-20) school improvement initiative to build interest in and understanding of STEM disciplines

The Study Committee strongly supports the implementation of a cogent, multi-year plan that integrates all of the previously identified initiatives with Connecticut's comprehensive STEM PreK-20 improvement proposal, **CONN*vene***. If the "World has become Flat," as Thomas Fried

man suggests, then Connecticut must be concerned about its place on this new "learning landscape." To meet Connecticut's 21st century economic development and workforce needs, the state must have a talent pool that is world class—with increasingly higher skills and better training in science, technology, engineering, and mathematics. Rather than instituting many various tactics, Connecticut will be better served by a comprehensive strategy to achieve its early childhood/preschool, after-school, and PreK-20 goals.

APPENDIX A
CONNECTICUT STEM-RELATED OUT-OF-SCHOOL TIME WORTHINESS AND BEST PRACTICE MATRIX

A CORRELATION OF CT PUBLIC ACT "PERFORMANCE INDICATORS" WITH RESEARCH-BASED FINDINGS AND SUGGESTIONS AND POTENTIAL OST, STEM "PERFORMANCE MEASURES."

Connecticut Expectations Performance Indicators from Public Acts (PA)	Summary of Research Findings and Suggestions from the Impact on Supplementary STEM Study	Out-Of-School Time - STEM Potential Performance Measures
1. Improving attitudes toward school and attendance rates (PA 03-206)	A. Programs should not closely imitate regular school, even though academic supports and enrichment are key elements of the activities – there may be overlap with regular school-like activities, but not duplication. B. Children in excellent OST programs like school more and are more engaged in school. C. Children preferred active as opposed to passive types of activities, including intellectual activities. D. There are statistically significant positive relationships between the time spent in OST programs and the academic and positive youth development outcomes. E. Students must enroll in the program, as opposed to a drop-in option, and must participate on a regular basis. F. Students who participated at least four years showed more positive achievement on standardized tests than students who did not remain with the program long term. G. Enrichment activities introduce participants to experiences that have shown to spark interests and expand their goals for their own schooling, careers and hobbies. H. High levels of collaboration among schools and community organizations help to ensure measurable results for OST programs.	➢ The degree to which students participating in the OST, STEM-related program demonstrate: - Regular attendance at the program functions; - Active participation in activities; - Growing interest in STEM-related subjects as evidenced by participant's, parent's and classroom teachers' feedback to OST; - Interest in sharing experiences with family and teachers in regular school program; - Willingness to help other participants, both older and younger; - Comfort with environment and safety of program experiences; - Positive relationships with staff - Positive relationships with peers ➢ The degree to which student participating in the OST program demonstrate measurable improvement on measures, such as: - Regular school attendance; and - Decreased disciplinary actions or other adverse regular school behaviors. The degree to which the OST organization can demonstrate that it has a clear and coherent one- to three-year strategy that is both actionable and measurable and that demonstrates the active continuing involvement of school and community leaders in planning and implementation.

APPENDIX A (CONTINUED)

Connecticut Expectations Performance Indicators from Public Acts (PA)	Summary of Research Findings and Suggestions from the Impact on Supplementary STEM Study	Out-Of-School Time - STEM Potential Performance Measures
2.. Improving school attendance, and academic and technical proficiencies (PA 06-182)	A. Rather than being "all things to all students," OST programs may need to be more attentive to how its strengths are coordinated with other after school environments in which young people are involved. B. Higher levels of OST participation lead to better subsequent school attendance, which in turn related to higher academic achievement on standardized tests. C. OST program gains are greatest and sustained longest when they are aligned with the school-day curriculum and reinforced with additional help during the regular school instructional program. D. OST programs are most effective when they have the active support, collaboration, and involvement of the local school system in all phases of planning and implementation. E. Many years of hit-or-miss involvement are not sufficient to promote academic improvement (attendance predicts performance). F. In terms of the perceived strongest areas, free play time and recreational activities received the highest mean ratings. Next highest were homework assistance, safe physical environment, arts and performances, and opportunity to be creative. G. Each after-school project creates opportunities for participants to build or augment skills through structured activities.	➢ The degree to which students participating in the OST program demonstrate: - Same as number one ➢ The degree to which student participating in the OST program demonstrate measurable improvement on measures, such as: - Achievement on STEM-related subjects as evidenced by classroom-based formative assessments; - Ability to get along with peers; - Optimistic attitude toward school; - Constructive behavior in school; - Affirmative motivation to learn; - Consistent and positive homework performance; - Cooperation with peers, teachers, and administrators in school; - Willingness to enroll in more challenging STEM classes, including Honors, Advanced Placement, and other college prep courses; - Receiving honors or awards; - No repetition of grade levels due to lack of competency with STEM materials; - Consistent achievement improvement on CT Mastery Tests and CT Academic Performance Test; - Willingness to take the SAT II and SAT I examinations ➢ The degree to which the OST organization can demonstrate that it has a set of demanding performance targets that are tightly linked to aspirations and strategy, and are focused on outcomes.

APPENDIX A (CONTINUED)

Connecticut Expectations Performance Indicators from Public Acts (PA)	Summary of Research Findings and Suggestions from the Impact on Supplementary STEM Study	Out-Of-School Time - STEM Potential Performance Measures
3. Closing the achievement gaps between groups of children, leading to higher grades and test scores (PA 03-206)	A. OST programming research has identified some linkage to improved academic achievement; however, these linkages are not always apparent. B. At-risk students are helped greatly when they receive intervention with complex mathematics and science concepts and with school- and family-based motivational issues. C. The time when programs are scheduled – before or after school or during the noon hour – does not appear to have a significant influence relative to the success of a program. D. Students who participate in OST programs the most consistently and for the longest period of time experience the greatest gains in math as assessed by standardized achievement tests. E. For OST staff; training, resources, and a proven curriculum are important. F. Consider other community-valued performance indicators to measure OST STEM success beyond simply Connecticut Mastery (CMT) and Academic Performance (CAPT) test results. G. Designing and implementing effective programs takes careful planning and attention—and probably very significant funding.	➢ The degree to which students participating in the OST program demonstrate: - Same criteria listed in numbers one and two; - Willingness to admit subject matter difficulties and to seek out help and support to advance performance and achievement; - Readiness to work with a tutor, mentor, or others to receive help to understand and to master STEM subject matter; and - Eagerness to share OST program activities with parents, family, and school personnel. ➢ The degree to which student participating in the OST program demonstrate measurable improvement on measures, such as: - Same as numbers one and two ➢ The degree to which the OST organization can demonstrate that all programs and services are well defined and fully aligned with State's performance indicators and comprehensive internal and external benchmarking is used regularly in target-setting and daily operations. ➢ The degree to which OST organizations can show multiple learning approaches and experiences, appropriate socialization experiences, and a safe and nurturing environment.

APPENDIX A (CONTINUED)

Connecticut Expectations Performance Indicators from Public Acts (PA)	Summary of Research Findings and Suggestions from the Impact on Supplementary STEM Study	Out-Of-School Time - STEM Potential Performance Measures
4. Improving the percentage of youth obtaining a high school diploma or its equivalent (PA 06-182)	A. Children in excellent OST programs report higher aspirations regarding finishing school and going to college. B. OST mathematics, science, and technology programs lend themselves to problem solving because fun, hands-on activities that students already enjoy can easily be incorporated into a less rigid, learning environment. C. Programs that combine mathematics instruction and social activities show the greatest gains however, the underlying academic content must be paired with effective instructional strategies and delivered by instructors who have a deep understanding of the subject matter.	➢ The degree to which students participating in the OST program demonstrate: - Same criteria in numbers one and two; and ➢ The degree to which student participating in the OST program demonstrate measurable improvement on measures, such as: - Same criteria in numbers one, two, and three; - Exhibit understanding of value of high school diploma; - Explore career and further education options with OST and school personnel; and - Communicate with family about value of continued education. ➢ The degree to which the OST organization can demonstrate the ability and tendency to develop and refine concrete, realistic operational plan; operations planning exercise carried out regularly operational plan tightly linked to strategic planning activities and systematically used to direct operations.
5. Increasing the percentage of youth who enroll in and complete post-secondary school educational and training programs (PA 06-182)	A. Programs were more effective at some grade levels than at others. The largest effect in mathematics was at the high school level, followed by middle school programs. B. The effect on student achievement was greatest for programs that served students for at least 45 hours; however, the achievement gain effects dropped off considerable when the programs exceeded 100 hours in math. C. There was no incontrovertible research available about generalized best practices training of staff for STEM-related OST programs, other than use of highly qualified classroom teachers.	➢ All criteria same as above. ➢ The degree to which the OST organization allows for career exploration activities and skills development.

