Science in After-School Market Research Study

A final report to the S. D. Bechtel, Jr. Foundation

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Introduction

After-school programs and venues are ripe with opportunities for reaching a large number of children with high-quality science learning opportunities, because more than six million children in the United States spend an average of eight hours per week in such programs *(*Afterschool Alliance, 2003*).* The Coalition for Science After School (CSAS) presents a compelling case for inclusion of science in out-of-school venues:

The Case for Science in After-School

Science Technology Engineering and Mathematics (STEM) Pipeline. There is a decrease in students following STEM academic and career paths, at a time when the nation's economy is becoming increasingly dependent on a STEM-literate workforce.

Changing Social Structures. Enrollment, especially of youth from populations historically underrepresented in STEM fields, is dramatically increasing in after-school programs as parents' working hours are increasing.

Advances in the Learning Sciences. There is increasing awareness of the importance of nonschool learning experiences in generating interest, engagement, and capacity to know and do science.

Expectations from After-School Funders. Many supporters of after-school programs are increasingly asking for evidence of academic achievement. STEM activities have the potential to support academic growth while being engaging and entertaining.

In light of the context described above, many have been working to understand how best to include high quality science learning opportunities in after-school settings. Although the knowledge base regarding science in after-school programs has been growing, details are still unclear about how leaders of such programs actually implement science activities in their programs. For example, prominent individual networks of after-school providers such as the federal 21st Century Community Learning Centers (CCLC) and Girls Incorporated (Girls Inc.) do an admirable job of annually collecting data from their programs. However, collecting information about science programming is only one of many survey objectives, often making the information limited. For example, a 2006 evaluation of the 21st CCLC program, drawing from its Profile and Performance Information Collection System (PPICS), reported that 90% of 21st CCLC sites offer math and 70% offer science, but offered no further details about how much and what kind of science activities are offered (Learning Point Associates, 2006). Girls Inc. serves a specific target audience (primarily low-income girls) and has offered STEM for many years through its Operation SMART program. As a result, its annual program survey focuses specifically on the implementation of its program, making it difficult to generalize its findings to other after-school programs. Other major providers of after-school programs, including Boys and Girls Clubs, YMCAs and YWCAs do not regularly survey their affiliates and have not yet included queries about the implementation of science in their programs.

To begin to better understand the details of what science programming looks like in after-school settings, the National Science Foundation (NSF) funded the Informal

Learning and Science in After School (ILSA) study in January 2006. The goal of this project is to examine characteristics of effective informal science learning in "typical" after-school settings. These typical settings were defined as those programs that met at least three times per week, included a variety of program elements, and were not established solely to implement grant-funded curricula or STEM approaches under specialized conditions. ILSA's ongoing research consists of three phases: survey, interview, and case study. To date, only the survey data have been analyzed. These data provide information outlining the lay of the land; at the same time, this study was not intended as a market research study and cannot be more broadly generalized to the field. For example, despite the fairly large number of respondents (over 1,300 total, with more than 750 representing "typical" after-school programs), it was difficult to determine the extent to which this sample was representative of the population of after-school programs. Since there was no accounting of the actual number of surveys sent out, and since only programs that included science were asked to respond, it is impossible to determine (1) the response rate for this particular survey and (2) what proportion of after-school programs actually include science. Accordingly, while the ILSA survey findings paint an interesting picture of what is happening in "typical" programs that *do* include science-learning opportunities, much remains unknown about the market for science in after-school.

About This Study

The limited available information about the implementation of science in after-school settings challenges the research, advocacy, and dissemination efforts of CSAS to promote high-quality science in after-school. At the same time, the absence of an overarching understanding of this emerging market for including science in after-school settings hampers both CSAS and its partners from systematic planning, development, and support for this field. In response to these conditions, CSAS set out to learn more about the existing and emerging markets for science in after-school settings.

This report summarizes findings of a market study funded by the S. D. Bechtel, Jr. Foundation and conducted in 2008 by the Coalition for Science After School (CSAS), in partnership with the Center for Research, Evaluation, and Assessment (REA) at the Lawrence Hall of Science (LHS), University of California, Berkeley. The purpose of the market study was to help answer some highly practical questions for CSAS, including: *Which after-school programs are "doing" science? What exactly are they doing? What are their needs?* By collecting data that answered these questions, CSAS proposed to gain a greater understanding of existing science programs in after-school settings.

The goals of this market study were (1) to describe the current conditions, including the frequency and nature of science programming in after-school settings, and (2) to provide information to both instructional materials developers and professional development providers about the needs and opportunities for their work. In addition, the data collected from this study were intended to identify which types of materials and

professional development would be most supportive of efforts to increase the quantity and quality of science programming in after-school settings.

Methodology

To create the market study survey, CSAS and LHS staff reviewed existing studies of science in after-school settings. Many evaluation studies document the implementation and impact of specific after-school science-focused programs, such as the Explore-It and Design-It curricula from EDC, or Community Science Workshops, or Operation SMART. Research has been done on indirect outcomes from these programs, revealing that after-school programs have many positive effects for students and that informal science experiences engage youth in science and help lead them into career pathways. However, this effort underscores the importance of distinguishing between "after-school science programs" and non-science-focused after-school programs that are attempting to offer science in their setting. Those examining and promoting after-school science need to continue to refine efforts to document the profile of this emerging genre of after-school programming in a way that differentiates these two program types. The latter is a relatively untapped audience for science resources, information, and support, and offers great potential to reach more students with high-quality science experiences.

In spring 2008, staff from CSAS and REA consulted evaluation leaders from several relevant after-school programs and networks to explore how this market study could contribute to existing knowledge about science in after-school settings. The goal of these consultations was to confirm leaders' interest in obtaining such information about their networks, as well as to probe whether they would be interested in forwarding the survey to their affiliates. CSAS and REA staff spoke to the following leaders in the after-school field to gather their advice and feedback about the market study survey and project:

- Heather Johnston Nicholson, Girls Incorporated, Director of Research (retired) – Dr. Nicholson has conducted research on after-school science since Operation SMART's inception in the 1980s. The national organization includes science questions in an annual survey of Girls Inc. sites.

