



R E S E A R C H
C O R P O R A T I O N

Evaluation

What's the BIG Idea? Science and Mathematics for Young Children in Your Public Library

Prepared for:
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Chester, VT 05143

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August 2007

Vermont Center for the Book

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Executive Summary

In 2005, the Vermont Center for the Book received a grant from the National Science Foundation (NSF) to promote the inclusion of mathematics and science into library programming for young children. The rationale for the grant was to provide children with more exposure to BIG Ideas, which experts identify as foundational for later success in mathematics and science. The BIG Ideas include patterns and relationships, change over time, geometry and spatial sense, and numbers and operations.

From August 2006 through July 2007, the second year of the NSF grant, the Vermont Center for the Book provided training and support to help librarians in the states of Delaware, New York, and Vermont, and in the city of Houston, Texas, to acquire the knowledge, skills, and dispositions that they needed to implement children's activities in mathematics, science, and literacy. A key professional development event was offered in December 2006 in Burlington, Vermont. Participants were introduced to several aspects of the BIG Idea science curriculum and practiced many of its activities. An evaluation report on the conference was issued in the spring following the conference and showed that the professional development sessions were very well received.

During the course of the year, the librarians received more resources and information, including the books and materials necessary to implement the new science curriculum. A Web site was maintained and Web Junction, a networking site, was initiated to provide access to additional resources including bibliographies and links to other sites. Librarians were asked to submit activity reports on their progress, and most attended state-level meetings to share information.

This evaluation report utilized multiple methods to determine the extent to which librarians implemented BIG Idea programming; the quality of their implementation; and the impact their participation had on their practices, comfort levels, and resource allocation. Perceived impacts on children and their families were also investigated, and materials were rated for the quality of their design. Evaluators collected data using pre- and post-surveys, program observations, librarians and parent/caregiver interviews, coordinator interviews, and analysis of activity reports and materials. Results indicated that the program was very effective in helping librarians increase their comfort levels; implement the programming; acquire new resources; and address early childhood standards in mathematics, science, and literacy. Specific results were as follows:

- **The librarians rated the professional development for implementation as being excellent in most areas.** They reported that they found the information provided on science exploration and the opportunity to network as being most valuable. They also liked the tips and tools provided that helped them to improve their skills and knowledge. Most believed the professional development materials and approaches prepared them well for implementation, stating that the conference was well-paced, enjoyable, and useful. They particularly appreciated the expertise of the presenters and the materials provided to them. A few felt that they did not learn as many new ideas as they had in the past and some were concerned that the content being taught was too sophisticated for children in the age ranges they served. All of the respondents reported that the support offered by the Vermont Center

for the Book was exceptional in its quality and responsiveness. Most respondents used the Web site for downloading bibliographies and ordering materials. Few used Web Junction and those that did access the site did not find it to be very valuable.

- **The new draft materials were found to be excellent in most areas.** They were appropriate for the audience, well-organized and accurate in content, designed by experts, engaging, professional, and easy to follow. Specific suggestions for improvement focused on presenting objectives consistently and adding ideas for children who were younger or older than the intended audience.
- **All of the librarians reported using at least some of the materials provided by the Vermont Center for the Book.** Most typically, librarians implemented the curriculum several times a month. Activities that were used most often included using words that described the location of objects, counting, and using comparative words. Activities used least often were making graphs and charts and designing and making things.
- **There was a wide range of fidelity to the curriculum.** Some librarians implemented all of the activities as presented in the guide, but most supplemented them with activities of their own. Most often, the supplements included songs or finger plays. The lack of fidelity often meant that the lessons did not have the intended depth of experience.
- **Librarians occasionally addressed the mathematics and science standards for young children, but did not do so in a systematic way.** When they did address standards, it was typically because they were following the curriculum. Few of the supplementary activities they added included standards, and several of the activities they did not use from a given lesson were the ones that addressed the most standards. Similar to results from the past, librarians explained two reasons for innovation: their own comfort levels with materials and preferences for other materials and the wide range of ages of the children being served in the sessions.
- **Parents and caregivers were uniformly positive in their perceptions of the sessions.** They strongly agreed that their children enjoyed the activities and were highly engaged. Most of them helped their children with activities during the session and took home many of the books and activities that were demonstrated or used during the story hour session.
- **The family resource kits were heavily used and valued.** The kits were said to be among the most popular items that the library loaned out and they were all returned intact. Additional kits were ordered in several sites, providing another testimony of their popularity.
- **Surveys showed a statistically significant change over time in the use of mathematics and science activities by the participating librarians in 13 of the 15 areas measured.** Largest differences over time were found for describing and combining shapes to make new shapes, making graphs and charts, talking about sequencing and patterning, using comparative words, describing how things grow and change over time, reading science books and doing science activities, and reading mathematics books and doing mathematics activities. The two areas where little change was reported were matching, sorting, naming, or

describing objects, which was already high during baseline measures; and designing and making things, which was rated low for implementation and remained low over time.

- **Statistically significant differences were also found in librarians' self-reported comfort levels in working with young children in all areas related to mathematics and science.** The greatest impact occurred during Year One of this project, and the impact was sustained over time.
- **Librarians made more mathematics and science materials available to children and their families, and provided more professional development in mathematics and science to other librarians.** Differences over time for both of these areas was statistically significant during the first year and was sustained over time. Librarians continued to report that they ordered and used more nonfiction books in their work. In addition, they often presented information about what they had learned to other librarians, to Head Start programs, and to other outside organizations, such as day care centers. Several also expanded the program into the summer, concentrating on more science activities.
- **Both librarians and parents/caregivers noted impacts on the participating children.** These children were reported to talk about mathematics and science more often in the home, sharing what they learned during the session. Children also were observed asking more questions during sessions. Several reported that they felt children gained more skills and knowledge related to kindergarten readiness.
- **Impacts were made on parents and caregivers.** Parents and caregivers were more likely to use the parent kits and check out more nonfiction books. Several parents reported that they were more likely to use mathematics and science vocabulary in the home and that they reinforced skills such as predicting, sorting, and sequencing.
- **All of the participants reported that they were likely to sustain the BIG Idea sessions over time.** They liked the programming and materials, noted the positive reaction of the participants, and felt that the value of the programming was high. Factors that could influence the implementation of the program included the amount of planning time needed, the age appropriateness of the activities, and the availability of the materials.

Recommendations for Improvement

Overall, the project is exceptionally well-organized and well-received. Most of the recommendations for improvement that came from the librarians revealed the value of the program in that they wanted more materials, more activities, and more family resource kits. Some specific areas where improvement may be made are the following:

- **Provide information within the curriculum for ways to vary program delivery depending upon the age of those children in the sessions.** This remains the largest implementation challenge for librarians. Most of the librarians serve children from aged 2-5 in their story-hour sessions. It would be helpful to provide information on how to tailor the materials to be appropriate for children at different developmental stages, especially since

some of the ways that the librarians are currently doing so results in diminishing the depth of the information or decreasing the likelihood that standards are being addressed.