APPENDIX A (CONTINUED)

Connecticut Expectations Performance Indicators from Public Acts (PA)	Summary of Research Findings and Suggestions from the Impact on Supplementary STEM Study	Out-Of-School Time - STEM Potential Performance Measures
6. Decreasing dropout rates and increasing numbers of students pursuing further education or training (PA 03-206)	A. High school-aged adolescents prefer OST activities that include: - Positive relationships with staff - Positive relationships with peers - Appropriate structure - Supportive relationships; and - Opportunities to belong B. Programs that have proven successful include the following characteristics: - A clearly stated mission that established high expectations; - An environment that was safe and healthy, both physically and emotionally; - A stable staff adequately trained to deliver the program and meet the needs of students; - Inclusion of families and the community as partners in the program; and - Ongoing assessment of all aspects of the program.	➢ All criteria same as above.
7. Full employment for youth not enrolled in educational programs (PA 06-182)	A. All criteria same as above and below.	➢ All criteria same as above
8. Protecting children and strengthening families and communities (PA 03-206)	A. OST site coordinators at high performing projects possess experience in youth development and a strong connection to the community, the children, and the families they served.	➢ All criteria same as above. ➢ The degree to which the OST organization can demonstrate a strong parental and community involvement component including a written plan for both.

APPENDIX A (CONTINUED)

Connecticut Expectations Performance Indicators from Public Acts (PA)	Summary of Research Findings and Suggestions from the Impact on Supplementary STEM Study	Out-Of-School Time - STEM Potential Performance Measures
9. Increasing community involvement; (PA 03-206)	A. Any push toward rapid expansion of slots for children should be tempered with an assessment of how that expansion might affect the quality of the programs offered.	➢ All criteria same as above, plus: - Degree to which OTS participants are provided opportunities to volunteer in community programs and/or projects. - Degree to which participants are provided community leadership development and opportunities. - Degree to which children participate in one or more school or community organizations. - Degree to which family and school personnel are invited to and valued in OST activities. ➢ The degree to which the OST organization can demonstrate that their membership includes a rich variety of fields of practice and expertise, drawn from the full spectrum of constituencies with a high willingness and proven track record of investing in learning about the organization and addressing its issues.
10. Involving families in their children's learning, helping them more effectively guide their development into successful adulthood (PA 03-206)	A. Successful projects foster positive relationships with the host school, followed by steps to set a positive tone with staff through orientation, training, and the establishment of participant expectations and regular communication with school staff and families.	➢ All criteria same as above.

APPENDIX A (CONTINUED)

Connecticut Expectations Performance Indicators from Public Acts (PA)	Summary of Research Findings and Suggestions from the Impact on Supplementary STEM Study	Out-Of-School Time - STEM Potential Performance Measures
11. Improving coordination and communication among agencies that administer programs serving youth and OST programs (PA 85-584)	A. The General Assembly needs to be cognizant that at least 15 state agencies have some level of responsibility for Connecticut-based OST programs. B. Encourage community-based OST, STEM-related program providers to work cooperatively with local school districts to achieve mutually agreed to objectives. C. Promote a collaborative and cooperative partnership among school systems and OST to achieve mutually agreed upon objectives, including curriculum development, access to transportation to OST, guidance, parental involvement, and access to facilities and technology where appropriate. D. Call upon community partners, including; businesses, higher education, cultural institutions, health care providers, social service agencies, and police departments to work together to strengthen the OST program. E. Close relationships between after-school projects and their sponsors build the foundation for project success and sustainability. F. In each successful partnership, the sponsor gives the site coordinator the autonomy and flexibility to manage the after-school project day-to-day, while providing administrative support to the project. G. State officers or agencies with some oversight over OST programs include: a. Governor b. General Assembly d. Office of Workforce Competitiveness e. CT Employment and Training Commission f. CT Commission on Children g. CT After School Network h. CT Youth Services Association i. Office of Policy and Management j. Court Support Services Division of Judicial Branch k. Department of Education l. Department of Social Services m. Department of Mental Health and Addiction Services n. Department of Public Health o. Department of Labor	➢ The degree to which the OST organization can demonstrate leveraged, and maintained strong, high-impact relationships with a variety of relevant parties and the relationships are anchored in stable, long-term mutually beneficial collaboration and respect.

APPENDIX A (CONTINUED)

Connecticut Expectations Performance Indicators from Public Acts (PA)	Summary of Research Findings and Suggestions from the Impact on Supplementary STEM Study	Out-Of-School Time - STEM Potential Performance Measures
12. Providing information and conducting research regarding the status of children and children's programs in the state (PA 85-584)	A. Ensure that the OST provides a stable staff, adequately trained to deliver the program and meet the needs of students. B. Most studies and publications available for review are not empirical but summarize recommendations provided by expert panels and individuals. C. Recommend independent systematic program evaluations for large, publicly funded programs. D. Develop and disseminate tools to collect and report information necessary to compare effectiveness of OST, STEM programs. E. Support the collection and analysis of program activity information and outcome data for use in decision making, monitoring, and funding of OST services.	➢ The degree to which the OST organization can demonstrate electronic data-base and management reporting systems in most areas for tracking clients, staff, volunteers, and program outcomes that are commonly used and that help increase information sharing and efficiency.

APPENDIX A (CONTINUED)

Connecticut Expectations Performance Indicators from Public Acts (PA)	Summary of Research Findings and Suggestions from the Impact on Supplementary STEM Study	Out-Of-School Time - STEM Potential Performance Measures
13. Assess existing funding resources, networks, and returns on investments to maximize the development of community level services that assist in achieving state goals and objectives with respect to youth policy (PA 06-182)	A. Implement a comprehensive support structure to connect and align of Out-of-School-Time, STEM-related programs with the **CONN***vene* Initiative, which is a statewide Pre-Kindergarten through baccalaureate degree (PreK-16) initiative to improve student interest and achievement in STEM to better meet Connecticut's 21st Century economic development, quality of life, and workforce preparation needs. B. Policymakers need to consider setting a set of clear and measurable expectations, including common data and reporting systems, definitions, eligibility criteria, and accountability measurements. C. The legislature should consider the degree to which small- to medium-sized OST program evaluation is realistic. D. Avoid rigid funding, programmatic, or accountability structures that can inhibit innovation. E. Promote improving the quality of existing, proven OST programs rather than rapid growth in supply new offerings. F. Support additional research to determine the impact of OST, STEM-related programs relative to state goals and objectives. G. The Appropriations and Education Committees should consider expanding the Results-Based Accountability framework model currently being piloted by the General Assembly's Work Group to establish population goals, relate program performance to those population goals, and to use both to inform the budget process for After School Programs.	➢ Above criteria. ➢ The degree to which the OST organization can demonstrate robust systems and controls in place governing all financial operations and their integration with budgeting, decision making, and organization objectives and strategic goals.
14. Enlisting the support of leaders in business, health, and education, state and local governments and the media to improve policies and programs for children (PA 85-584)	A. Develop effective forums and incentives to disseminate existing standards, guidelines, and best STEM practices, and new ones as they evolve or are discovered through research.	➢ The degree to which the OST organization can demonstrate a diversified funding base across multiple source types and has in place organizational practices to regularly communicate with funding constituencies about community needs, organizational practices, and program outcomes.

APPENDIX B
CONNECTICUT PUBLIC ACTS CONCERNING OST PROGRAMS 1985 THROUGH 2006

Constitutional Offices or State agencies listed in the legislation below with some cognizance over Out-of-School programs or operations include: Governor, House, Senate, Office of Workforce Competitiveness, CT Employment and Training Commission, CT Commission on Children, CT After School Network, CT Youth Services Association, Office of Policy and Management, Court Support Services Division of Judicial Branch, and Departments of Education, Social Services, Mental Health and Addiction Services, Public Health, and Labor.

Public Act No. 85-584 *An Act Creating the CT Commission on Children*	**Public Act No. 03-206** *An Act Establishing An After-School Advisory Committee*	**Act No. 06-135** *An Act Implementing the Provisions of the Budget Concerning Education,*	**Public Act No. 06-182** *An Act Establishing A Youth Future Committee*
➢ Providing information and conducting research regarding the status of children and children's programs in the state;	The Connecticut After School Advisory Committee identified that successful, high-quality programs contribute to:	$5 millions dollars were allocated for after school programs through the budgets of the Department of Social Services and the State Department of Education.	– Develop guidelines for the delivery of services that incorporate best practices based on defined, developmentally appropriate, positive outcomes for your relating to health, safety, and education;
➢ Enlisting the support of leaders in business, health, and education, state and local governments and the media to improve policies and programs for children;	o Protecting children and strengthening families and communities;	The purpose of the $5 million dollars After School Grant is to ensure quality after school opportunities for children and youth while parents work and school has ended	– Improve communication among agencies that administer programs serving youth;
➢ Reviewing coordination and assessing programs and practices in all state agencies as they affect children;	o Diverting youth from the juvenile justice system;	Specific results were to bolster social skills, cognition, and to decrease loitering, drug and sexual experimentation.	– Assess existing funding resources, networks, and returns on investments to maximize the development of community level services that assist in achieving state goals and objectives with respect to youth policy;

APPENDIX B (CONTINUED)