- Robert Stonehill, Learning Point Associates (and former Program Manager, 21st CCLC, U.S. Department of Education) – Learning Point manages PPICS, the data set of federally funded 21st CCLC sites. Mr. Stonehill recommended key points for CSAS data collection and expressed interest in having Learning Point include more-detailed questions about STEM in future PPICS collections.

- Megan Green, Afterschool Program Manager, Developmental Studies Center – Ms. Green manages the development and marketing of DSC's widely used after-school curricula, KidzLit and KidzMath. She reviewed the survey and provided

feedback regarding what DSC needs to know to effectively develop and distribute after-school materials.

- Pam Garza, National 4-H and Next Generation Youth Workforce Coalition – Ms. Garza provided guidance regarding questions on staff development needs. The discussion addressed possible collection of the CSAS market research data through 4-H data collection. However, 4-H is not specifically focused on after-school programming, so determining appropriate channels to specifically target its programs was thought to be too challenging.

During these conversations, REA researchers determined that the information provided for this project would be useful to both program and organizational staff, as well as to funders seeking to promote the inclusion of science in after-school settings. Two of the networks, Girls Inc. and 21st Century Community Learning Centers, were already collecting significant data from their affiliates, so they chose not to participate directly in this market study, although their affiliates could receive the survey through the state after-school networks. CSAS has forwarded copies of this survey to these networks to review for possible inclusion of questions in their existing data-collection efforts.

CSAS and REA staff reviewed existing surveys from 21st Century Community Learning Centers, Girls Inc., 4H, and ILSA to create the online survey during summer 2008. CSAS and REA developed a 10- to 15-minute online survey to collect the following:

- General information about the program (location, frequency of service, and number and types of youth served);
- Information about whether programs included science activities (regularly, occasionally, or not at all);
- Information about any science activities provided, including frequency, number of hours, and reasons for including them;
- Specific details about the science activities, including whether they were self-created or purchased, their cost, what was taught, and who taught them; programs were given an opportunity to describe up to three types of science activities provided through their after-school program; and
- Description of their needs to expand the quality or quantity of science programming in their after-school programs, including challenges for implementation, types of support that would be most helpful to them, total program budget to support science, and funding resources.

Survey respondents were instructed to consider as “after-school programs” those that run after regular school hours during the school year or run full time during the summer. Thus, if a program operated year-round, survey respondents were asked to include in their survey responses information about both the after-school and the summer program components. Also, for the purposes of the survey, “science activities” could include a purchased curriculum, a set of self-designed activities, a specific science program provided to an after-school program through a contract, interdisciplinary programs that

include a science component, and/or professional development opportunities for after-school program staff that relate to the STEM topics.

In fall 2008, CSAS invited the following groups and organizations to distribute the survey: the state affiliates of the National AfterSchool Association; the Statewide Afterschool Networks funded by the Charles Stewart Mott Foundation; two national listservs of after-school/out-of-school time programs, the Promising Practices in Afterschool, hosted by the Academy of Educational Development, and the School-Age Care (SAC-L), co-owned by the National Institute on Out-of-School Time (NIOST) at the Center for Research on Women at Wellesley College and by the Early Childhood and Parenting (ECAP) Collaborative at the University of Illinois; and the national organizations of the YMCA and of Boys and Girls Clubs.

REA staff followed up this invitation to participate in the CSAS survey, sent by email, with a phone call to all invited networks and organizations. CSAS knew from the onset that it would be challenging to reach each and every after-school program in all 50 states. Such programs are often understaffed and under-resourced, and therefore have limited capacity to respond to these types of requests. Also, often, there is no centralized way of reaching the smaller programs that may operate in single sites. In addition, state or organizational network coordinators confirmed that they did not want to push people to participate in the survey, because they had their own data collection activities in place and CSAS's was clearly an additional request. That being said, CSAS received feedback from various states and organizations stating that they were interested in the results and were happy to help forward the survey to their members and affiliates.

Finally, some comments are in order about limitations in the sample of programs that responded to the CSAS survey. Obviously, those that responded had the staff and the technological capacity to submit this type of information, and so this sample probably over-represents programs that are fairly well resourced and established. One of the goals of this project was to attempt to better define the universe of after-school programs that exist. While CSAS has gathered more details about what occurs in many after-school programs, staff found it challenging to reach every state (as noted below) and to reach every program. Even the seemingly simple task of understanding the number of after-school programs is challenging, as staff asked state network coordinators to estimate the number of after-school programs that operate in their state. Their responses ranged from "hundreds" to "we can't answer that question." Therefore, the results of this study reported below represent only the beginning of an effort to improve the general understanding about the inclusion of science in after-school programs. The challenges faced by research efforts in this arena suggest that there is work yet to be done to gain a better understanding of this universe of programs. CSAS intends to seek additional funding to enable it to pursue this effort and to continue collecting data, using this survey instrument, to both augment its sample and enhance its understanding of this important market.