- **Explicitly discuss implementation of specific activities and implementation quality during professional development or support sessions.** Librarians reported being comfortable and confident in their ability to offer the activities during their story hours, but observations revealed significant variation in implementation quality. Hold discussions either in the professional development sessions or on Web Junction about common implementation challenges and what to do to address them. Gently nudge the librarians to address standards more often and to use the vocabulary and inquiry strategies. Help them to see the importance of adding depth to their sessions.
- **Provide more opportunities for librarians to share implementation practices.** Librarians liked the professional development sessions and the opportunities to network, but they particularly wanted more time to share practices with each other. However, since the sharing session last year was not always on target for implementing mathematics and science activities, it may be useful to have a structured sharing session around mathematics and science, asking librarians to share specific ways to address standards rather than for enhancements in general.
- **Provide more bilingual resources and ideas for other special populations.** Librarians, particularly those in Houston, would be very appreciative if parent kits and other materials were provided in Spanish so that they were more accessible to the audiences they serve. In addition, materials that could be more easily used by children with disabilities were desired.
- **Give librarians information and materials to give to parents on the ways they can reinforce learning in the home.** The children were reported by respondents to be excited about what they learned, discussing activities in the home. Help parents or caregivers to extend this learning by giving librarians specific ideas or materials to give to the parents or caregivers.
- **Add information to the family resource kits to help parents with their use.** A few librarians mentioned that they thought the kits were terrific, but that the parents did not always know how to use them. Since there is a lot of room in the boxes, additional information could be added.
- **Develop training-of-trainers materials.** Many of the librarians either have or would like to provide training for others in their states. Help them by providing high quality training-of-trainers materials to ensure that they are focusing on the important parts of the curriculum and the rationale for the activities provided.

In 2005, the Vermont Center for the Book received a grant from the National Science Foundation (NSF) to promote the inclusion of mathematics and science into library programming for young children. The rationale for the grant was to provide children with more exposure to BIG Ideas, which experts identify as foundational for later success in mathematics and science. The BIG Ideas include patterns and relationships, change over time, geometry and spatial sense, and numbers and operations. The project is designed to answer five questions:

1. How can the public library become a science and mathematics learning center for young children and their families?
2. What information and training do librarians need in order to make science and mathematics learning come alive for young children?
3. What information, knowledge, and materials do librarians need in order to infuse science and mathematics content into their practice, programming, collections, and displays?
4. Who are the community resource partners who will augment this effort?
5. How can the answers to these questions be disseminated nationally?

The Vermont Center for the Book recruited librarians from four states—Delaware, New York, Texas, and Vermont—to participate in this project. The Delaware site was a statewide project; the New York site was comprised primarily of librarians in the Clinton-Essex-Franklin area in rural New York; the Texas site was located in the city of Houston; and the Vermont site included volunteers who expressed an interest in the program. Approximately 64 people participated in the project; 4 were state coordinators and 60 were local librarians.

From August 2006 through July 2007, the second year of the NSF grant, the Vermont Center for the Book provided training and support to help librarians to acquire the knowledge, skills, and dispositions that they needed to implement children’s activities in mathematics, science, and literacy. A key professional development event was offered in December 2006 in Burlington, Vermont. Participants were introduced to several aspects of the BIG Idea science curriculum and practiced many of its activities. They received materials and resource guides at the event. An evaluation report for the conference was issued in the spring following the conference and showed that the professional development sessions were very well received.

During the course of the year, the librarians received more resources and information, including the books and materials necessary to implement the curriculum. A Web site was maintained and Web Junction, a networking site, was initiated to provide access to additional resources including bibliographies and links to other sites. Librarians were asked to submit activity reports on their progress, and most attended state-level meetings to share information.

This report provides information on the second year of implementation of the *What’s the BIG Idea* project. This introduction is followed by a description of the methodology used to collect data on implementation and a description of the respondent pool. Results are presented in terms of implementation and impact. The final section of this report has conclusions and recommendations. The Appendix includes copies of all data collection instruments.

The BIG Idea project was evaluated during the 2006-2007 project year using multiple qualitative and quantitative methods. This section describes the methods and instruments used to collect data and the analytic technique used for the evaluation.

Librarian Surveys

All participating librarians were asked to complete a pre-survey about their practice in September 2006 and an identical post-survey in June and/or July 2007. The survey measured the experience and demographic characteristics of participants, the extent to which they used various activities associated with the BIG Idea project, their comfort levels with multiple mathematics and science activities, and the degree to which various resources were available to them in their libraries. Measures used a 4- or 5-point scale for responses. In addition, librarians completed conference evaluations for the institute, which took place in December 2006.

Site Visits

Site visits were conducted at 3 libraries during the summer and fall of 2006 and at 12 libraries during the spring of 2007. The sites were selected using a stratified approach, with half of the sites drawn from a sample of libraries that were visited last year and half drawn from the sample of sites that had never been visited. Site visits included: an **observation** of a BIG Idea session; an **interview** with the librarian; and a **focus group or interview** with parents or caregivers of participating children.

Interviews with librarians queried:

- Experiences, roles, and responsibilities;
- Perceptions and ratings of the professional development received in conjunction with the BIG Idea program;
- Changes in practice; perceptions of impact on children and their parents or caregivers;
- Utility of resources; likelihood of programs being sustained over time;
- Suggestions for improvement; and
- Any other comments they wished to make.

Parents or caregivers of participating children were randomly selected for focus groups or interviews during or immediately following the BIG Idea session. Respondents were asked where they learned about the BIG Idea sessions, perceptions of their children's reactions to the sessions, carry-over and reinforcement in the home, and perception of value.

In addition, RMC Research staff interviewed the state coordinator. Data collected from coordinators included roles and responsibilities, perceptions of implementation in their states, program branding and marketing, impacts on participating children and their families, supports, and suggestions for improvement. For this report, fall and spring were analyzed separately since those visited in the fall had only been to the first conference.

Materials Review

RMC Research provided an evaluation of the new curriculum materials; the professional development institute was provided to prepare librarians for implementation. The report on the conference was submitted in a separate document in February 2006. Material reviews are in this report. Materials were reviewed for fidelity to the benchmarks for effective instructional design.

Data Analysis

Librarian surveys were measured to determine changes in practice, comfort levels, and available resources over time and to identify librarian characteristics associated with any differences that were found. Repeated measures analysis of variance (RMANOVA) is a statistical procedure used to examine differences within and between groups when the same data are available for multiple points in time. RMANOVA was used to test for statistical significance for changes over time.

Observations were coded for the presence of several variables associated with fidelity and quality of implementation. Fidelity was defined as how closely the BIG Idea curriculum was followed. Librarians, during a debrief, were also asked to discuss fidelity and reasons for variation, if they strayed from the curriculum. Quality was measured using 15 indicators derived from the research and embedded in the BIG Idea curriculum as advice or guidance for implementation. Observations were also coded for types of participation by the parents, and for evidence of the degree to which standards in mathematics, and science were addressed.

Interviews and focus groups with coordinators, librarians, and parents/caregivers were analyzed for both trends and range of responses. Illustrative quotes were abstracted from the data.

Respondents

Survey respondents. Spring 2007 survey data were collected from 52 librarians. The sample included data from 34 librarians who also completed both the fall 2005 and spring 2006 surveys and 18 librarians who completed either the fall or spring surveys. Exhibit 1 shows the number of surveys received by state.

Exhibit 1. Number of Respondents Who Completed Both Pre-Survey and Post-Survey by State

State	Number of Librarian Respondents
Delaware	17
New York	13
Texas	18
Vermont	4
Total	36

Observations. Evaluators observed 15 BIG Idea sessions at 12 libraries: three in New York, two in Vermont, two in Delaware, and five in Houston, Texas.

Interviews and Focus Groups. Evaluators interviewed the four state coordinators and 15 librarians: two from Delaware, four from New York, five from Texas, and four from Vermont. RMC Research also conducted 17 interviews with parents or guardians of children who attended the BIG Idea sessions. Of these, four were from New York, three from Vermont, five from Texas, and five from Delaware.

The Vermont Center for the Book provided its annual conference in December 2006. During the conference, participants were introduced to an extended science curriculum and were given choices for the materials they would like to receive to help them with implementation. This section provides evaluation results for librarians' perceptions of the quality and utility of the professional development sessions that they attended approximately 6 months after the conference. This section also provides participants' perceptions of the additional resources they received from the Vermont Center for the Book throughout the year. Evaluation of the conference itself was provided in a separate report in February 2007.