Public Act No. 85-584 *An Act Creating the CT Commission on Children*	**Public Act No. 03-206** *An Act Establishing An After-School Advisory Committee*	**Act No. 06-135** *An Act Implementing the Provisions of the Budget Concerning Education,*	**Public Act No. 06-182** *An Act Establishing A Youth Future Committee*
➢ Serving as a liaison between government and private groups concerned with children;	○ Improving attitudes toward school and attendance rates;		– Collaborate with public and private partnerships in order to facilitate positive outcomes for youth.
➢ Making recommendations for children annually to the Legislature and to the Governor.	○ Closing the achievement gaps between groups of children, leading to higher grades and test scores, as well as development of useful, marketable skills (e.g., computer, literacy, critical thinking, problem solving, leadership, teamwork), and helping students and families bridge the digital divide;		– *Key to this legislation is the definition of "positive outcomes", which include, but are not limited to:*
	○ Reducing teen pregnancies, teen violence, substance abuse and other risk behaviors;		– Improved school attendance, and academic and technical proficiencies;
	○ Increasing early development of health-promoting knowledge, behaviors and attitudes; decreasing dropout rates and increasing numbers of students pursuing further education or training;		– Improvement in the percentage of youth obtaining a high school diploma or its equivalent,

APPENDIX B (CONTINUED)

Public Act No. 85-584 *An Act Creating the CT Commission on Children*	**Public Act No. 03-206** *An Act Establishing An After-School Advisory Committee*	**Act No. 06-135** *An Act Implementing the Provisions of the Budget Concerning Education,*	**Public Act No. 06-182** *An Act Establishing A Youth Future Committee*
	○ Supporting working families and fostering student and family self-esteem, self-confidence and cultural awareness;		– Increases in percentage of youth who enroll in and complete post-secondary school educational and training programs, and employment programs that build skills;
	○ Increasing community involvement;		– Full employment for youth not enrolled in educational programs;
	○ Involving families in their children's learning, helping them more effectively guide their development into successful adulthood.		– Opportunities to be engaged in public service, stable and safe housing, access to quality mental and physical health providers, and opportunities to develop leadership and mentoring skills.

APPENDIX C: HARVARD FAMILY RESEARCH PROJECT SCIENCE/TECHNOLOGY/MATHEMATICS OUT-OF-SCHOOL TIME PROGRAMS AND THEIR EVALUATIONS THAT ARE CURRENTLY BEING TRACKED

The Harvard Family Research Project (HFRP) is profiling the following programs and their evaluation(s) in its Out-of-School Time Program Evaluation Database available at www.gse.harvard.edu/hfrp/projects/afterschool/evaldatabase.html.) Entries that are new or updated are marked as such.

New! **4-H Animal Science Program—Wisconsin**
Begun in the early 20th century, this program in Wisconsin engages youth in animal care activities to build knowledge and provide opportunities for life skill development. (*positive youth development,* ***science/technology/mathematics***)

Grenawalt, A., Halback, T., Miller, M., Mitchell, A., O'Rourke, B., Schmitz, T., & Taylor-Powell, E. (2005). *4-H Animal Science Program evaluation: Spring 2004—What is the value of the Wisconsin 4-H Animal Science Projects?* Madison, WI: University of Wisconsin Cooperative Extension. www.uwex.edu/ces/pdande/evaluation/evalstudies.html

Updated! **4-H/Missouri Department of Elementary and Secondary Education After School Computer Lab Project**
Begun in 1998, this project assists Missouri schools and other community organizations to develop computer-based after school programs for elementary through junior high school youth. The primary purpose is to create a supervised and supportive environment that encourages youth to play computer games that have positive educational content. (*academic/enrichment,* ***science/technology/mathematics***)

Benesh, C., & Pabst, B. (2003). *Playing to learn: An evaluation of the participation of upper elementary and middle school students in Missouri recreational computer lab programs*. Columbia: University of Missouri Columbia Outreach & Extension. 4h.missouri.edu/go/projects/computer/labs

Henness, S., & Brown, S. J. (2004). *Brightening horizons: The impact of after school programs on children's computer skills*. Columbia, MO: University of Missouri Columbia Outreach & Extension.

New! **Ascend Summer Youth Program**
This program for teens in Washington, DC, provides mentoring, workforce readiness awareness, and project-based learning experiences using information technology to address

Nielsen, N. (2005). *Evaluation of the Ascend Summer Youth Program 2005: Summative report*. Washington, DC: Ascend, Inc.

Bill Nye the Science Guy Television Series
This television series on science is designed for 8- to 10-year-olds and is broadcast nationwide during after school hours and on weekends. (***science/technology/mathematics***)
Rockman Et Al. (1996). *Evaluation of the Bill Nye the Science Guy television series and outreach*. San Francisco, CA: Author. rockman.com/projects/projectDetail.php?id=124

APPENDIX C (CONTINUED)

Boys & Girls Clubs of America—Project Connect
Initiated in 1999 in a small number of Boys & Girls Clubs across the country, this pilot program was designed to test the feasibility of installing computer centers in clubs nationwide. These Clubs provided enhanced access to technology, educational software, and the Internet. (*positive youth development,* ***science/technology/mathematics****, system-building*)

Henriquez, A., & Ba, H. (2000). *Project Connect: Bridging the digital divide – Final evaluation report.* New York: EDC Center for Children & Technology. www2.edc.org/CCT/admin/publications/report/pc_bdd00.pdf

Buhl Middle School After School Math Help Class
Starting in 2003, this program in Buhl, Idaho, provides computer-assisted remedial math classes after school to middle school students who voluntarily attend. (***science/technology/mathematics****, tutoring/extra instruction*)

McDonald, N. Trautman, T., & Blick, L. (2005). *Computer-assisted middle school mathematics remediation intervention: An outcome study*. Oklahoma City, OK: American Education Corporation. www.amered.com/research_2.php

Community Science Workshops
Funded in 1994, these institutions are part science center, part woodshop, part nature center. Located in community centers and schools in urban neighborhoods throughout California, they are designed for youth (mostly 8–12-year-olds) to drop in after school and on weekends and provide local youth with opportunities to engage in their own projects and to pursue their own firsthand learning. (*positive youth development,* ***science/ technology/mathematics***)

St. John, M., Carroll, B., Hirabayashi, J., Huntwork, D., Ramage, K., & Shattuck, J. (2000). *The Community Science Workshops: A report on their progress*. Inverness, CA: Inverness Research Associates. www.inverness-research.org/reports/ab_cswrpt.html

Darlington Summer Academic Program
This summer mathematics enrichment program was implemented in the early 1990s for high-achieving mathematics students in sixth through eighth grade in Darlington County, South Carolina. (*academic/enrichment,* ***science/technology/mathematics***)

Buck, D. S. (1994). *The effects of a summer enrichment program on mathematically bright students*. Unpublished doctoral dissertation, South Carolina State University, Orangeburg.

Delta Area Summer Science, Mathematics, and Technology Academy
This program, initiated in 2000, is a summer science enrichment program for rising eighth-grade students in the Mississippi Delta area. Activities include inquiry-guided activities and field trips to science-related locations. (*academic/enrichment,* ***science/technology/mathematics***)

Moore, J. M. (2001). *The effects of inquiry-based summer enrichment activities on rising eighth-graders' knowledge of science processes, attitude toward science, and perception of scientists.* Unpublished doctoral dissertation, University of Mississippi, Oxford.

Discovery Youth
Initiated in 2001, this after school program gives 10- to 14-year-olds in San Jose, California, the chance to develop multimedia projects that promote healthy behaviors to other audiences,

APPENDIX C (CONTINUED)

especially younger peers. (***science/technology/mathematics***, *service-learning/civic engagement, youth leadership*)

Gilbert, D. (2002). *Looking back and looking ahead: A formative evaluation of Discovery Youth at San Jose Children's Discovery Museum.* San Jose, CA: San Jose Children's Discovery Museum. Moghadam, S. H. (2004). *An evaluation of the San Jose Children's Discovery Museum after school and weekend program*. Oakland, CA: ASSESS. www.cdm.org/p/viewPage.asp?mlid=159

Earth Force

Founded in 1993, this national environmental education, civic participation, and service-learning program is designed to teach middle school youth the knowledge, skills, and attitudes needed to become active citizens on environmental issues in their communities. (***science/technology/mathematics***, *service-learning/civic engagement, youth leadership*)

Melchior, A., & Bailis, L. N. (2003). *2001–2002 Earth Force evaluation: Program implementation and impacts*. Waltham, MA: Center for Youth and Communities, Heller Graduate School, Brandeis University.

Fifth Dimension/University-Community Links

Begun in 1986, this after school programming approach is used by Boys and Girls Clubs, YMCAs and YWCAs, recreation centers, and public schools in several countries, including the U.S., with a special focus in California. It provides a way to increase the educational programming of such institutions without substantially increasing the costs of operation. (*academic/enrichment, literacy,* ***science/technology/mathematics***)

Blanton, W. E., Moorman, G. B., & Zimmerman, S. J. (n.d.). *Ways of knowing, ways of doing, ways of transporting: Mastering social practices in the Fifth Dimension.* Boone, NC: College of Education Appalachian State University, Laboratory of Learning and Technology. 129.171.53.1/blantonw/5dClhse/publications/tech/WaysofKnowing.html DeKes-Woodruff, M., & Waldorf, J. (1995). Educational telecommunication usage in an after school environment: Using recreational practices toward educational goals. *Electronic Journal of Communication, 5*(4).