Study Sample

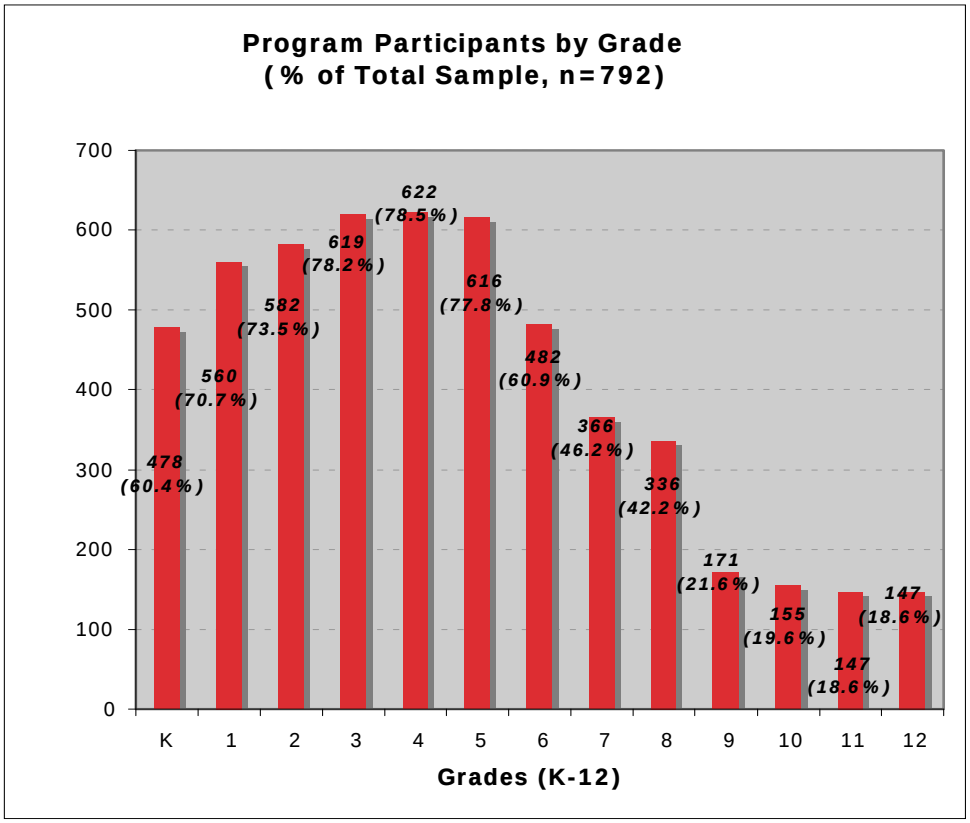
A total of 804 responses were submitted, from 36 states, by the deadline (December 15, 2008). However, once duplicates of survey responses from the same programs were removed, the remaining total sample of 792 was used to determine the findings. The total number of youth served by the respondents was 614,903 youth in prekindergarten through 12th grade. However, it was clear that not all the respondents counted their participant numbers using similar methodology. For example, in response to the question "What is the estimated total number of youth participants in your program?" some respondents reported their enrollment numbers, while others reported their attendance numbers. This distinction is important for after-school programs because often the enrollment is significantly higher than actual attendance at every session. One respondent explained this difference: "We currently have 38 enrolled students, although different students participate on different days." In future surveys, these numbers should be requested separately.

When respondents offered both enrollment and attendance numbers, this report includes the enrollment numbers as the total number of participants. When respondents offered a range of students (e.g., 80 to 100), the report uses the average. Other respondents reported different numbers for their after-school program during the school year and for their summer program; the analysis uses the total number of students in both programs, although there may be students who enroll in both the after-school and the summer programs, thus potentially creating a double-count of an unknown subset of participants.

Also, it was difficult to distinguish between those respondents who were reporting for a network of programs with multiple sites, and other respondents who only reported information about their individual program. Future surveys should include specific questions requesting estimates of enrollment and attendance, as well as a question to distinguish whether respondents were reporting for a single site or multiple sites.

Grades Served

The following chart summarizes the student populations that respondents reported serving:



Clearly, most of the programs (74% to 78%) served grades 2 through 5. The finding that after-school participation peaks in upper elementary grades is consistent with previous studies of after-school programs, including *America After 3 PM* and 21st CCLC data (Afterschool Alliance, 2003; Learning Point Associates, 2006).

Diversity of After-School Program Participants

As noted earlier, it is still unclear how representative this sample of respondents is of the general after-school population. Regarding the racial and ethnic diversity of the program participants, 721 survey respondents estimated serving certain populations of program participants, as shown in the shaded right-hand column in the following table:

Race/Ethnicity of Youth Participants	21st CCLC Data Collection (2004–2005)	America After 3 PM*	NCES Public School Enrollment (2006)	Average % of Participants Served by Survey Respondents (n=721)
African American	25%	53%	16%	22%
Asian/Asian American	4%		4%	3%
Caucasian/White	29%	23%	57%	52%
Hispanic/Latino	40%	40%	20%	18%
Native American	1%		1%	2%
Other/Unknown	2%		3%	2%

(*Percent of parents reporting they would be likely to participate if after-school programs were available in their community)

When considering how representative this sample is, it is useful to compare it to other extensive data collection efforts on after-school programs, such as 21st CCLC data and the America After 3 PM report, as well as the general K–12 public school student population (as reported by the National Center for Education Statistics). When comparing this survey's program participant population with these other after-school data collection efforts, the CSAS survey respondents, on average, serve a similar percentage of African-American and Asian-American youth but serve a higher percentage of white/Caucasian students and a lower percentage of Hispanic/Latino youth participants. However, the numbers reported by respondents are similar to the overall public school student population. In summary, because data for the overall after-school population are not available, this report cannot claim that this sample is representative. Yet the findings from this diverse sample of programs suggest areas for further exploration of the types and frequencies of science activities provided, as well as of the challenges and support they would need to increase the quantity and quality of science provided to their participants.

Goals of After-School Programs

The goals of the after-school programs that were included in the market study represented a wide range, including the following:

- Providing quality child care for working parents;
- Increasing student academic achievement in all areas, especially math, reading, and science;

- Providing enrichment beyond what is currently offered during the school day, including arts, technology, physical activity, or other topics such as environmental education or social action;
- Fostering broader youth development outcomes to help youth become "productive, responsible, and caring citizens"; and,
- Addressing the needs of specific youth, such as reducing childhood obesity or assisting non-English-speaking children and their families.

A few of the programs were science-specific and had the following goals to expand opportunities for science:

- To "spark kids' imaginations and give them insight into discovering how scientific experiments work";
- To let students explore science in ways that "time does not allow during the regular school day";
- To "offer science remediation after school";
- To "extend the classroom learning with more hands-on experiments"; and
- To "explore topics that are not covered in the current Curriculum Standards and Objectives."