Perceptions of Professional Development Activities

All of the librarians who were interviewed had attended all of the sessions during the Burlington professional development conference in December 2006. About 6 months after their attendance, they were asked to reflect upon what they had learned and the quality and utility of the conference.

Outcomes

Participants had mostly very positive responses to the conference. For some, the conference provided a lot of new information, particularly in the area of science exploration. Some appreciated the many opportunities for networking. Others liked the tips and tools to improve their practice. A few said that while they did not learn any new content, they learned or reminded about best practice. Two participants were somewhat overwhelmed. The range of responses are illustrated here.

I think it gave me a new way to look at the way I do story time. I probably used some of the concepts before, but it made me more aware. It also taught me to use more questions that allow for open-ended responses, and it made me focus more on what is in the surroundings that I can bring into story time. For example, as we are thinking about the seasons and change over time, we might look at the tree outside and think how it looks in different seasons. I might not have done that before.

I loved all the sessions. I learned about building structures using lots of new materials. That session was great and I liked the new materials we got.

It was different materials. I learned new ideas for using them. There was a broadening of the program. It wasn't just patterns but growth and weather. They seemed to open it up to science exploration, not just a particular field of science.

I loved growing plants because I already do a lot, but was able to refine what I know and do. The sessions this year and last made me more comfortable with

math and science. I could do it. I learned that I could stretch a concept over a couple of months.

The most important piece of information I learned is that I am not supposed to tell the kids the answers. I am supposed to solicit ideas from them. In fact, when I went to different sessions, they gave us ideas for questions to ask. That was very helpful.

I heard about a number of new books. The math person was very knowledgeable, but a little over our heads. I did get some good ideas about developmental levels for numbers. Science was more abstract this year.

I was amazed at how other librarians can take information and expand it in different directions. The concepts seem to be just an introduction.

Content

The librarians had mixed reactions to the content of the workshop, with eight respondents reporting that the content was excellent, three providing mixed reviews, and two feeling that the content should have been improved. Those who felt that the content was excellent discussed the clarity and thoroughness of the explanations, the exposure to new ideas, and the wealth of information that was provided. Those who had mixed reviews liked some of the presenters and not others. Those with low reviews explained that they believed that the information was “over the heads” of the children they served. Representative quotes were as follows:

Excellent. I couldn't think of any way they could have done it better. They are presenting information in a way that is understandable.

The content was very good. The explanations were good and thorough.

The content was age appropriate and we can adapt it to younger or older children.

They varied . . . There were different personalities and as with any teaching and learning situation, how effective it is depends on the dynamics of the group. But I really liked the topics.

I thought the activities were over our heads.

Length of Sessions

All but two of the participants thought the length of the conference and the sessions were just right. The two who wanted a change asked for a longer conference. The few suggestions offered about the sessions were a desire for more movement and more hands-on activities. One participant wanted to shorten the sharing session and one wanted to lengthen it. Two participants also commented that they appreciated that the sessions were not in the evening as they were last year.

Pacing

Ten of the participants felt that the pacing was just right. Two reported that the pacing varied by instructor and that some instructors spent too much time talking or concentrating on one theme. One said that she felt “antsy” and did not think the pacing was as good as last year.

Expertise of the Presenters

Without exception, presenters were considered very knowledgeable. While some participants liked some presenters more than others, they all believed that the presenters “knew their stuff.” Several respondents appreciated bringing in new speakers, especially the first keynote speaker. One suggested that an expert librarian (“not just content experts but a working person like us”) should be added to the speaker list next year.

Utility of Information

All of the participants reported that the information was very useful. Most believed that the demonstration of materials was particularly valuable and they liked the curriculum itself. A few still had some issues with adapting materials to very young children. The following quotes illustrate the range of responses:

Incredibly practical, that was the whole point. They are really teaching us how to apply what we learned. I always walk away thinking, “I can do this!”

This makes my work easier. It’s easy to put together a program and to add to it what works with the children here.

It was very useful. I couldn’t have done the BIG Idea program if I hadn’t attended the conference. I thought the exhibits were very useful and the fact that you were able to open and read the books and work with the manipulatives.

I do incorporate BIG Ideas, but still age is an issue for me. I get around this in part by providing toys for the younger children to go to when they need other things.

I got a lot of good ideas. The materials and manipulatives, some I thought I would never use in a library, but others I was excited about applying. Examples of things I thought I would never use are the sinking and floating materials, because they involve water. I think a lot of the stuff they gave us would be useful for special programs, but not necessarily for our everyday story hour. The books you can incorporate automatically; but the manipulatives I’m not sure how to use them in a library. That’s one of the things I’m frustrated about.

Utility of Other BIG Idea Resources

Participants were very familiar with resources available to them through the Vermont Center for the Book. They most often mentioned that they used bibliographies and ordered materials from

the Web site. Some also downloaded handouts. Very few participated in Web Junction and those that did said that they did not find any value in it. About half of the librarians also mentioned the parent resource kits. The following quotes are illustrative:

We use the Web page and all the professional references that were furnished by BIG Idea, particularly the science and math standards. These have been enormously helpful, and the handouts that are on the site are very helpful. We were able to use a lot of them with the professional development we did. Also, the bibliographies for ordering materials.

I have used and check out maybe twice a month the family resource kits. Also Head Start teachers have used the kits. I have also used the bibliographies and I use the Web site. I used the Web site for a project I'm doing in a master's degree course I'm taking. I haven't used Web Junction.

The bibliographies I have taken to classrooms to give to educators and I have used them to get additional titles to purchase to add to the collection. With the Web site, whenever I do an activity, I try to give an activity sheet that goes with it, so I go to the Web site to get additional ideas. Also, I try to let the public know that the Web site exists and they can explore it, too.

I went into the Web site and downloaded some of the free activities and will be incorporating those into the summer reading program. That is the resource I use the most. I also have several kids who like the family resource kits a lot. When I asked the parents what they thought of the kits, they said the information in there is very good. It really gave them ideas for things they could do with their kids.

I use the Web site a little . . . I tried to use Web Junction, but it wasn't useful at all. People were introducing themselves but I didn't find what I needed.

Ongoing Support From the Vermont Center for the Book

Coordinators were asked to comment on the types and quality of support that they received from the Vermont Center for the Book. In addition, librarians often provided comments about support in their answers to questions about implementation.

In each case, the support offered from the Vermont Center for the Book was thought to be responsive and of high quality. Typical comments were as follows:

It's outstanding. I have asked Sally to come a couple of times to meet with the group and she always does. Wendy responds immediately every time I e-mail her. They have all offered to come or e-mail if we need help. We feel totally supported. They are very approachable.

They are always there if you have any questions or concerns. They are very helpful and very available.

We get a response almost immediately if we have a question or problem. They have worked with us on funds for materials. The support from them is excellent and timely. They are always ready to help.

They are wonderful. They are very supportive and respond to everything we ask for.

Finally, when asked if they had any suggestions or needs for support in the future, coordinators primarily said to keep up the good work. The few suggestions that were offered were as follows:

They have promised us more math with Juanita Copley. I think that would be good. More time for librarians to share information with each other, and maybe how I can use Web Junction more effectively.

I could use more information on how to train others. That would cover most things. I am specifically interested in what materials would circulate the best and what would have the most impact if we loaned it out to libraries.

It would be good to have something that ties in with space.