First Step

Initially piloted in 1990, this summer science bridge program was designed to assist incoming ninth grade students in Prince George's County, Maryland, gain high initial academic achievement in all courses, especially science, mathematics, and engineering technology. (***science/technology/mathematics***)

Wheatley, J. V. (1995). *Effects of constructivistic summer science activities on the initial academic achievement of culturally diverse in-coming ninth-grade students*. Unpublished doctoral dissertation, University of Maryland, College Park.

First Teachers

This after school family involvement program in Washington, D.C., incorporates families telling, writing, and then typing family stories on computers with their elementary school aged children to promote literacy, familiarity with technology, children's sense of efficacy and self-confidence, and parents' involvement with their child's education. (*family/community involvement, literacy,* ***science/technology/mathematics***)

APPENDIX C (CONTINUED)

Samaras, A. P., & Wilson, J. C. (1999). Am I invited? Perspectives of family involvement with technology in inner-city schools. *Urban Education, 34*, 499–530.

Gevirtz Summer Academy
This summer school program was implemented at four Santa Barbara, California, elementary schools in 1998. The program is intended to provide learning opportunities to fifth and sixth graders that are closely tied with the district's curricular standards, but which were taught in a more experiential, integrated way, combining science, math, and language arts. (*academic/enrichment, literacy,* ***science/technology/mathematics***)

Brenner, M., Hudley, C., Jimerson, S., & Okamoto, Y. (2003). *3 year evaluation of the Gevirtz Summer Academy – 1998–2000.* University of California, Santa Barbara Gevirtz Graduate School of Education—Gevirtz Research Center. Evaluation information available at education.ucsb.edu/grc/summer.html.

Girls at the Center
Initiated in 1996, this program teams girls in economically disadvantaged communities across the country with an adult partner for experiences in science. (*academic/enrichment, family/community involvement,* ***science/technology/mathematics***)

Abrams, C., Dierking, L., McKelvey, L., & Jones, D. (1998) *Year two report: Summative evaluation – Girls at the Center.* Annapolis, MD: Institute for Learning Innovation.
Adelman, L., Dierking, L. D., & Adams, M. (2000*). Summative evaluation year 4: Findings for Girls at the Center (Tech. Rep.).* Annapolis, MD: Institute for Learning Innovation.

Girls Math and Technology Program
Initiated in 1998, this residential summer camp in northern Nevada is designed to impact middle school girls' attitudes and perceived abilities in mathematics and technology. (*positive youth development,* ***science/technology/mathematics***)

Wiest, L. (2003). *The impact of a summer mathematics and technology program for middle school girls*. Reno, NV: Author.

Hands on Science Outreach
This national after school recreational science enrichment program was created to encourage youth, pre-K to sixth grade, to take an active interest in science through a "hands on" approach. (*academic/enrichment,* ***science/technology/mathematics***)

Goodman, I. F. (1993). *An evaluation of children's participation in the Hands on Science Outreach Program.* Cambridge, MA: Sierra Research Associates.
SDS & Associates. (1994). *1993–94 Hands on Science program report*. Memphis, TN: Author.

InfoLink
In operation from 1994 to 2002 in Pittsburgh, Pennsylvania, this intensive summer program provided low-income high school students with information technology and professional development skills, experience, and confidence to improve their long-term educational and occupational attainment. (***science/technology/mathematics****, vocational education*)

Nelson, C. A., Post, J., & Bickel, B. (2002). InfoLink final evaluation report: Building confidence and aspirations in low income high school students through a technology and workforce skills development program: Lessons learned from the InfoLink

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experience, 1994–2002. Pittsburgh, PA: University of Pittsburgh. itclass.heinz.cmu.edu/infolink2003/InfoLink03/docs/Lessons_Learned.pdf

Intel Computer Clubhouse Network
Begun in 2000, this national program encourages young people to use technology-rich environments to construct artifacts, explore ideas, and creatively express themselves, in collaboration with peers and local mentors. (*mentoring, positive youth development,* ***science/technology/mathematics***)

Pryor, T., Culp, K. M., Lutz, S., & John, K. (2001). *Evaluation of the Intel Computer Clubhouse Network, year 1.* New York: Center for Children and Technology, Education Development Center. www2.edc.org/cct/publications_report_summary.asp?numPubId=46

Lavine, M., & Hochman, J. (2002). *Evaluation of the Intel Computer Clubhouse, year two report.* New York: Center for Children and Technology, Education Development Center. www2.edc.org/cct/publications_report_summary.asp?numPubId=79

JCPenney/Junior Achievement Afterschool Partnerships
This pilot program was implemented in the greater St. Louis, Missouri, area in 2003. The pilot promoted programs focusing on business, finance, and the Internet at Boys and Girls Clubs and YMCAs in an effort to increase implementation of these programs in after school settings across St. Louis and surrounding counties. (*positive youth development,* ***science/technology/mathematics***)

Breinig, J. & Frankel, P. (2004). *Analysis of survey results from the JCPenney–St. Louis/Junior Achievement After-School Program Partnership*. Colorado Springs, CO: Junior Achievement. www.ja.org/programs/programs_eval_afterschool.shtml

Jobs for Youth—Boston PLATO Summer Transition Program
This program, initiated in 2000, provides ninth grade students in Boston, Massachusetts, who failed the citywide public schools' math or reading test with supplemental instruction using specially designed computer instruction software called PLATO. (***science/ technology/mathematics****, tutoring/extra instruction*)

Quinn, D. W., & Quinn, N. W. (2001). *PLATO learning evaluation series: Jobs for Youth, Madison Park Alternative High School, Boston, Massachusetts*. Bloomington, MN: PLATO Learning. www.plato.com/downloads/evaluations/madison.pdf

Kids Learning in Computer Klubhouses (KLICK)
Begun in 1999, this consortium of 10 middle school after school computer clubhouses across Michigan provides safe and engaging learning opportunities to students during the out-of-school hours. (*academic/enrichment,* ***science/technology/mathematics***)

Zhao, Y., Mishra, P., & Girod, M. (2000). A clubhouse is a clubhouse is a clubhouse. *Computers in Human Behavior. 16*(3), 287–300. citeseer.ist.psu.edu/cache/papers/cs/13618/http:zSzzSzpunya.educ.msu.eduzSzpubszSzprintzSzclubhouse.pdf/a-clubhouse-is-a.pdf

APPENDIX C (CONTINUED)

Math Academic Enhancement Program
Implemented in February 2000, this after school program is an academic intervention services program provided to selected fourth grade students in the Excelsior school district in New York in preparation for the grade four state-mandated mathematics assessment. (***science/technology/mathematics****, tutoring/extra instruction*)

Deeb-Westervelt, W. (2002). *The effects of an after-school academic intervention services math program on the grade four New York State Mathematics Assessment: A quasi-experimental case study*. Unpublished doctoral dissertation, Hofstra University, Hempstead, NY.

Martin Luther King, Jr. After-School Program
This after school technology project in Dorchester, Massachusetts, for middle and high school students uses the Encarta Africana (an encyclopedia of Africa and its diaspora) as the core of the curriculum. The goal of the program is to teach technology skills through the study of Afrocentric topics. (*cultural/heritage,* ***science/technology/mathematics***)

Goldsmith, L. & Sherman, A. (2002). *Evaluation of the pilot year of the Martin Luther King, Jr. After-School Program*. Newton, MA: Education Development Center.

Matzko, M. (2002). *An evaluation study of the Martin Luther King, Jr. After-School Program*. Somerville, MA: Brett Consulting Group.

Migrant Educational Technology Program
This after school program in Detroit, Michigan, teaches Latino migrant families basic computing and educational software applications to help them support their children's schoolwork more effectively. (*academic/enrichment, family/community involvement,* ***science/technology/mathematics***)

Carrillo, R. (2004). Making connections: Building family literacy through technology. In *Scholars in the field: Challenges in migrant education*, Cinthia Salinas & María E. Fránquiz (Eds.). Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools.

Minority Pre-Engineering Mentor Program
This summer program in Wichita, Kansas, involves high school juniors in science, math, and engineering workshops and offers tutorials in note taking, calculator use, and computer usage and programming, as well as a job shadowing internship at the Boeing Military Airplane Company. The program is designed to increase minority participation in math, science, and engineering. (*mentoring,* ***science/technology/mathematics****, vocational education*)

Dunn, C. W., & Veltman, G. C. (1989). Addressing the restrictive career maturity patterns of minority youth: A program evaluation. *Journal of Multicultural Counseling and Development, 17*, 156–165.

Morgan State University SEM (Science, Engineering, and Math) Summer Bridge Programs
From 1994–1998 two summer bridge programs were conducted at a university in Baltimore, Maryland, for incoming science, engineering, and math students (SEM) to bolster their academic performance and retention in SEM during the 1st year of college. (*academic/enrichment,* ***science/technology/mathematics****, vocational education*)

Wheatland, J. A. (2000). *The relationship between attendance at a summer bridge program and academic performance and retention status of first-time freshman science, engineering, and mathematics students at Morgan State University, an historically black university*. Unpublished doctoral dissertation, Morgan State University, Baltimore.

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National Society of Hispanic Masters of Business Administration's Summer Enrichment Program

This summer enrichment program provides Washington, D.C., Hispanic high school students with instruction in language, writing, public speaking skills, and an innovative mathematics curriculum in order to increase their success in the classroom. (*literacy,* ***science/technology/mathematics****, tutoring/extra instruction*)

McShea, B., & Yarnevich, M. (1999). The effects of a summer mathematics enrichment program on Hispanic mathematical achievement. *Journal of Women and Minorities in Science and Engineering, 5*, 175–181.