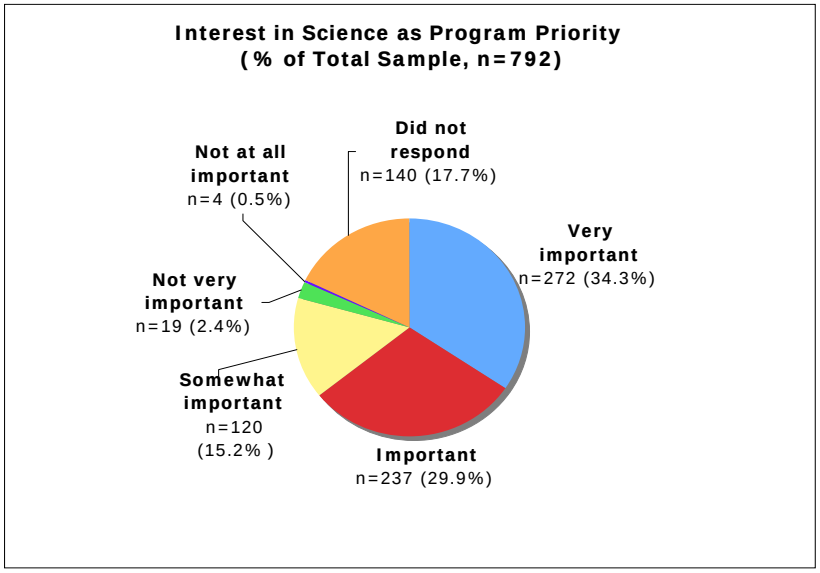
Because the feedback collected through this market study proved valuable, CSAS expects to continue to collect data throughout the remainder of the current school year (2008–09) from additional states and networks that did not submit responses by the December 15, 2008, deadline. For example, CSAS did not receive responses from the following states: AK, AL, AR, HI, KS, LA, ME, MS, ND, NE, NM, NV, SD, and VT. In addition, CSAS has only one respondent from the following states: ID, MA, OK, SC, and VA; only two to four respondents were from AZ, GA, OH, RI, TN, and TX. Funding permitting, CSAS plans to follow up with these states to encourage greater participation in this survey, and it will provide state-specific findings to those networks that request it. Findings from the initial set of data collected are reported in the following sections.

Study Findings

Finding #1: Significant Interest in Including Science in After-School Settings

Many program leaders (64%) indicate that science is an "important" or "very important" priority for their after-school program, and indicate an interest in including science activities and content in their after-school program offerings, for a variety of reasons.

Clearly, as seen in the following chart, among this population of programs (n=792), there is a significant interest in science as a priority area for after-school programming; 64% of respondents stated that it was "very important" or "important" to provide science activities in their after-school program.



When asked to offer reasons why science is or should be included in their after-school program, respondents cited the reasons listed in the following table, which were included in the survey:

Reasons for Including Science in After-School Programs	# of Programs	% of Total Sample (n=792)
Increase youth's interest in science	578	73%
Provide science content enrichment	494	62%
Give youth experience with the scientific process	475	60%
Teach other life skills (group work, learning from mistakes, etc.)	440	56%
Engage youth in social or community issues	352	44%
Help youth understand what scientists actually do	272	34%
Career exploration	226	29%
High school or college readiness	146	18%

In addition to those reasons offered in the survey, respondents offered other reasons for providing science activities to their program participants, including the following:

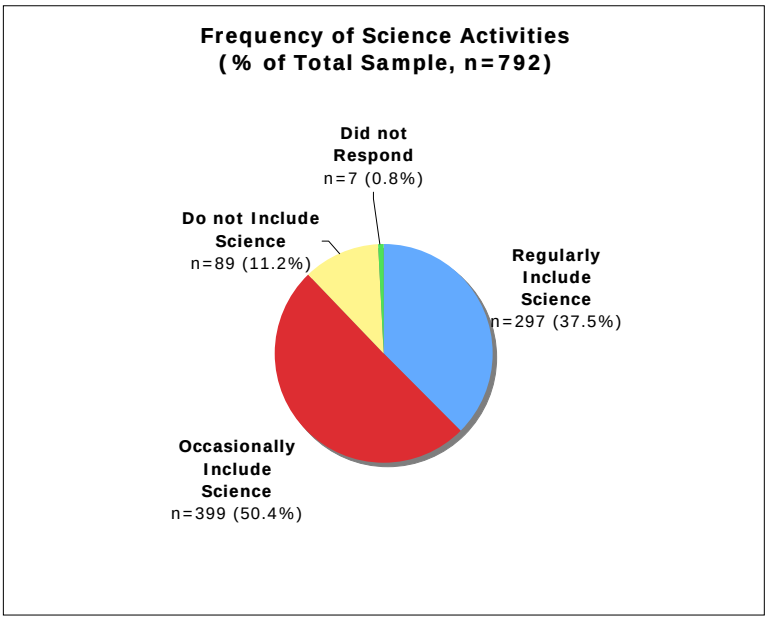
- Providing youth with science activities because they think of it as "FUN!";
- Providing positive, hands-on science experiences;
- Fulfilling parental interest in science (as demonstrated by parents' willingness to pay for after-school science programs for their children);
- Showing youth participants that science is part of their everyday lives and "not just mixing chemicals in a lab";
- Fostering higher-level thinking skills and problem-solving skills that can be learned from science;
- Providing more opportunities to teach science, because it is being "cut from schools as literacy and mathematics become more of the focus in elementary school curriculum"; and
- Using science activities to reinforce other core-content areas, such as math and reading.

According to study respondents, the after-school setting provides a multitude of opportunities to present science activities that meet multiple perceived needs of youth, parents, and schools.