In this section, BIG Idea program implementation is described. Results from surveys assessing practice are presented first, followed by vignettes, which are observation descriptions, and an analysis of observation data. Information from coordinator and librarian interviews that discuss implementation issues follows, along with an analysis of a sample of activity reports.

Survey Results on Implementation Practices

On the spring 2007 survey, librarians were asked about the frequency with which they provided activities addressed during the BIG Idea professional development sessions. Exhibit 2 shows the percent of librarian respondents in each category for each activity. Over all activities, the most frequent response category was “several times a month.” For the *making graphs and charts* and *designing and making things* activities, the frequency of use was somewhat less with the most frequent response given as “once every month or two.” Librarians tended to use three activities more often than the others: *using words that describe where objects are located*, *counting*, and *using comparative words*.

Exhibit 2. Current Use of Mathematics and Science Activities, Spring 2007

Survey Item	N	Percent				
		Never/ Almost Never	Several Times a Year	Once Every Month or Two	Several Times a Month	Once a Week or More
Matching, sorting, naming, and/or describing objects.	51	3.9	27.5	17.6	31.4	19.6
Talking about same and different.	52	1.9	21.2	26.9	34.6	15.4
Naming and describing shapes found in everyday environments.	52	1.9	17.3	26.9	44.2	9.6
Describing and combining shapes to make new shapes.	52	9.6	25.0	30.8	34.6	---
Making prediction.	52	7.7	15.4	23.1	32.7	21.2
Measuring and comparing sizes, shapes, and events.	51	3.9	23.5	29.4	35.3	7.8
Making graphs and charts.	52	23.1	30.8	36.5	5.8	3.8
Designing and making things.	48	4.2	18.8	33.3	27.1	16.7
Talking about sequences and patterns.	52	1.9	17.3	25.0	42.3	13.5
Using words that describe where objects are located.	52	1.9	19.2	11.5	28.8	38.5
Counting.	52	1.9	5.8	13.5	30.8	48.1
Using comparative words.	51	5.9	15.7	11.8	27.5	39.2
Describing how things grow and change over time.	52	3.8	34.6	30.8	21.2	9.6
Reading science books and doing science activities.	52	1.9	26.9	32.7	26.9	11.5
Reading mathematics books and doing mathematics activities.	52	3.8	23.1	44.2	21.2	7.7

Observations of Implementation

Evaluators observed 15 BIG Idea sessions at 12 libraries: three in New York, three in Vermont, two in Delaware, and four in Texas. The observations were analyzed for fidelity to the curriculum, quality of presentation, effect on participants, parent participation, and the degree to which they included evidence of standards. This section provides vignettes from six observations to give the reader a sense of what the implementation looked like. Results of analyses are then presented.

Sample Vignettes from the Observed Sessions

The BIG Idea sessions that were observed showed a range of fidelity to the curriculum, quality, and evidence of standards. The following six vignettes, displayed as Exhibits 3-8, are provided to show the range of practice.

Exhibit 3. BIG Idea Vignette 1

The room was set with chairs around three sides of a large rug and long tables along the fourth side. The tables had story-time materials, including books and props. Music was playing as children arrived. There were 12 children present: two infants and 10 who appeared to be 2 to 4 years old.

The librarian started the session by saying, “Today we will read stories about counting.” She pulled out the book *Three Billy Goats Gruff* and read the title. After mentioning the author and illustrator, she held up three fingers and reread the title. Then she read the story with expression and showed the pictures on every page to the children.

After reading one book, the librarian led the children in several familiar songs/finger plays—one of these involved counting, “Johnny Works with One (to Five) Hammer.” Several children and their parents or caregivers sang or acted out the finger plays with enthusiasm. Placing five bears on a felt board, the librarian then told a story of bears in bed and falling out. She counted, “Five, four, three, two, one.” She then read the book *Ten Red Apples* where various animals came and ate apples until there were none left. The children followed along as the librarian read the book and then they sang several more familiar songs.

The last book the librarian read was *Ten Little Fish* in which she asked the children to count down from 10 and back up to ten. “This is our last story today, so it’s time for our cup of tea.” The group then all acted out the “I’m a Little Teapot” song.

The librarian summarized the many counting activities from which the children could choose at the tables around the room. The activities included matching numeral cards with a number of objects, an elephant puzzle with numbered pieces to place in order, matching a number of chips with the dots on ladybugs, counting sticks; and matching numbered fish with a number of bubbles. Children could also choose to do a craft in which they made a fish bowl with three fish and three bubbles. Children selected their activities and worked with their parents to complete the activities.

Exhibit 4. BIG Idea Vignette 2

Story time at the library took place in a large activity room with five tables on one side of the room. On these tables there were blue pieces of construction paper set up like place mats for approximately 40 children. On the other side of the room, there was a table with books and other information about the library. In one corner, there was a table with session supplies. Pads for children to sit on and chairs for adults were in the center of the room. Music was playing as children arrived with a parent or caregiver. The session started with about 25 children and the librarian singing a well-known song; but as more people arrived, there were 34 children, aged infant to 3.

The librarian said, “We have been talking about counting and reading counting books. Today we are going to talk about weather.” The librarian showed the book *Little Cloud* and asked about parts of a book. A couple of children responded “cover,” “back,” and “spine” when the librarian pointed these parts and asked “What is this?” The librarian turned around and pointed to her own spine as she observed that just as your spine holds you up, the spine of a book holds it together.

Children were mostly attentive as the librarian read the book, showed the pictures, and acted out or commented on the changing cloud. Then everyone listened to the music, “World Outside My Window” about rain, rainbow, sun, clouds, and people. One child pointed out that trees were outside the window.

The librarian then showed the book *It Looked Like Spilt Milk* and asked, “What does spilt milk look like?” The children responded with descriptions of milk spilled on tables or the floor. The librarian then read the book, showed the pictures, and commented on all the possible “looks” a cloud could have. Many children were fidgety, so the librarian asked them to stand up and sing and act out the blackbird song.

“I have one more story about clouds for you.” The librarian found and read the book *Once Upon a Cloud*, emphasizing how to imagine different shapes for clouds or what clouds could be made of. Speaking mostly to the adults in the room, the librarian described how she would demonstrate an experiment they could try at home and would give hints to make it “work.”

The librarian then said to the children, “We are going to make a cloud in a jar.” The experiment involved putting ice and talcum powder in a jar and then adding hot water. After the experiment, the librarian told the children that the craft for the day was at the tables. They could make a cloud picture using white paint on the blue construction paper. The directions were to put a little glob of white paint on one half of the paper, fold the paper in half and press, and then open it up to see what the “cloud” looked like.

Exhibit 5. BIG Idea Vignette 3

Six parents/caregivers came with seven children, aged infant to 3. The activity room that accommodated story time was arranged with tables on three sides and a blanket in the middle so children could sit on the floor. The librarian welcomed everyone by asking them to join her in singing “Come Read with Me.”

The session started with a song about working at the button factory. Then the librarian introduced two books about size, *Just a Little Bit* and *Too Big, Too Small*, talking about the parts of a book, the author, and the illustrator. She read both books with expression, but without comment.

Following this reading of books, the children joined the librarian in doing the finger play “Itsy, Bitsy Spider,” acting it out as usual first and then for a very small spider and for a very large spider, and then faster and faster. The librarian said, “Look at your hands and look at my hands. What sizes are our hands?” After talking about the varying sizes of hands, the librarian brought out the book *Actual Size* and read and showed the pictures to the children. Children made comments like, “My mouth is too small”; “I have Tigger the Tiger”; and “I see two bugs.”

Next the librarian took out and read *Minnie’s Diner: A Multiplying Menu* in which customers at the diner keep asking for twice as much or twice as big a portion. Children were not quite as involved with this book, looking away and not responding to questions.