Newton Summer Academy

This summer academy was piloted in Columbus, Missouri, in 1997. The program was designed to increase or maintain high school girls' interest and participation in the physical sciences. (***science/technology/mathematics***)

Chandrasekhar, M., Phillips, K. A., Litherland, R., & Barrow, L. H. (1999, March). *Science interests and experiences for high school girls in a summer integrated program.* Paper presented at the annual meeting of the National Association for Research in Science Teaching, Boston, MA. www.missouri.edu/~wwwepic/html/body_publications.html

Phillips, K. A. (2000). *High school females' interests in physical science and related careers one year after participation in a summer intervention program*. Unpublished doctoral dissertation, University of Missouri-Columbus.

NYC FIRST! (New York City For Inspiration and Recognition of Science and Technology)

Implemented in 1998, this program in New York City is typically run as either an after school or weekend program. FIRST is a national organization that engages middle and high school students, working with adult coaches and mentors, in researching, designing, and building robots and participating in games of skill and strategy meant to transfer the enthusiasm youth feel for athletics to the fields of math, science, and engineering. (***science/technology/mathematics***)

Jeffers, L. (2003). *Evaluation of NYC FIRST!* New York: EDC Center for Children and Technology. www2.edc.org/CCT/publications_report_summary.asp?numPubId=141

Oceanography Camp for Girls

Started in 1991, this summer educational program helps motivate girls about to enter ninth grade to consider career opportunities in the sciences. The program, located in St. Petersburg, Florida, encourages girls to understand the natural world and provides a multidisciplinary, hands-on/minds-on practical experience in both laboratory and field environments. (*academic/enrichment,* ***science/technology/mathematics****, vocational education*)

Butler, Y. J. (1999). *Introducing oceanography to eighth-grade girls: Evaluation of the Oceanography Camp for Girls, summer of 1998.* Philadelphia: Public/Private Ventures.

PAGE ONE (Peer and Group Education)

This program, initiated in 1996, provides an academically stimulating environment that extends the instruction third through eighth graders in the Rock Hill School District in South Carolina receive in their public school classrooms to after school and summer programs. (*academic/enrichment,* ***science/technology/mathematics****, tutoring/extra instruction*)

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Brown, D. C. (1999). *The effects of peer and group education (PAGE ONE), a comprehensive compensatory program for students at-risk of school failure, on mathematics achievement and student attitude*. Unpublished doctoral dissertation, University of South Carolina, Columbia.

PowerUP

Founded in 1999, this program's mission is to ensure that America's underserved youth acquire the skills, experiences, and resources to succeed in the digital age. PowerUP provides technology, funding, training, and technical assistance to local PowerUP centers, which foster positive development among youth during after school, evening, and weekend hours. (*positive youth development, **science/technology/mathematics**, system-building*)

Vesneski, W., Skinner, N., & Schneider, L. (2002). *PowerUP evaluation report*. Seattle, WA: The Evaluate Group.

Project Mentor

Begun in 1997, this after school mentoring program matches middle school girls in New Hampshire with undergraduate mentors in order to improve the girls' academic achievement, attitudes toward math and science, self-esteem, and career aspirations. (*academic/enrichment, mentoring, **science/technology/mathematics***)

Fachin Lucas, K. M. (1999). *Mentoring in adolescence: A sociocultural and cognitive developmental study of undergraduate women and sixth grade girls in a mentoring program*.

Saturday Science Academy at Clark Atlanta University

Established in the late 1970s in Atlanta, Georgia, the mission of this weekend science enrichment program is to bring African American children in Grades 3–7 into a culturally compatible setting to facilitate their science learning. (*cultural/heritage, positive youth development, **science/technology/mathematics***)

Dickerson, T., Bernhardt, E., Brownstein, E., Copley, E., McNichols, M., Thompson, R., et al. (1995). African American children reflecting on science, mathematics, and computers through creative writing: Perspectives from a Saturday Science Academy. *Journal of Negro Education*, *64*(2) 14–153.

Saturday Science Program

Begun in 1989, this program is designed to assist underrepresented students in achieving higher skills in mathematics and science at the secondary level and to increase the number of minority students entering science-related fields at the post-secondary level in Broward County, Florida. (***science/technology/mathematics***) The School Board of Broward County, Florida, Research and Evaluation. (1999). *Saturday Science Program evaluation report*. Fort Lauderdale, FL: Author. www.broward.k12.fl.us/research_evaluation/Evaluations.htm

Saturday Science QUEST

This program provides hands-on experiences during selected Saturdays designed to provide opportunities in science for elementary and middle school students interested in science in Bloomington, Indiana. (***science/technology/mathematics***)

Worch, E. A., Gabel, D. L., et al. (1994). Saturday Science QUEST: A Science Enrichment Program for Elementary Children and Preservice Elementary Teachers. *School Science & Mathematics, 94*, 401–406.

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Service at the Salado
This after school program, implemented at four schools in Phoenix, Arizona, in 2003, engages students in grades 5–8 in learning about and serving their community through scientific inquiry and technology and by creating projects that are exhibited to the public at a local park. (***science/technology/mathematics***, *service-learning/civic engagement*)

Saltz, C., Crocker, N., & Banks, D. L. (2004). *Evaluation of Service at the Salado for Fall 2004*. Tempe, AZ: Arizona State University International Institute for Sustainability. caplter.asu.edu/explorers/riosalado/pdf/fall04_report.pdf

ECME RISE (Raising Interest in Science & Engineering)
Begun in 1998, this 3-year program aimed to increase middle school girls' self-esteem and confidence in learning mathematics and science, therefore reducing the attrition in advanced level mathematics and science coursework that occurs as girls move from middle school to high school. (*mentoring, positive youth development,* ***science/technology/mathematics***)

Jarvis, C. (1999). *SECME RISE Raising Interest in Science & Engineering: Year two progress report*. Miami, FL: Miami Museum of Science. www.miamisci.org/rise/report2.html

Jarvis, C. (2002). *SECME RISE Raising Interest in Science & Engineering: Final evaluation report, September 1, 1998–August 31, 2001*. Miami, FL: Miami Museum of Science.

Society of Women Engineers and ExxonMobil Education Foundation's After-School Science Program
Initiated in 1999, this after school science program serves minority female urban middle school students who work with female engineer mentors in cooperative learning groups in hands-on/minds-on activities. Mentors act as role models to positively influence girls' attitudes toward science. (*mentoring,* ***science/technology/mathematics***) Ferreira, M. M. (2001). The effect of an after-school program addressing the gender and minority achievement gaps in science, mathematics, and engineering. *ERS Spectrum*, 11–18.

South Bay Project
This collaboration of school and community institutions provides K–12 students in low-performing schools in San Diego, California, with computer-integrated activities after school. The program provides computer-mediated activities combining play with academically rigorous learning in a low-surveillance, collaborative learning environment. (*academic/enrichment,* ***science/technology/mathematics***)

Tripp, L. M. (2002). *Trying to bend the bars of the iron cage: A case study of a K–12 partnership*. Unpublished doctoral dissertation, University of California, San Diego.

STUDIO 3D
Initiated in 2000, this after school outreach program provides access for 10–18-year-olds living in low-income, inner-city neighborhoods in Minneapolis and St. Paul, Minnesota, to equipment, software, and adult mentors to support them in learning and applying advanced digital design technologies. (*mentoring,* ***science/technology/mathematics***)

Volkov, B. B., & King, J. A. (2003). *Report of STUDIO 3D project evaluation*. Minneapolis: University of Minnesota, Department of Educational Policy and Administration, Evaluation Studies Program. www.smm.org/studio3d/mission.html

APPENDIX C (CONTINUED)

Summer Science Academy
Initiated in 1996, this program offers high school students in Rochester, New York a challenging, intensive 2 to 4 week summer program consisting of independent lab projects, bioethics discussion sessions, a biocomputing course, scientist seminars, and field trips. (***science/technology/mathematics***)

Markowitz, D. G. (2004). Evaluation of the long-term impact of a university high school summer science program on students' interest and perceived abilities in science. *Journal of Science Education and Technology, 13*, 395–407.

Summer Science Enrichment Program—University of Tennessee, Memphis
This 5-year program (1993–1997) was designed to encourage achievement and career interest in science among students attending inner-city schools in the Memphis City, Tennessee school district. (***science/technology/mathematics****, tutoring/extra instruction, vocational education*)

Hardy, J. M. (2000). The effects of a Summer Science Enrichment Program on college enrollment, college majors, and career preferences of inner city youth. Unpublished doctoral dissertation, University of Mississippi, Oxford.

Technology-Rich Virtual Community After School Class
This program, implemented in 2001, creates technology-rich activities and experiences for an after school class in science and technology for middle school girls from a low socio-economic urban neighborhood. The program was designed to create a virtual community of practice whose members used science in diverse ways. (***science/technology/ mathematics***)

Edwards, L. D. (2002). *Creating a virtual community of practice to investigate legitimate peripheral participation by African American middle school girls in science activities*. Unpublished doctoral dissertation, University of Colorado, Boulder.