Finding #2: Limited Access to Quality Science-Learning Opportunities

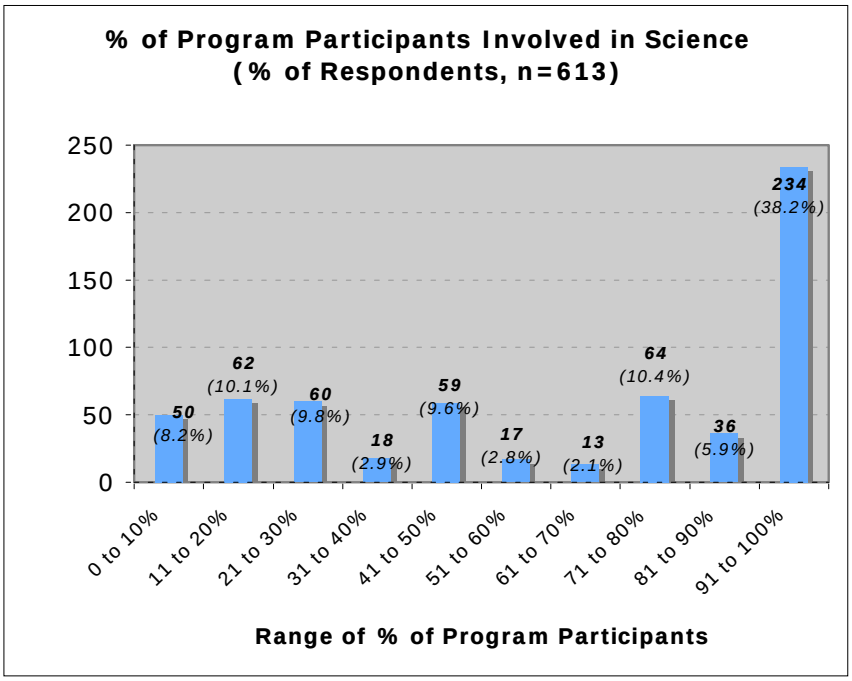
Many programs offer limited opportunities for participants to engage in high-quality science learning. Most programs (88%) report that they regularly or occasionally offer science to their after-school participants. However, the percentage of students engaged in science and the frequency with which they participate in science varies widely. Program leaders request additional support in order to increase the quality and quantity of science activities that they provide in after-school settings.

As shown in the following chart, when asked the following question, **"Do you regularly include science activities in your after-school program?"** 38% (297 respondents) of the total sample (n=792) reported that they regularly offer science; 50% (399 respondents) occasionally offered science; and 11% (89 respondents) reported not offering any science at all. Seven programs did not respond to this question.



The result of 88% of programs reporting that they offer science (regularly or occasionally) seems to indicate a fairly strong level of commitment to provide science activities. However, when examining the frequency of science activities offered to youth participants, there is a wide variety of ways that science is provided, in terms of both who participates and how the programming is structured.

When asked to **"estimate the percentage of your participants who are involved in science activities through your program,"** 613 programs reported a wide range of the percentage of youth involved in science, as shown in the following chart:



Overall, programs reported involving an average of 65% of their participants in science activities. A significant number of programs (234, or 38%) report involving over 90% of their youth participants in science activities, indicating that science was a program-wide activity for all participants. However, the significant number of programs (41%) that involved 50% or less of their participants suggests that science activities are often provided to smaller subsets of program participants.

To better understand how much science was actually provided to participants, it was important to also explore the frequency with which science activities are provided. As a result, the survey asked the following question:

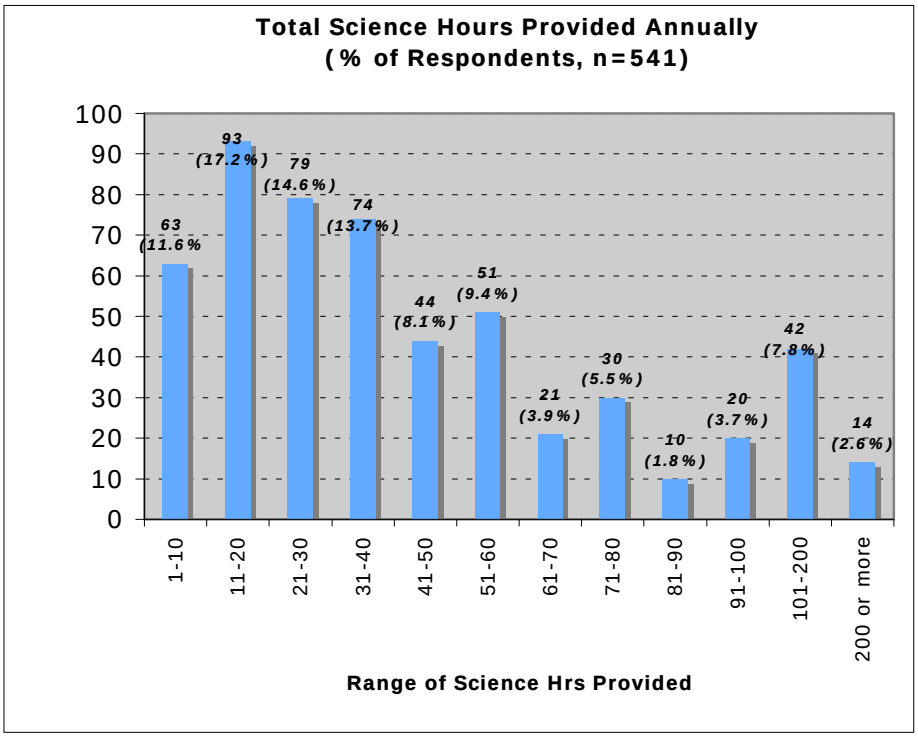
> *The amount and frequency of after-school science activities offered to students vary widely from program to program. We would like to know how often science is provided in your program. Please tell us the number of HOURS of science per week AND the total number of WEEKS per year that science is provided (e.g., "one hour of science per week over a 12-week period during the school year," or "45 minutes one day per week during the school year and two hours a week during the summer.")*

Respondents provided descriptions of an extremely wide range of possibilities for science programming in after-school settings. For example, of those programs that offer science regularly, survey descriptions of the frequency of science activities included the following:

- A certain number of minutes or hours per week over the course of the year, including school and summer programming (ranging widely from "one hour every ten weeks" to "15 minutes a week during the school year" to "90 minutes twice a month" to "three hours a day, three days a week");
- A certain period of time that science was provided during the course of the year (e.g., "6 hours of science per week over a 14 week period");
- A focus on science during the summer months (but not during the school year);
- A focus on science during the school year, but not during the summer; and
- An assumption that science was regularly offered to youth participants, because the "science center is available to children at all times throughout the year," thereby providing them with opportunities to engage with science activities if they chose to do so; or, put another way, the "time frame for science discovery is open to participants through self-discovery."