The reading session ended with singing and doing the motions for “I’m a Little Teapot.” The librarian introduced two choices of craft activities for children to do: measure objects with anteater’s tongues (pieces of yarn) or make tracings of their hands and their parents/caregivers hands. Children selected activities and worked with their parents to complete them.

Exhibit 6. BIG Idea Vignette 4

The library was closed for maintenance this day, but the librarian had arranged for a class of 13 second graders from a nearby school to join her in the children's book area of the library for a BIG Ideas session. The students were escorted by their teacher and an aide through a side door directly into the children's book area where they sat at three round tables. The librarian had another round table and counter readied with many supplies as well as a nearby shelf with relevant books.

The librarian started the session by saying, "Today we are going to read and talk about growing plants." She introduced the book *Ten Seeds*. After a quick mention of parts of a book, she began reading and showing pages of the book to the children. With each page of the book, the librarian asked questions and encouraged observations or connections to what the students knew about plants. For example, she asked, on the first page "What do you see?" Students noted worms, an ant, and a seed packet. As they proceeded through the story, students were questioned about what was happening or what happened. They talked about roots and their purposes, about leaves, about slugs and ladybugs and what they do, and about a seed-plant cycle.

Next the librarian gave each student a clipboard with paper and told them that these items were for them to write or draw any observations they made during the rest of the class. Referring back to the book *Ten Seeds*, she showed students seeds/plants at various stages of growth. She pointed to the first and said, "These seedlings were planted 4 days ago." At the second page, she said, "These small plants are from seeds planted 10 days ago." At another page, she said, "These bigger plants are from seeds planted 3 weeks ago." Using a flat pan in the middle of each table, seeds/plants of all three types were made available for students to handle and examine. They talked about the parts of the plant and they pulled some out of the soil to observe the roots. The children measured heights of plants and lengths of roots, and they were asked about what was going to happen with these plants if they were left to grow.

When students were ready to move on, the librarian passed around several different types of leaves—fern, fig tree, various house plants, and a very large outdoor philodendron—with a warning not to put leaves in their mouths. The class talked about characteristics of leaves: size, shape, spike-like, thickness, and texture. They recalled other types of leaves and in particular thought about leaves they did eat (e.g., lettuce).

For the last activity of the session, the librarian said, "Let's talk about what plants grow in." She had a big container of soil mixed with compost and put some in the pans on the tables. Students were asked to observe color and what things they could find in the dirt. They found worms, leaves (now dark brown), bugs, pine needles, sticks, and egg shells. There was much interest in the bugs and worms.

Finally, students were given wipes to clean up their places and their hands. They each received a plastic bag and sticker to label it with their name. Then they got items to put in the bag: a paper worm, a tattoo, a packet of seeds, a *Mother Goose* card about growing seeds at home, and a list of books on a bookmark.

Exhibit 7. BIG Idea Vignette 5

The BIG Idea session was held in an open area of the basement of the library. Ten children and four parents attended. Children sat on carpet squares near the librarian. The topic of the session was *Numbers and Operations*. The librarian opened the session by saying, "We are going to have one of the BIG Idea investigations today. We are going to do a counting story time today. If we counted the grownups in this room, how many grownups are there?"

Children begin to count. "One, two, three, four, five." The librarian responded, "But wait, you left someone out . . . Me. So, if you count me, how many would that be? What about this many?" She held up five fingers on one hand and one on the other. "How many is this?" The children answered, "Six!" The librarian asked, "Now what if I did this?" She held up four fingers on one hand and two fingers on the other. The group counted together. The librarian summed, "So 4 plus 2 equals . . . ?" The children affirmed, and the librarian said, "And 5 plus 1 equals . . ." The children responded, "Six!"

The librarian announced, "So that's what we are going to do today. Count with cardinal numbers. Do you know what a cardinal is?" One child answered, "It's just a red bird." The librarian replied, "Well, a lot of people think

that a cardinal is just a red bird. But it is also a way of counting. So when we count 1-2-3-4, we are using a cardinal way of counting.”

The librarian held up a large bucket with buckets inside that were not visible to children. The librarian asked, “How many buckets do I have?” The children replied, “One!” The librarian took out the bucket that was inside the large bucket. “Now, how many do I have?” The children answered, “Two!” The librarian took out another bucket . . . “So that’s three.”

She repeated this activity until she reached 10 buckets. Then she showed the children the numbers on the bottom of each bucket, and asked, “What number is that...? Ten, and 10 is Michael’s number today.” She held up the bottom of each bucket and repeated the activity, having children read the number and stacking the buckets in a tower from large to small. Once the tower was built, she counted, “1-2-3-4-5-6-7-8-9-10.”

She then said, “Now we’ll do it this way. She counted the buckets again. “First, second, third, fourth, fifth, sixth, seventh, eighth, ninth, tenth. Now I am going to read you a story. [First child’s name] and [Second child’s name], I need you over here.”

The librarian held up a book and said, “This is *Let’s Count*.” She pointed to the cover and asked, “How many balloons are there?” The group counted the balloons on the cover. The librarian turned to the first page that displayed the word one, one dot, and a chicken. The librarian started, “One...” The children replied, “Chicken.” The librarian turned the page and asked, “What comes next?” Children responded, “Two.” The librarian said, “That’s two,” and pointed to the word two and said, “and 2,” and pointed to the ice cream cones, “and 2,” and pointed to the dots. She continued reading, saying the numbers, reading the number words, and counting objects and dots.

A child observed, “You have dots on your shoes,” and the librarian responded, “I do have dots on my shoes. These are Crocs. How many dots do I have on my shoes?” The group counted together. The librarian said, “Eleven. Okay, look at your shoes. Do your shoes have holes on them anywhere? Can you count them?” Children began counting holes in their shoes.

The librarian then said, “Okay, let’s finish this.” They turned to the page with 10 items and she showed the children the dots on the page. “Can we count two, four, six, eight? That would be one way to count. What about five and five?” The librarian continued in this way until she reached the page with 15 numbers, then asked, “What do you think will be next?” The children responded, “Nineteen.” The librarian turned the page and found that the number was 20.

The librarian asked, “What happened? We are missing sixteen, seventeen, eighteen, and nineteen. That’s because we are counting by fives now, so the next number is twenty. And what do you think the next number will be? If you add five, what would it be?” One of the parents replied, “Twenty-five.”

The librarian turned to the next page and showed the number 30. She asked, “What happened? Now, we are counting by tens. So we went from 20 to 30.” She stopped reading and held up plastic bags with foam flower shapes in them. A child distributed the bags to the other children. The librarian asked, “How many flowers are in your bag? Twelve, right. Now what I want you to do is put these in two rows. You can put as many as you want to in each row.”

Parents worked with their children. After the children formed two rows of flowers, the librarian asked one child, “Zander, how many are in your first row?” The child replied, “Twelve.” The librarian said, “That’s exactly how many you are supposed to have. Now, [First child’s name] . . . She pointed to the child’s flowers. “You have seven and five; how many is that?” She continued to work with several children, counting the number of flowers in each of their rows and the total number they had.

Exhibit 8. BIG Idea Vignette 6

The BIG Idea session was held at a table in the children's section of the library. Three children and two parents attended. The topic was *Change Over Time*. The librarian started the session by asking, "How's everybody this bright, sunshiny, hot day? How are your flowers? Are your flowers all growing? Today we are not going to be talking about plants, but we are going to be talking about something that grows." She showed the children a plush caterpillar. The children exclaimed, "It's a caterpillar!" The librarian responded, "This caterpillar started out teeny tiny, and it grew, and then it's going to spin something. Then it's going to grow and then it's going to shed its skin and then it's going to turn into a . . . ?" A child answered, "A butterfly."