TechREACH
Launched in 2003, this after school program targets low-income, at-risk middle school girls in western Washington State and engages them in science, mathematics, engineering, and technology (STEM) activities to increase their interest in STEM with high-quality curricula and real world projects. (***science/technology/mathematics***)

Molloy, P. & Aronson, J. (2004). *TechREACH: Year 1 evaluation report*. Bothell, WA: Puget Sound Center for Teaching.

Molloy, P. & Aronson, J. (2005). *TechREACH: Year 2 evaluation report*. Bothell, WA: Puget Sound Center for Teaching.

www.pugetsoundcenter.org/techREACH/program_info/activities.html

Twenty-First Century Mathematics Center for Urban High Schools
Begun as a pilot in 1989 in Philadelphia, Pennsylvania, this summer mathematics program provides a model for upgrading the mathematics skills of urban high school students. (***science/technology/mathematics****, tutoring/extra instruction*)

Riley, A. H. J. (1997). *Student achievement and attitudes in mathematics: An evaluation of the Twenty-First Century Mathematics Center for Urban High Schools*. Unpublished doctoral dissertation, Temple University, Philadelphia, PA.

APPENDIX C (CONTINUED)

University of Virginia's Summer Enrichment Program Invention and Design
Initiated in 1994, this is a 3-week summer invention and design course in Charlottesville, Virginia, for high school students. (*positive youth development,* ***science/technology/ mathematics***)

Plucker, J. A., & Gorman, M. E. (1999). Invention is in the mind of the adolescent: Effects of a summer course one year later. *Creativity Research Journal, 12*(2), 141–150.

Verilette Parker Science Intervention Program
This summer program was developed in 1998 and provides science lessons for fifth and sixth grade African American students in rural Georgia. (***science/technology/mathematics***)

Parker, V., & Gerber, B. (2000). Effects of a science intervention program on middle-grade student achievement and attitudes. *School Science and Mathematics, 100*(5), 236–242.

Water Educational Training (WET) Science Project
Conducted during a 16-month period from 1999 to 2000, this after school program promoted science literacy through an interdisciplinary program around the theme of water for elementary students in southeast Michigan. Lessons were designed to strengthen wetlands knowledge and applications of science concepts related to water. (*literacy,* ***science/technology/mathematics***)

Moore-Hart, M. A., Liggit, P., & Daisey, P. (2002). *Interdisciplinary teaching in a Water Education Training Science Program: Its impact on science concept knowledge, writing performance, and interest in science and writing of elementary students.* Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA. www.emich.edu/wrc/wet/eisenhower.htm

Wonderwise 4-H
Begun in 2000, this 3-year project extends previous Wonderwise projects to target 4-H programs in 10 states. Wonderwise is a curriculum designed to encourage young women to become more involved in science and science careers. (***science/technology/mathematics***)

Acklie, D. S. (2003). *Community based science education for fourth to sixth graders: Influences of a female role model*. Unpublished doctoral dissertation, University of Nebraska.
Wever Frerichs, S., & Spiegel, A. N. (2004). *Dissemination of the Wonderwise 4-H Project: An evaluation of the process*. Lincoln: University of Nebraska-Lincoln, Center for Instructional Innovation. net.unl.edu/wonderwise/research/research.htm

Wonderwise Sleepovers
Using Wonderwise (specially designed kits used as a curriculum to promote science to young girls), teachers in Lincoln, Nebraska, public schools organized a series of science sleepovers for fifth and sixth grade girls in 1998 and 1999. (***science/technology/mathematics***)

Spiegel, A. N.(2002). Evaluation of Lincoln Public Schools' Wonderwise Sleepovers: Brief summary and compilation of five individual reports, with example questionnaires. Lincoln: University of Nebraska-Lincoln, Center for Instructional Innovation. net.unl.edu/wonderwise/research/pdfs/Sleepover_Report.Harvard Family

All of these programs and their evaluations are available at: Research Project, Harvard Graduate School of Education, 3 Garden Street, Cambridge, MA, 02138. Tel: 617-495-9108, Fax: 617-495-8594. Email: hfrp@gse.harvard.eduwww.hfrp.org www.gse.harvard.edu/hfrp/projects/afterschool/evaldatabase.html

APPENDIX D
PARTIAL LIST OF CONNECTICUT STEM PROVIDERS

Organization	Chief Executive Officer	Address	Phone	Email	Website
American Clock & Watch Museum	Donald Muller Executive Director	100 Maple Street Bristol, CT 06010	860/583-6070	donmuller@clockmuseum.org	www.clockmuseum.org
Ansonia Nature & Recreation Center	Donna Lindgren Director	10 Deerfield Rd, Ansonia, CT 06401	203/736-1053	ansnaturectr@snet.net	www.ansonianaturecenter.org
Barnes Nature Center	Jon Guglietta Director	175 Shrub Road Bristol, CT 06010	860/589-6082	www.elecct.org	
Bartlett Arboretum	Jack Dillon Executive Director	151 Brookdale Rd Stamford, CT 06903	203-322-6971		
Bauer Park	Julie P. Ainsworth	Copse Road Madison, CT 06443	203/245-5623	julieainsworth@sbcglobal.net	www.madisonct.org/Bauer%20Farm/bauerhome.html
Bruce Museum	Peter C. Sutton	One Museum Drive Greenwich, CT 06830	203/869-0376	pcsutton@brucemuseum.org	www.brucemuseum.org
Bushy Hill Nature Center	Erik Becker Director	P.O. Box 577 Ivoryton, CT 06442	860/767-2148	info@bushyhill.org	www.bushyhill.org
Children's Garbage Museum (Stratford)	Paul Nonnenmacher Director of Public Affairs	1410 Honeyspot Road Ext. Stratford, CT 06615	203/381-9571		www.crra.org/pages/edu_museums.htm#strtfd
Children's Museum of SE Connecticut	Tony Mollica Executive Director	409 Main Street Niantic, CT 06357	860/691-1111	cmsect@aol.com	www.childrensmuseumsect.org
Clean Air-Cool Planet	Adam Markham Executive Director	Tri State Office 161 Cherry Street New Canaan, CT 06840	203/966-5429	amarkham@cleanair-coolplanet.org	www.cleanair-coolplanet.org
Connecticut Audubon Center at Bent of the River	John Longstreth Center Manager	185 E. Flat Hill Road Southbury, CT 06488	203/264-5098	jlongstreth@audubon.org	www.audubon.org
Connecticut Audubon Center in Greenwich	Jeff Cordulack Education Program Manager	613 Riversville Road Greenwich, CT 06831	203/869-5272	mdennis@audubon.org	www.greenwich.center.audubon.org
Connecticut Audubon Center in Sharon	Scott Heth Manager	325 Cornwall Bridge Road Sharon, CT 06069	860/364-0520	sheth@audubon.org	www.audubon.org/local/sanctuary/sharon
Connecticut Audubon Society at Fairfield (State Office)	Bernard Mucci Senior Director	2325 Burr Street Fairfield, CT 06824	203/259-6305	bmucci@ctaudubon.org	www.ctaudubon.org
Connecticut Audubon Society at Glastonbury	Judy Harper Director	1361 Main Street Glastonbury, CT 06033	860/633-8402	jhrper@ctaudubon.org	www.ctaudubon.org/visit/glastonbury.htm
Connecticut Audubon Society at Ragged Hill Woods	Linda Richardson Director	139 Wolf Den Road Brooklyn, CT 06234	860/774-9600	lrichardson@ctaudubon.org	www.ctaudubon.org/visit/raggedhill.htm
Connecticut Audubon Society at Trail Wood	Sarah Heminway Director of Northeast Corner Programs	The Edwin Way Teale Memorial Sanctuary 93 Kenyon Road Hampton, CT 06247	860/928-4948	sheminway@ctaudubon.org	www.ctaudubon.org/visit/trailwood.htm
Connecticut Audubon Society Birdcraft Museum at Fairfield	Bernard Mucci Senior Director	314 Unquowa Road Fairfield, CT 06824	203/259-0416	bmucci@ctaudubon.org	www.ctaudubon.org/visit/birdcraft.htm
Connecticut Audubon Society Center at Milford Point	Frank Gallo Director of Shoreline Education	1 Milford Point Road Milford, CT 06460	203/878-7440	fgallo@ctaudubon.org	www.ctaudubon.org/visit/milford.htm

APPENDIX D (CONTINUED)