To better understand the total amount of exposure to science activities, respondents were asked to estimate **"over the course of a year, how many TOTAL HOURS of science activities are presented to those youth?"** As illustrated in the following chart, 541 programs provided estimated hours that range from as little as 1 hour of science over the course of a year to over 760 hours, especially if programs included their summer science programming. It is important to note that the participants involved in the school year program may or may not be involved in the summer program, so more information would have to be collected to better understand how much science participants actually receive. Still, these estimates of "total science hours" offer insights

into the range of science activities that programs plan for and provide to their participants.



The average total hours of science activities reported was 54 hours. However, as illustrated in the chart above, there is a wide range of hours provided to participants. The majority of programs (57%) provided 40 hours, or fewer, of science activities for their participants, and almost a third (29%) provided fewer than 20 hours. These numbers were similar to those found in a recent study of the status of science education in the San Francisco Bay Area, which reported that almost 80% of elementary school teachers instruct in science for 60 minutes or less each week, for a total of fewer than 40 hours per teacher per school year (Dorph, R., Goldstein, D., Lee, S., Lepori, K., Schneider, S., and Venkatesan, S., 2007). Put another way, for youth participating in science activities during after-school hours, in the majority of programs it could double or more the number of science minutes that students could otherwise receive during in-school hours. Slightly more than 10% of the programs offer more than 100 hours of science hours. These are programs that were typically science focused and offered programs throughout the school year, as well as camp experiences during the summer.

It is interesting to note that this estimate of total science hours provided was difficult for many programs to state, for a variety of reasons. Some respondents were reporting on a range of programs within their purview, indicating that there was great variation across sites, even within the same program (because of the variety of instructor interests or experiences). For example, within one organization's after-school programs, the number of hours of science provided to participants varies widely by program "from 1 to 2 hours/week in childcare to 12-hour science summer camps to 12- to 16-hour science

enrichment classes over 4- to 5-week periods." Other programs cite that the number of science hours vary, being entirely dependent upon the interest of participant choice. For example, some students may fully engage in science activities during free-choice time, while others may rarely engage in science activities at all. Overall, this information suggests that the commitment and programmatic structure to provide science to all students within a program varies significantly.

Another indication that youth participants may have limited access to quality science-learning opportunities is that the majority of programs (57%) report creating their own science activities, as shown in the following table. Another 46% reported purchasing or obtaining a science program from an outside organization, while 29% received programming by a science partner. (The percentages of the total sample add up to more than 100%, as some programs checked more than one response to this question).

Source of Science Activities	# of Programs	% of Respondents (n=543)
% self-created	309	57%
% purchased (or obtained for free) from outside organization or publisher	250	46%
% provided by science partner who works directly with our program	156	29%
Other	112	21%

For those programs that reported self-creating the science activities, they were asked, **"if the science activity was self-created, please describe (in 2–3 sentences) what is taught through this activity."** Responses provide insights into how these self-designed science activities were created, as well as topics that after-school programs are interested in conveying to their participants.

For example, after-school leaders who probably have limited science background use both existing published books on science topics and the Internet to create and adapt science activities that are guided by the interests of the students and/or the staff, as illustrated by the following responses:

> "We use a number of science experiment books purchased for this reason. We do projects that focus on cause/effect, gravity, observation of the natural world and prediction."

> "Teachers propose and students choose from between five and ten different courses each year, including: Anatomy, Biology, Cell Biology, Chemistry, Environmental Science, Forensics, Genetics, Physics, and others. Teachers both design their own curriculum and rely on various published science resources."

> "The staff who teach the enrichment choose the themes. They then research projects to go with the theme they choose. We try to expand on activities taught during the school day."

Many of the science projects appear to be activity-based and endeavor to use common, easy to-find materials.

> "All of the senior staff must do 'science activities' with the children. They use resource books and the internet and design the small projects [to] build a volcano, monitor the weather, study trees in the school yard, etc."

> "We use materials we can purchase cheaply (cups, vinegar, baking soda, etc.) to create different activities."

> "We teach the children how to make slime, play dough, bubbles, etc."

The themes and science concepts that after-school leaders want to teach and reinforce for their participants vary, but several themes came up repeatedly: scientific processes such as the scientific method, observations, measurement, and cause and effect. In addition, after-school leaders offered a wide range of topics that they and their participants were interested in: animals, plants, water, space, magnets, electricity, nature, continents, dinosaurs, chemical reactions, earth science, life cycles, and other topics.

A few programs described more-extensive processes or topics for their self-created science programming, indicating that a potentially higher level of quality of science activity is being provided than the typical after-school program in this sample provides, although this is certainly not guaranteed:

> "The activities are adapted from written materials or the Internet and then tested prior to presentation to make sure they are age appropriate and doable within the time allotted."

> "We have an engineering challenge, taken from experiments and demonstrations that I used to use in the classroom. It is essentially open-ended problem solving. We provide the students a set of materials and ask them to solve a problem with only what they have been given."