The librarian reached into a bag and pulled out a caterpillar puppet. She sang, "A fuzzy caterpillar, spun her chrysalis . . ." At the end of the song, she turned the caterpillar inside out to become a butterfly. She said, "Let's do this story. This is called *From Egg to Butterfly*." She began to read the book and came to a page with butterfly eggs, saying, "There are lots of eggs there aren't there?" A child replied, "And they are cracking." The librarian said, "And these eggs are so small, they are smaller than your littlest toenail."

The librarian continued reading. "So the eggs grow for a few months and then they turn into a caterpillar. And the caterpillar eats green plants." A child said, "Like leaves." The librarian read more of the book and showed the children a picture of a caterpillar on a leaf. "So the caterpillar sheds its skin. See that? The caterpillar's skin splits open and a new skin grows. And that's called molting. It sheds its skin and grows a new skin and does that four or five times, and then it spins a chrysalis." She showed a picture of the chrysalis and said, "When the butterfly comes out, it can't fly. Can you see why?" A child replied, "The wings." The librarian responded, "Yes. When the butterfly comes out, it's soft and very wet, and it can't fly."

The librarian finished the story, showing a picture of many butterflies in a tree. "That is a nice story. It goes all the way from an egg to a caterpillar to a chrysalis and to a butterfly. Now, I have a surprise for you." The librarian asked the children to close their eyes. She brought out a sock puppet of a caterpillar. "Okay. Are we ready?" The librarian began telling the story of *The Very Hungry Caterpillar*. She had objects made of felt with holes in the center for each of the things that the hungry caterpillar ate, (e.g., a red circle for the apple, green circles for leaves, purple circles for pears, rings decorated to look like ice cream, a sausage, and a lollipop). As she named the things that the caterpillar ate, she had children put the rings around the caterpillar's neck. She said, "So the very hungry caterpillar ate through one green leaf and made himself a chrysalis." She covered up the caterpillar with a green felt sac like a pupa and read about the caterpillar spinning a pupa. She then covered the pupa with a butterfly and read about the caterpillar becoming a butterfly. She continued, "So, those are all the things he ate! Do you remember all the things he ate?" The librarian took the felt objects off the caterpillar in reverse order, asking children to name each food as she pulled the felt objects off.

She said, "So caterpillars turn into something else. Now, when you grow up, are you going to turn into anything else?" A child responded, "I am going to be a doctor." Another child said, "I am going to be a cat trainer." The librarian asked, "But will you change like a caterpillar? Let's stand up. Now, do you have two legs? And you have two arms. When you grow up do you think you will grow more legs?" One child responded, "Yes." The librarian replied, "Look at me. Do I have two legs?" The child said, "Yes." The librarian asked, "Now when you grow up will you learn new math problems?" The children shouted, "Yes." The librarian continued, "And will you learn new facts?" The children replied affirmatively. The librarian concluded, "So when you grow up, you will learn new things and you get bigger and taller, but you won't change and become something different."

She continued, "Now let me show you what we are going to do today. We are going to make a book, a butterfly book!" The librarian showed the children a book she made with a butterfly as the cover. Inside was a smaller book. Each page of the smaller book showed a stage in the butterfly's development. The librarian paged through the book with children. "It starts as an egg, and then it turns into a caterpillar, and then it turns into a chrysalis and then it turns into a butterfly. And you will each get a book mark that shows that stages of the butterfly."

The children moved to tables. The librarian handed out sheets with butterflies for the children to paint or color for the covers of books and sheets with the pictures showing each stage of the butterfly's development. Parents worked with their children on painting and making the books.

Fidelity to Curriculum in Observed Sessions

As is evident from the vignettes, observed sessions showed a range of fidelity to curriculum. Most of the classes observed used parts of the BIG Idea curriculum, but only one followed the curriculum precisely. Others appeared to select some books and activities from the curriculum and supplement the curriculum with other activities that the librarians appeared to enjoy. Most frequently, the curriculum was supplemented with songs and finger plays.

The lack of fidelity, however, typically meant that the sessions did not have the depth of exploration that the curriculum featured. Oftentimes, the activities that were left out were those that helped the children to learn more sophisticated mathematics or science concepts, addressed the standards, and/or explored ideas presented in the investigations.

Implementation Quality in Observed Sessions

The BIG Idea sessions were coded to indicate the degree to which there was evidence that 15 quality indicators were present. Exhibit 9 displays results and shows that in all sessions, there was adequate time to complete activities, and in nearly all, there were enough materials for all children. There was substantial evidence that the majority of those librarians observed made the activities fun for the children, read books with expression, provided encouragement to all children, provided enough space for activities, managed the session well, provided positive feedback to children, used mathematics and/or science vocabulary, and helped students who were having difficulty. Areas with the lowest amount of evidence of quality were librarians answering all questions from parent/caregivers knowledgeably and librarians providing information to parents or caregivers about what they could do at home to reinforce or extend learning.

Parents/Caregiver Participation in Observed Sessions

In more than 75% of the observed sessions, parents or caregivers were at least somewhat active participants. As can be seen in Exhibit 10, there was some evidence parents encouraged their children to engage in the activities and participated alongside their children. There was substantial evidence in about half the observations that the parents or caregivers made the activities fun. In almost all of the observations, parents or caregivers were observed to emphasize the importance of literacy, mathematics, and/or science to children or to use the vocabulary of math or science. These observations suggest that parents could be invited to be even more active in these sessions. Vignettes showed that parents typically listened with their children and did not participate with them until the activities at the end of the sessions.

Exhibit 9. Evidence of Quality Indicators in Observed Sessions (N = 12)

Quality Indicators	Percent		
	No Evidence	Some Evidence	Substantial Evidence
The librarian explained the goals of the lesson to any adults that were present.	16.67	33.33	50.00
The librarian related the lesson to children's prior knowledge.	0.00	33.33	66.67
The librarian made the activities fun for the children.	0.00	16.67	83.33
The librarian used mathematics vocabulary.	0.00	41.67	58.33
The librarian used science vocabulary.	8.33	41.67	30.00
The librarian provided positive feedback to children.	0.00	25.00	75.00
The librarian provided encouragement to all children in the class, regardless of their backgrounds and abilities.	0.00	16.67	83.33
The librarian helped children who were having difficulties with the activities.	0.00	50.00	50.00
The librarian read books with expression.	0.00	16.67	83.33
The librarian managed the class well; there were few behavioral disruptions.	0.00	25.00	75.00
There were enough materials for all children.	0.00	8.33	91.67
There was enough time to complete most or all of the activities.	0.00	0.00	100.00
There was enough space to conduct all activities.	8.33	8.33	83.33
Librarians could answer all questions from parents/caregivers knowledgeably.	8.33	58.33	33.33
Librarians provided information to parents/caregivers about what they could do at home to reinforce or extend learning.	8.33	41.67	41.67

Exhibit 10. Parent/Caregiver Participation in Observed Sessions (N = 13)

Parent/Caregiver Participation	Percent		
	No Evidence	Some Evidence	Substantial Evidence
The parent/caregiver participated in the activities alongside his/her children.	8.33	75.00	16.67
The parent/caregiver encouraged his/her children to participate fully in the class.	16.67	58.33	25.00
The parent/caregiver helped to make the activities fun for the child.	8.33	50.00	41.67
The parent/caregiver emphasized the importance of literacy, mathematics, and/or science to his/her child.	8.33	91.67	0.00
The parent/caregiver used mathematics and/or science vocabulary.	16.67	83.33	0.00

In the 15 interviews with parents or caregivers, all reported that his/her child enjoyed the BIG Idea session in which he/she participated. All but one of the respondents felt that the sessions were at the right level for their children, who ranged in age from 3 to 6. The one who did not feel it was right said that the activities were a little difficult for her 3-year-old.