Organization	Chief Executive Officer	Address	Phone	Email	Website
Connecticut Audubon Society Center at Pomfret	Sarah Heminway Director of Northeast Corner Programs	189 Pomfret Street (Rte. 169) Pomfret Center, CT 06259	860/928-4948	sheminway@ctaudubon.org	www.ctaudubon.org/visit/pomfret.htm
Connecticut Center for Advanced Technology	Susan Palisano Director Educational Programs	111 Founders Plaza Suite 1002 East Hartford, CT 06108	860/291-8832	spalisano@ccat.us	www.ccat.us
Connecticut Children's Museum		Children's Building 22 Wall Street New Haven, CT 06511	203/562-5437	the childrensbuilding@snet.net	www.childrensbuilding.org
Connecticut Clean Energy Fund	Lise Dondy	200 Corporate Place 3rd Floor Rocky Hill, CT 06067	860/563-0015	Lise.Dondy@ctinnovations.com	www.cleanenergy.com
Connecticut College Arboretum	Glenn D. Dreyer Director	270 Mohegan Avenue New London, CT 06320	860/439-2144	glenn.dreyer@conncoll.edu	http://arboretum.conncoll.edu
Connecticut DEP	Gina McCarthy Commissioner	79 Elm Street Hartford, CT 06106	860/424-3001	gina.mccarthy@po.state.ct.us	http://dep.state.ct.us
Connecticut Forest & Parks Association	Richard Whitehouse President	16 Meriden Road Rockfall, CT 06481	860/346-2372	conn.forest.assoc@snet.net	www.ctwoodlands.org
Connecticut Outdoor Environmental Education Association	Lori Paradis Brant Acting President		860/346-2372	president@coeea.org	http://www.coeea.org
Connecticut Resource Recovery Authority Visitors' Center & Trash Museum	Thomas D. Kirk President	211 Murphy Road Hartford, CT 06114	860/757-7765	tkirk@crra.org	www.crra.org
Connecticut River Museum	Brenda Milkofsky Interim Director	Main Street Essex, CT 06426	860/767-8269	BrendaM@ctrivermuseum.org	www.ctrivermuseum.org
Connecticut Science Center	Ted Sergi President	50 Columbus Blvd. Suite 500 Hartford, CT 06106	860/727-0457	tsergi@ctcse.org	www.ctcse.org
Connecticut Science Center	Christine Moses Director, Program Outreach	50 Columbus Blvd. Suite 500 Hartford, CT 06106	860/727-0457	cmoses@ctcse.org	www.ctcse.org
Connecticut Sea Grant	Sylvain De Guise Interim Director	University of CT Avery Point, Marine Science Building 1080 Shennecossett Road Groton, CT 06340-6048			
Connecticut State Museum of Natural History	Leanne Kennedy Harty Director	University of Connecticut 2019 Hillside Rd., Unit 1023 Storrs, CT 06269-1023	860/486-4460	leanne.harty@uconn.edu	www.cac.uconn.edu/mn-hhome.html
Connecticut Trolley Museum	Barbara Grimaldi Executive Director	58 North Road East Windsor, CT 06088	860/627-6540	bbg1430@comcast.net	www.ct-trolley.org
Connecticut's Beardsley Zoo	Gregg Dancho Zoo Director	1875 Noble Avenue Bridgeport, CT 06610	203/261-4663	gdancho@beardsleyzoo.org	www.beardsleyzoo.org
Copernican Observatory & Planetarium at CCSU	Kris Larsen	Central CT State University 1615 Stanley Street New Britain, CT 06050		Larsen@ccsu.edu	www.ccsu.edu/astronomy

APPENDIX D (CONTINUED)

Organization	Chief Executive Officer	Address	Phone	Email	Website
Copernican Space Science Center	Josh Cohen President	Central CT State University 1615 Stanley Street New Britain, CT 06050	860/832-3399	President@asgh.org	www.asgh.org
Danbury Railway Museum		120 White Street Danbury, CT 06813-0090	203/778-8337		www.danbury.org/drm/mu-seum.htm
Darien Nature Center	Lynn Hamlen Director	120 Brook Side Road Darien, CT 06820	203/655-7459	lynnhamlen@dariennaturecen-ter.org	www.dnc.darien.org
Denison Pequotsepos Nature Center	Maggie Jones Executive Director	109 Pequotsepos Road Mystic, CT 06355	860/536-1216	mjones@dpnc.org	www.dpnc.org
Devil's Den Preserve		33 Pent Road Weston, CT 06883	860/226-4991	theden@tnc.org	
Dinosaur State Park	Margaret Enkler	400 West Street Rocky Hill, CT 06067	860/529-5816	Margaret.enkler@po.state.ct.us	www.dinosaurstatepark.org
Discovery Center at Ridgefield	Rick Bucich Director	PO Box 926 Ridgefield, CT 06877	203/438-1063		www.ridgefielddiscovery.org
Discovery Museum	Linda Malkin Executive Director	4450 Park Avenue Bridgeport, CT 06604	203/372-3521	Malkin@discoverymuseum.org	www.discoverymuseum.org
Earthplace	John Horkel Executive Director	10 Woodside Lane Westport, CT 06881	203/227-7253	j.horkel@earthplace.org	www.earthplace.org
Eleanor Buck Wolf Nature Center	Christopher Shepard Director	156 Prospect Street Wethersfield, CT 06109	860/529-3075	naturecenter@wethersfieldct.com	http://wethersfieldct.com/rec/nature_center.html
Eli Whitney Museum	William Brown Director	915 Whitney Avenue Hamden, CT 06517	203/777-1833	wb@eliwhitney.org	www.eliwhitney.org
Farm Implement Museum		434 Tunxis Avenue (RT 148 N) Bloomfield, CT 06002			
Flanders Nature Center and Land Trust	Arthur Milnor Executive Director	5 Church Hill Road Woodbury, CT 06798	203/263-3711	arthur@flandersnaturecenter.org	www.flandersnaturecenter.org
Garden Education Center of Greenwich	Adrienne Parker Managing Director	130 Bible Street Greenwich, CT 06807	203/869-9242 x 14	gec@gecgreenwich.org	www.gecgreenwich.org
Gurleyville Grist Mill	Madge Manfred Joshua's Trust President	Stone Mill Road Storrs, CT 06268	860/429-9023	joshuastrust@snet.net	www.joshuaslandtrust.org/gristmill.html
Holcomb Farm	Sam Hammer Farm Manager	113 Simsbury Road West Granby, CT 06090	860/653-5554	sam@holcombfarmcsa.org	http://holcombfarmcsa.org
Institute for Sustainable Energy @ Eastern Connecticut State University	Laurel Kohl	83 Windham St. Willimantic, CT 06226	860/465-0256	kohll@easternct.edu	www.easternct.edu/depts/sustainenergy/
Kellogg Environmental Center	Diane Chisnall Joy Director	500 Hawthorne Avenue Derby, CT 06418	203/734-2513	diane.joy@po.state.ct.us	http://dep.state.ct.us/educ/kellogg/kec.htm
Lock 12 Historical Park		487 North Brooksvale Road Cheshire, CT 06410	203/272-2743		www.cheshirect.org
Lutz Children's Museum	Bob Eckert Executive Director	247 South Main Street Manchester, CT 06040	860/643-0949	reckert@lutzmuseum.org	www.lutzmuseum.org
Maritime Aquarium	Jack Schneider	10 North Water Street Norwalk, CT 06854	203/852-0700 x 2242	jschneider@maritimeaquarium.org	www.maritimeaquarium.org

APPENDIX D (CONTINUED)

Organization	Chief Executive Officer	Address	Phone	Email	Website
Mark Twain House	Jeffrey Nichols Director of Education	351 Farmington Avenue Hartford, CT 06105	860/280-3131	jeffrey.nichols@marktwain-house.org	www.marktwainhouse.org
Mashantucket Pequot Museum & Research Center	Theresa Bell Executive Director	110 Pequot Trail Mashantucket, CT 06339-3180	800/411-9671	tbell@mptn-nsn.gov	www.pequotmuseum.org
Mattatuck Museum	Marie Galbraith Director	144 West Main Street Waterbury, CT 06702	203/756-6283	mgalbraith@mattatuckmu-seum.org	www.mattatuckmuseum.org
Menczer Museum		230 Scarborough Street Hartford, CT 06105	860/236-5613	huntmemorial@aol.com	http://library.uchc.edu/hms
Millstone Discovery Center		278 Main Street Niantic, CT 06357			
Mystic Aquarium/Institute for Exploration	Gerard N. Burrow, M.D.	55 Coogan Boulevard Mystic, CT 06355	860/572-5955 x606	gburrow@mysticaquarium.org	www.mysticaquarium.org
New Britain Youth Museum Hungerford Park	Ann F. Peabody Director	191 Farmington Avenue Kensington, CT 06037	860/827-9064	annnewb@snet.net	www.newbritainyouthmu-seum.org
New Canaan Nature Center	Catharine Sturgess	144 Oenoke Ridge New Canaan, CT 06840	203/966-9577 x 19	csturgess@newcanaannature.org	www.newcanaannature.org
New England Air Museum	Caroline d'Otreppe Director of Educational Programs	36 Perimeter Road Windsor Locks, CT 06096	860/623-3305	caroline@neam.org	www.neam.org
New England Science Center Collaborative	Richard Polonsky		603/444-1110	Richard@innovation-works.net	
New Pond Farm	Kristen Allore Director	101 Marchant Road West Redding, CT 06896	203/938-2117	kristen@newpondfarm.org	www.newpondfarm.org
Norwalk Seaport Museum	Bill Collins Managing Director	132 Water Street South Norwalk, CT 06854	203/855-1017	nseaport@snet.net	
Northwest Park and Nature Center	Ford Parker	145 Lang Road Windsor, CT 06095	860/285-1886	parker@townofwindsorct.com	
Peabody Museum of Natural History	Michael J. Donoghue	Yale University P. O. Box 208118 New Haven, CT 06520-8118	203.432.3752	peabody.director@yale.edu	www.yale.edu/peabody
Project Oceanology		Avery Point 1084 Shennecossett Road Groton, CT 06340	860/445-9007	oceanology@aol.com	www.oceanology.org
Quinebaug Valley Trout Hatchery	David Sumner Hatchery Supervisor	151 Trout Hatchery Road Plainfield, CT 06374	860/564-7542	david.sumner@po.state.ct.us	
Roaring Brook Nature Center		70 Gracey Road Canton, CT 06019	860/693-0263	rbnc@sciencecenterct.org	www.sciencecenterct.org
* Science DNA Epicenter (Only Open to Education Groups)	Abby Demars	33 Gallows Lane New London, CT 06320	860/442-0391	ademars@dnaepicenter.org	www.science-epicenter.org
Sessions Woods Conservation Education Center	Laura Rogers-Castro Natural Resource Educator	341 Milford Street (Rt. 69) Burlington, CT 06013	860/675-8130	laura.rogers-castro@po.state.ct.us	
Sheffield Island Lighthouse	Thomas Kies President, Board of Directors	Norwalk Seaport Assoc. 132 Water Street South Norwalk, CT 06854	203/838-9444	seaportadmin@snet.net	www.lighthouse.cc/sheffield