> "Each topic starts with a KWL (Know, Want to Know, Learned) chart. Free exploration of multiple books on various reading levels come[s] next. Hands-on activities follow. Journal activities, mathematics activities, and individual research follow the hands-on activities."

> "Students learn about watershed, how to test water quality, water conservation, and sample macro invertebrates living in the streams."

An additional question, to collect feedback on HOW the activities were created, would have been useful to better understand the extent to which programs will go to create science programming. Also, it was not clear why so many programs create their own

science activities. This may be driven by limited knowledge of resources that already exist, limited funding for science activities, or both. Further examination of this issue would be useful, so as to better serve the needs of after-school programs.

As shown in the following table, programs reported facing significant challenges in providing science activities regularly to their participants, including: limited funds (73%), limited time (55%), and lack of staff training (40%). (The percentages of the total sample add up to more than 100%, as programs checked more than one response to this question).

Challenge Faced	# of Programs	% of Respondents (n=644)
Limited funds	473	73%
Limited time	359	56%
Lack of staff training	258	40%
Lack of staff interest	102	16%
Lack of student interest	77	12%
Not part of our program's mission	49	8%
Other	75	12%

Finally, over three-quarters of staff leading the science activities were typically after-school leaders who work directly with the youth, as shown in the table below. (The percentages of the total sample add up to more than 100%, as some programs checked more than one response to this question).

Who Teaches Science Activities?	# of Programs	% of Respondents (n=492)
After-school leader who works directly with youth	378	77%
After-school staff who specializes in science	141	29%
Staff from local science partner	108	22%
Program or education director	108	22%
Other	109	22%

This finding is significant for after-school science curriculum and program developers to take into account, because these staff members often possess little science background or experience and have limited access to professional development, according to CSAS.

Finding #3: Implementation Support Required

Many programs appear to require significant support (materials, staff development, program design, advocacy, and the like) in order to effectively implement high-quality science learning opportunities.

As shown in the following table, most programs (64%) in the total sample (n=792) reported using only one type of science program or set of activities with their after-school participants. A scant 2% reported offering three or more science programs.

# of Science Activities Described	# of Programs	% of Total Sample (n=792)
One	503	64%
Two	44	6%
Three	14	2%
Did not respond	231	29%

These data can be viewed as indicating the need for quality science materials, in at least two ways. First, the fact that 231 of the 792 respondents (or 29%) did not complete this question suggests that a significant number of after-school programs either do not offer a coherent set of science activities, or offer no science at all. Second, that such a large percentage (63%) of respondents offer only one science program or set of activities suggests that greater awareness of science materials and resources may be helpful to after-school programs, given their interest in providing science.

In addition, based on the market survey findings, it seems clear that existing curricula that have been created and/or evaluated for use in after-school settings are not widely penetrating the market, although it is not evident from these findings why this may be the case. For example, CSAS, the Lawrence Hall of Science, and the SEDL National Center for Quality Afterschool collaborated to produce an online resource called the Consumers Guide to Afterschool Science Resources (CG), available online at http://www.sedl.org/afterschool/guide/science. The CG was created to share information about sources of high-quality, hands-on science resources for program leaders and instructors who wish to provide science to their after-school participants. The CG provides information about more than 50 materials, including the cost, the target audiences, the science disciplines addressed, and contact information for the curriculum developers. In addition, the CG provides two reviews of each material, one by a science expert and one by a youth development or after-school program expert. Still, despite the availability of this wealth of information about science programs and materials specifically focused on after-school programs, more than half the respondents report using materials *not* included in the Consumers Guide.

Given the intensive effort by the CG to collect and organize high-quality science resources, CSAS staff felt it was worthwhile to examine which programs were successfully being used by the survey respondents. The top six programs (by order of frequency cited by respondents) are shown in the table below.

Science Program Reviewed in Consumers Guide and Used by Programs	# of Responses	% of Programs that Include Science (n=696)
21st Century After School Project (NJ Dept. of Education)	37	5%
Mindstorms for Schools (LEGO)	15	2%
After-School Science PLUS (Center for Educational Equity)	10	1%
Fetch (PBSkids.org)	9	1%
PCS Edventures	9	1%
ZOOMSci	9	1%

The box below includes descriptions of each of the above programs that are reviewed in the CG, along with some initial analysis of potential reasons for their relative success in reaching after-school programs.

SCIENCE PROGRAMS MOST CITED IN CSAS MARKET STUDY

21st Century After-school Science Project (21st CASP)
Over the last three years, the Liberty Science Center partnered with the New Jersey Department of Education (NJDOE) and the New Jersey School-Age Care Coalition to develop a program model and curricula to help after-school providers integrate science into their existing programs. The resource is available for free online or by CD, and NJDOE helped distribute it to programs in the state. While some early adopters actively sought the resource from the providers, the NJDOE representative notes that it is still important to go to the sites to help them complete the adoption process. Key implementation difficulties included access to materials (since the curriculum does not come as a kit) and space to do the activities and store materials. Most of the programs implementing 21st CASP are in school buildings. The project team hopes to develop additional curricula and programs that follow a similar model for training, technical assistance, and inquiry-based, hands-on curriculum that providers need.

Robotics (Lego Mindstorms* and *PCS Edventures)
Lego robotics, as well as similar programs such as K'NEX, are widely available in retail stores nationwide. The robotic kits can be used to construct any number of devices, programmable with a computer. These robots are used to teach math, physics, robotics, mechanics, and other scientific and technology concepts. Several organizations have developed specific educational applications for these products. In particular, PCS Edventures has targeted the after-school audience, promoting materials at national and regional conferences and having a salesperson directly contact each 21st CCLC site.