The librarian makes it appropriate for all ages. – Parent

He may not appear to participate because he sits on my lap, but he really enjoys it. – Parent

I thought it was excellent for their ages. – Parent

*My daughter loved it, and both of them enjoyed going to the summer program.
My son just loves anything having to do with math and science.* – Parent

When asked what they thought was the best part of the session, most parents mentioned the hands-on experiences that their children received or the songs that they sang. Several parents also mentioned that they liked the specific books that were read or that they liked particular activities. Several parents mentioned that they liked having the children interact with each other and one discussed the best part as “stimulating imagination.”

The hands-on activities make the books come alive. – Parent

He relates to the stories. We check them out after we listen to them. I also like the multisensory part. – Parent

Parents were pleased and said that they would not recommend any changes to the program. Most mentioned that they liked the librarians and the range of activities conducted.

(The librarian) is wonderful. She serves as a great resource to me. – Caregiver

Extent to Which Mathematics Standards Were Addressed

Observers coded the extent to which they saw various standards being addressed in the sessions they attended. Exhibit 11 provides information on the extent to which mathematics standards were addressed. Numbers and operations standards were more apparent in the sessions observed than geometry and spatial sense, patterns, or measurement. Within the area of number and operations, about one fourth of the librarians addressed using numbers and counting as a means for solving problems, counting in sequence and recognizing numerals, using one-to-one correspondence when counting objects, identifying positions of objects in a sequence, and observing numerals in the environment. Only one librarian used a number line and just three addressed subtraction. Few addressed the concept of zero or named how many were in a group without counting.

In the area of geometry and spatial sense, there was some evidence that three fourths of the librarians addressed the idea of same and different. Few, however, addressed geometric concepts through block play or had children take things apart and put them back together.

Librarians that were observed tended to address patterns by identifying patterns in the environment or categorizing objects according to various properties. Librarians were less likely to have children recognize and name common colors, make comparisons between objects based on single attributes, or represent patterns in different ways.

Children were asked to engage in measurement activities in some of the observed sessions. Using measurement vocabulary was more common than using nonstandard and standard measurement units.

Exhibit 11. Extent to Which Librarians Addressed Mathematics Standards in Observed Sessions (N = 12)

	Percent		
	No Evidence Observed	Some Evidence Observed	Substantial Evidence Observed
Numbers and Operations			
1. Use numbers and counting as a means for solving problems and understanding (measuring) quantity.	41.67	33.33	25.00
2. Count in sequence and recognize numerals 0 to 10.	50.00	25.00	25.00
3. Begin to use one-to-one correspondence when counting objects.	66.67	8.33	25.00
4. Begin to use language to compare numbers of objects with terms such as more, less, fewer, equal, add, and subtract.	58.33	41.67	0.00
5. Match a number of objects with a written numeral.	41.67	33.27	8.33
6. Identify positions of objects in a sequence (e.g., first, second).	50.00	16.67	25.00
7. Add two groups of concrete objects by counting objects.	41.67	50.00	16.67
8. Subtract one group of concrete objects from another by taking some away and counting the remainder.	75.00	16.67	8.33

	Percent		
	No Evidence Observed	Some Evidence Observed	Substantial Evidence Observed
Numbers and Operations			
9. Use a number line to count forward and backward.	91.67	0.00	8.33
10. Begin to name “how many” are in a group of at least three objects without counting.	75.00	25.00	8.33
11. Recognize and describe the concept of zero (meaning there are none).	66.67	33.33	0.00
12. Use ordinal numbers from first to tenth.	58.33	25.00	16.67
13. Observe numerals in the environment.	50.00	25.00	25.00
Geometry and Spatial Sense			
14. Begin to recognize, name, describe, match, sort and compare common shapes and their parts and attributes.	50.00	33.33	16.67
15. Progress in ability to put together and take apart shapes.	83.33	0.00	8.33
16. Begin to understand geometric concepts through block play.	91.67	0.00	8.33
17. Begin to develop the concept of same and different.	25.00	66.67	8.33
18. Match and sort according to attributes such as shape and size; put in a series and regroup objects according to one or two attributes.	50.00	41.67	8.33
19. Build an understanding of directionality, order, and positional terms such as up, down, over, under, top, bottom, and so forth.	58.33	41.67	0.00
Patterns			
20. Begin to recognize, copy, and extend simple patterns with a variety of materials.	58.33	33.33	8.33
21. Show ability to match, sort, and put in a series and regroup based on one or two attributes such as shape or size.	58.33	33.33	8.33
22. Categorize objects according to various properties including size, number, length, texture.	41.67	50.00	8.33
23. Identify patterns in the environment.	41.67	41.67	16.67
24. Represent patterns in a variety of ways.	75.00	8.33	16.67
25. Begin to make comparisons between several objects based on a single attribute.	75.00	25.00	0.00
26. Begin to recognize and name common colors.	83.33	16.67	0.00
Measurement			
27. Recognize and name measurable attributes such as weight, volume, and length.	58.33	33.33	8.33
28. Use nonstandard and standard measurement units.	75.00	8.33	16.67

Extent to Which Science Standards Were Addressed

Exhibit 12 shows the extent to which librarians addressed various science process standards in the 12 observations that were conducted. The Exhibit shows that the areas with the most evidence was asking questions. More than half of the librarians asked students what they noticed or “what if” types of questions and half showed substantial evidence of engaging children in discussions to increase their understandings of “what happens when . . .” or asking questions of the children about objects, events, or organisms. About half also encouraged children to show curiosity about the natural world and to use their senses to explore objects in the natural environment. Fewer asked children to observe changes in the world or to discuss cause and effect. Fewer still asked children to test the predictions they made or to discuss reasons why a prediction was correct or incorrect.

Sorting and classifying occurred in about half of the classrooms though none sorted according to predictions. Less than half communicated scientific ideas or information through mapping or charting and few recorded information about weather. There was little evidence of design and make models being used or of scientific measurements. While about half talked about how living things changed, few described how matter changes. Few asked the children to recognize or reproduce simple patterns or to use ideas and language related to time. Simple investigations were also rarely seen.

Some of the standards infrequently addressed were not emphasized in the curriculum, though all appeared somewhere in the curriculum. The more sophisticated the skill or standard, the less often it was addressed.

Exhibit 12. Extent to Which Science Processes, Skills, and Concepts Were Observed

	Percent		
	No Evidence Observed	Some Evidence Observed	Substantial Evidence Observed
“Ask” Questions			
1. Ask “what if?” and “what do you notice?” and “what can we try?” questions that further children’s understanding.	16.67	25.00	58.33
2. Participate in discussions to increase an understanding of “what happens when . . . ?”	16.67	25.00	58.33
3. Ask questions about objects, events, and organisms.	8.33	41.67	50.00
Observe and Gather Information			
4. Show curiosity about the natural world.	0.00	50.00	50.00
5. Use senses to explore objects and the environment.	8.33	50.00	41.67
6. Observe and discuss the physical properties of objects: differences/similarities and comparisons.	25.00	41.67	33.33
7. Observe and discuss changes that occur in the world (plant growth, stage of living things, etc.).	50.00	8.33	41.67