APPENDIX D (CONTINUED)

Organization	Chief Executive Officer	Address	Phone	Email	Website
Shoreline Outdoor Education Center	Dr. Karen Christensen Director	730 County Road Guilford, CT 06437	203/457-0692	earth@99main.com	wwwlshorelineoutdooreduca-tioncenter.org
Shoreline Trolley Museum		17 River Street East Haven, CT 06512	203/467-6927	berasltm@comcast.net	www.bera.org
SmartPower	Brian Keane President	100 Pearl Street Hartford, CT 06103	860/249-7040	bkeane@smartpower.org	www.smartpower.org
SoundWaters	Leigh Shemitz, Ph.D., Executive Director Dianne Selditch	Cove Island Park 1281 Cove Road Stamford, CT 06902	203/406-3304	Dianne@soundwaters.org	www.soundwaters.org
Stamford Museum & Nature Center	Ky Underwood Education Director	39 Scofieldtown Road Stamford, CT 06903	203/322-1646 860/559-0244 (cell)	kunderwood@stamfordmu-seum.org	www.stamfordmuseum.org
Stepping Stones Museum	Rhonda Kiest	Mathews Park 303 West Avenue Norwalk, CT 06850	203/899-0606 x 226	rkiest@steppingstonesmuseum.org	www.steppingstonemuseum.org
Submarine Force Library and Mu-seum/Historic Ship Nautilus	Randolph Tupas Director	U.S. Naval Submarine Base Route 12 Groton, CT 06349	800/343-0079	randolph.tupas@navy.mil	www.ussnautilus.org
Sunny Valley Preserve	Margaret McCauley Director	8 Sunny Valley Lane New Milford, CT 06776		mmccauley@tnc.org	www.nature.org
Talcott Mountain Science Center	Jonathan Craig Director	Montevideo Road Avon, CT 06001	860/677-8571	jcraig@g3.tmsc.org	http://g3.tmsc.org
The Childrens Museum	Hank Gruner V.P./Programs & Exhibits	950 Trout Brook West Hartford, CT 06119	860/231-2830	hgruner@thechildrens-museumct.org	www.thechildrensmuseumct.org
The Family Center for Girls and Boys	James Truscio Executive Director	47 Upson Street Bristol, CT 06010	860/583-1679	jtruscio@familycenter.org	
The Institute for American Indian Studies	Elizabeth McCormick Director	38 Curtis Road P.O. Box 1260 Washington, CT 06793	860/868-0518	emccormick.iais@charter.net	www.birdstone.org
Tomasso Nature Park		Granger Lane Plainville, CT 06062	860/747-6022		
West Rock Nature Center	Wray Williams Park Ranger	Wintergreen Avenue New Haven, CT 06515	203/946-8016	wwilliams@newhavenct.net	www.cityofnewhaven.com/parks/parksinformation/westrockpark.asp
Westmoor Park	Douglas Jackson Park Naturalist	119 Flagg Road West Hartford, CT 06117	860/232-1134	douglas@westhartford.org	www.west-hartford.com/lei-sureservices/recreationfacili-ties/westmoorpark
White Memorial Conservation Center	Jeff Greenwood	80 Whitehall Road Litchfield, CT 06759	860/567-0857	jgreenwood@optonline.net	www.whitememorialcc.org
Whitney Water Center	Kate Powell Environmental Outreach Manager	945 Whitney Avenue Hamden, CT 06517	203/777-1142	kpowell@water.com	www.rwater.com
Woodcock Nature Center	Henryk Teraszkiewica Executive Director	56 Deer Run Road Wilton, CT 06897	203/762-7280	woodcocknaturecenter@yahoo.com	www.woodcocknaturecenter.org
Yale Sustainability Initiative	Julie Newman		203/432-2523	julie.newman@yale.edu	

APPENDIX E
OUTCOME FRAMEWORKS: AN OVERVIEW FOR PRACTITIONERS (2004), PUBLISHED BY RENSSELAERVILLE INSTITUTE'S CENTER FOR OUTCOMES

	Model	Description	Key Concepts	Strong Points	Well Suited For
Program Planning/Management	**1. Logic Model**	Diagrammatic representation of a program, showing what it is supposed to do, with whom, and why	Inputs, outputs, outcomes; arrows show relationships between elements in the model	Easy to use; provides easily understood representation of program's theory of change	Program overview; presentations; program and evaluation planning
	2. Outcome Funding Framework	Key management focus on the achievement of specific, sequential results for customers of services; emphasis on results, not activity	Investor return, results, customers, milestones, performance targets, outcome statement	Highly disciplined approach that serves both program investors and implementers; Web-based software has strengthened usability	Government and philanthropic grantmaking; program and organization management
	3. Results-Based Account-ability	Real-time approach that describes what desired results look like, defines results in measurable terms, and uses measures to drive action plans for improvement	Results, experience, indicators, baselines, strategy, action plan and budget, accountability	Thorough system for planning community-change efforts and improvements in program, agency, or system performance; uses lay language and provides direct link to budgeting; useful for integrating different outcome systems	Project planning and start-up; development of community report cards; program/ agency improvement plans and budgets; grantmaking and evaluation design
	4. Targeting Outcomes of Programs	Tracking progress toward achievement targets; evaluating degree to which programs impact targeted conditions	Knowledge, attitude, skills, and aspiration; process, outcome, and impact evaluation	Fairly easy to use; helps integrate program development and evaluation; implementers and managers can use same concepts	Program design and evaluation
Program and Resource Alignment	**5. Balanced Scorecard**	Business-based model designed to provide integrated management and accounting for multiple variables impacting organization performance by connecting them to a set of performance indicators	Strategy, alignment, short- and long-term objectives; financial and nonfinancial measures; lagging and leading indicators; performance measures and drivers; internal and external indices of success	Allows for a graphic assessment of the degree to which an organization's resources and efforts support its goals	Monitoring either a single program with several associated initiatives or multiple programs within an organization; analyzing alignment of resources and initiatives to strategic targets

APPENDIX E (CONTINUED)

Program and Reporting	**6. Scales and Ladders**	Graphic tool that centers around a series of scales and their placement within a matrix designed to illustrate progress along a continuum of stages	Scales; mutually exclusive, multiple, and floating indicators	Places a client, community, or program on a continuum; shows incremental and relative progress, stabilization, or decline; individual data together tell a complete story; behaviorally anchored description of levels of change	Demonstration of aggregate progress; measuring concepts that are not easily quantified
	7. Results Mapping	Outcome-based evaluation tool designed to systematically capture otherwise nonquantifiable anecdotal evidence	Causal and synchronistic attribution; levels and milestones	Way to systemize, standardize, gather, and utilize lessons embedded in anecdotal information	Turning anecdotal information into a useful tool for program presentation, evaluation, and assessment
	8. Program Results Story	Uses stories to capture organizations' achievements and present them in a results-based format	Results, stories, anecdotal evidence	Easily understood approach for presenting results; brings outcomes to human interest level; captures/ conveys richness of information	Presenting program and results to multiple audiences

NOTES

1. McKinsey Capacity Assessment Grid, Venture Philanthropy Partners, Reston, VA, (2005). http://www.venturephilanthropypartners.org
2. Kyle Zinth, Kyle, *Economic/Workforce Development–High Tech/(STEM),* Education Commission of the States, Denver, CO, (September 2006). http://www.ecs.org
3. Coan, Stephen, Institute for Exploration; and President, Immersion Presents, Mystic Aquarium, (2006), Mystic, Connecticut. http://www.mysticaquarium.org/index.cgi/353 and http://www.immersionpresents.org
4. Connecticut After School Network. http://www.ctafterschoolnetwork.org
5. Geiger, Elke and Britsch, Brenda., eds. Out-of-School Time Program Evaluation: Tools for Action, Northwest Regional Educational Laboratory (See pages 2-4). http://www.nwrel.org/ecc/21century/index.html
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