After-School Science PLUS
The Educational Equity Center at the Academy for Educational Development (EEC/AED) developed After-School Science PLUS, an inquiry-based science program, for use in after-school centers serving students aged 6–14. With features like bilingual materials and biographies of diverse scientists, this program builds the science skills of girls and minorities while bringing awareness to the barriers they can face in scientific fields. After-School Science PLUS encourages students' speaking and literacy skills as they gain comfort with scientific principles through hands-on, exploratory activities. For busy instructors with varying levels of science experience, these materials are easy to use, straightforward, and concise. After-School Science PLUS is widely used in New York City due to a partnership with The After-School Corporation (TASC). Staff from EEC/AED have trained instructors from TASC sites for several years, resulting in some instructors transporting the training from one site to another. The program is also distributed by EEC/AED staff at multiple national and regional conferences.

Fetch! and ZOOMSci
Fetch! is a PBS television program, produced by WGBH Boston, that airs nationally in 90% of the PBS market, reaching 4.5 million viewers. Over 30,000 children visit the Fetch Web site each day. The television show uses a game show setting, sending the kids out to complete various challenges. In turn, WGBH produces activity guides that mirror these challenges. Each year covers a different curriculum for different STEM content areas. The show also models important science process skills. ZOOM is the predecessor to Fetch!, and Fetch! builds on the lessons learned on ZOOM. The ZOOM materials are still freely available on the PBS Web site and remain popular. In particular, ZOOM piloted simple instructional materials, including video demonstrations, for use by parents and after-school instructors. These materials are promoted by WGBH staff at national and regional conferences. The resources gain recognition through connection to the widely viewed television programs.

The market study also asked programs **"Which of the following types of support would be most helpful for you to increase the quality and/or quantity of science activities in your after-school program?"** Responses are summarized in the table below.

Type of Support	# of Responses	% of Respondents (n=663)
Funding for science materials	495	75%
Age-appropriate curriculum materials	414	62%
Staff development opportunities	370	56%
Partnerships with local science experts	354	53%
Funding for staff development	351	53%
Web site containing information about science activities	330	50%
Having contact with other after-school programs doing science (e.g., being on a listserv)	219	33%
We are not interested in changing what we are currently doing.	30	4%
Other	45	7%

As shown in the table, additional funding for science materials was the most frequently cited type of support identified (75%). Information about age-appropriate curriculum materials (like those found in the Consumers Guide) was also cited by 62% of respondents. This finding may lead resource providers to consider how to better market an existing resource, such as the CG, that meets a strongly identified need of after-school programs. Over half the respondents would also find staff development opportunities, with accompanying funding and partnerships with local science experts, to be very helpful.

Summary and Conclusion

This project was an important step to better understand the needs and challenges of after-school programs interested in implementing science activities for their youth participants. Clearly, there is both interest in science and an understanding of the importance of including science activities, at least among the respondents to this survey. Findings from this study also illuminate the uneven levels of science programming that exist across programs, reflected in the percentages of youth participants involved as well as in the number of total hours of science programming actually provided. Respondents also articulated a clear set of challenges in implementing high-quality science activities, and requested numerous types of support and resources to address those challenges.

Based on the findings of this preliminary market study, several areas require further exploration. First, gaining a better handle on the full universe of after-school programs that include (or want to include) science is important toward understanding whom these programs target, who their participants are, and how to serve them well. Further, knowing whether and how much science is provided to their participants remains elusive. Learning more about what is happening in after-school programs is critical to supporting increased quality and quantity of science offerings in these settings.

Second, organizations such as CSAS that are committed to promoting science in after-school settings need to better comprehend the challenges faced by programs in accessing information and resources that already exist, such as the Consumers Guide. For example, in recent years the National Science Foundation and other funders have made considerable investments in after-school science curriculum. Many of the after-school sites surveyed report being interested in accessing high-quality materials. Yet only a small fraction of programs report using existing materials. Perhaps curriculum developers need to pay greater attention to marketing strategies and opportunities, and funders should be more aware of distribution and dissemination as critical components of curriculum development programs. Programs that had greater reach than others in this study, such as the New Jersey 21st CASP and After-School Science PLUS, should be examined to learn from their success. For example, they are available at little or no cost, and the program developers are paid to provide staff development and technical assistance. Less successful curricula often charge high costs for the materials, and either include staff development in the price or offer no such support.

Finally, if funding is provided, it is not clear to what extent it would be most effectively distributed, and for what purpose. Certainly, staff development for science programming is an important need, yet the after-school field is known for its high staff turnover. Similarly, curriculum materials may be purchased but remain underutilized. Therefore, more study is needed of how funds can be leveraged to add value for after-school programs.

Given these findings, there is significant and exciting potential to increase both the quality and the quantity of science in after-school programming, particularly since most after-school programs offer a more-flexible, youth-development-focused environment that allows for high-quality, hands-on, inquiry-based scientific exploration and experimentation that go beyond mere textbooks and worksheets. With findings from this market study, CSAS and its members have a more grounded understanding of the needs and challenges facing these programs and will work to craft these findings into concrete proposals and initiatives that help to address them. The next challenge for CSAS and its members is to find ways to best use these data to increase the quality and quantity of science-learning opportunities in after-school settings.

References

21st Century Afterschool Science Project website. Retrieved December 2008 from http://www.state.nj.us/education/21cclc/casp/

Afterschool Alliance. (2003). America After 3 PM: A Household Survey on Afterschool in America. Afterschool Alliance.

Consumers Guide to Afterschool Science Resources. Retrieved December 2008 from http://www.sedl.org/afterschool/guide/science/index.html

Dorph, R., Goldstein, D., Lee, S., Lepori, K., Schneider, S., Venkatesan, S. (2007). The status of science education in the Bay Area: Research brief. Lawrence Hall of Science, University of California, Berkeley; California.

Fetch website. Retrieved December 2008 from http://pbskids.org/fetch/

Learning Point Associates. (2006) *21st century community learning centers (21st CCLC) analytic support for evaluation and program monitoring: An overview of the 21st CCLC program: 2004–05*. Retrieved September 2006, from http://www.ed.gov/programs/21stcclc/2006report.doc

Science and Math | Educational Equity Center website. Retrieved December 2008 from http://www.edequity.org/programs/science-and-math-programs#23