	Percent		
	No Evidence Observed	Some Evidence Observed	Substantial Evidence Observed
Observe and Gather Information (cont'd.)			
8. Observe, describe, and investigate changes in materials and cause and effect relationships.	50.00	16.67	33.33
9. Observe changes in sizes, color, position, weather, and sound.	58.33	33.33	8.33
10. Understand that living things are made of parts.	50.00	33.33	16.67
Estimate and Predict			
11. Make predictions, explanations, and generalizations based on past experiences.	16.67	58.33	25.00
12. Predict “what will happen if . . . ?”	33.33	41.67	25.00
13. Test predictions through concrete experiences to confirm or refute them.	66.67	33.33	0.00
14. Discuss reasons why a prediction is correct or incorrect.	75.00	25.00	0.00
Sort and Classify			
15. Notice similarities and differences and put objects into groups based on shared attributes.	41.67	50.00	8.33
16. Observe and discuss common properties, differences, and comparisons among objects and materials.	41.67	41.67	16.67
17. Sort living things by characteristics such as movement, environment, and physical characteristics.	50.00	41.67	8.33
18. Sort objects based on predictions (e.g., sink and float) and then test the predictions.	100.00	0.00	0.00
Communicate Information and Ideas			
19. Collect, describe, and record information through a variety of means including discussions, drawings, maps, and charts.	58.33	8.33	33.33
Collect and Use Data			
20. Think back on what they have observed, sorted, or measured in order to explain ideas about the world around them.	25.00	50.00	25.00
21. Make generalizations based on experiences.	50.00	16.67	33.33
22. Record information about weather.	83.33	8.33	8.33
Design and Make Models			
23. Solve simple design problems.	91.67	0.00	8.33
24. Explore a variety of materials.	75.00	16.67	8.33
Notice Change Over Time			
25. Recognize and describe how objects and living things change.	41.67	8.33	50.00
26. Use language to demonstrate knowledge of physical change (e.g., color mixing).	58.33	16.67	25.00

	Percent		
	No Evidence Observed	Some Evidence Observed	Substantial Evidence Observed
Notice Change Over Time (cont'd.)			
27. Describe how matter can change such as melting, freezing, combining to make a new substance.	75.00	25.00	0.00
28. Associate the seasons with changes.	50.00	33.33	16.67
29. Use words related to weather, night and day, and other changes in the natural world over time.	58.33	33.33	8.33
30. Show increased awareness of cause and effect relationships.	25.00	66.67	8.33
Find Patterns and Relationships			
31. Notice repeated sequences and organized arrangements in the world around them.	33.33	50.00	16.67
32. Compare sizes, shapes, quantities, colors and events.	16.67	58.33	25.00
33. Imitate sound and movement patterns.	58.33	25.00	16.67
34. Recognize and reproduce simple patterns of concrete objects.	66.67	16.67	16.67
35. Develop an awareness of ideas and language related to time such as daily routines.	66.67	25.00	8.33
36. Create, copy, and extend patterns.	58.33	16.67	25.00
Measure			
37. Compare sizes, temperatures, weights, as well as use numbers to quantify measurements.	66.67	25.00	8.33
38. Use simple measuring devices and concepts to gather information, investigate materials, and observe processes and relationships.	75.00	16.67	8.33
Use the Simple Tools of Science			
39. Use the senses and a variety of simple tools to gather information, investigate materials, and observe processes and relationships.	41.67	41.67	16.67
Experiment			
40. Conduct simple investigations.	83.33	16.67	0.00

Librarian Reports of Implementation

Of the 13 librarians that were interviewed, nine reported that they had implemented at least some of the *What's the BIG Idea?* curriculum. The lessons or units that were most often implemented were those that addressed weather (8 respondents), building (5 respondents), plants (5 respondents), seasons (2 respondents), growth/change over time (2 respondents), and counting (2 respondents). Several mentioned that they intended to conduct the building lessons but were waiting for material to arrive.

One respondent that had implemented several of the units discussed some challenges associated with implementation and ways that the staff had integrated BIG Idea concepts in all their work.

For us, the issue is still how to avoid the one-shot deal. The kids are different every week, so you don't have anything to build on. That's why incorporating things downstairs (in the children's library program) helps. This year we are trying much harder to integrate the material with our regular programming. As part of every theme we were doing in the children's library, we now incorporate BIG Idea. What I think we have gotten better at is using all this stuff in every way we can think of. For example, we have something called "The Kindergarten Initiative." We had 16 kindergarten classes come to the library this year. This year, the theme was, "If You Give a Mouse A Cookie." We set up a graph on children's favorite cookies. That's an example of integration into regular programming. We didn't do a lesson on graphing, but we set up a graph. We have also integrated BIG Idea into another program our library has called "Book Express." Book Express is a program in which we lend boxes of books and materials on different themes to early childhood programs. The boxes circulate for a month. We have volunteers who go out into the communities and deliver the boxes. The program has grown from 7 boxes to 32 boxes.

Three of the four respondents who had not yet implemented BIG Idea activities reported that they planned to do so in the very near future or over the summer. The one who did not have plans said that she had been ill and simply did not have time yet to plan anything.

Coordinators' Perceptions of Implementation

Coordinators reported that the BIG Idea curriculum was implemented in nearly all of the sites in all participating states and expanded to other sites. In Houston, there were participating librarians from 36 sites, and the coordinator and others trained librarians in the additional 16 sites within the city, providing them with all of the BIG Idea materials. In Delaware, the program also expanded from the original 17 to over 20. Of the original 17, only one site was not actively implementing the program. Delaware also expanded its BIG Idea programming into summer programs, and had the Vermont Center for the Book develop a complementary summer program, delivering new training and materials. Materials may also be expanded in an effort to collaborate and become part of a financial literacy initiative in the state. In New York, the program was expanded to include bookmobiles. Materials were adapted to be shorter and more interactive. In addition, several libraries joined as partners and hired librarians to implement science activities. Vermont was still at the start-up stage, with two librarians actively involved and the rest receiving some training on some of the activities.

As far as the bookmobile goes, the activities are different . . . For example, we did change over time using weather. Each day the children could put up what the weather was like for that day. At the end of the month, we had a graph of what the weather was like.

Some of the libraries that were not involved last year are involved this year . . . Another initiative our libraries have taken up is that they are starting to put together themed science displays and these are being rotated to libraries throughout our system. The displays include books and activities.

The biggest change was that we expanded the BIG Idea into a summer reading program . . . We didn't want to lose the momentum that BIG Idea created. The reading was extended into math and science. We needed to do that because our summer programs had been mostly arts and crafts and were very shallow, not meaningful at all.

State coordinators said that while they had not collected any specific information, they perceived that most librarians branched out beyond what was in the curriculum. The coordinators thought that allowing librarians to do this was important for helping the librarians make the curriculum fit with their interests and talents.

There is quite a bit of innovation for the ages in the story times and for use with children with monolingual Spanish speaking parents. Mostly librarians look for and use other books, and try to include more activities for 2- and 3-year olds.

I think a lot of them are innovating, but in good ways. For example, for sequencing, one library had a fireman come in and show what order he put his clothes on . . . I think they have taken the ideas and expanded on them. I think the trainings have been essential in getting the ideas across to everyone.

Parent Reports of Implementation

When asked about the activities in the session, parents and caregivers provided consistently positive feedback. Without exception, respondents stated that their children were highly engaged in the sessions, their children enjoyed all the activities, and that the children looked forward to coming. Parents and caregivers also reported that the material was appropriate for the age level and that all of the activities fit into place with the topics being addressed. Activities were seen as being conducted seamlessly, with no time lost in transition. In every case, the respondents reported that they would not do anything differently. Below are some examples of the parents or care givers thoughts on the program:

(The librarian) gets the best responses out of the kids because the atmosphere is so open and inviting.

They do such a nice time tying everything together with the story, everything keeps getting reinforced.

There is a wide range of activities that also hits all the modalities.

They are learning very well, they enjoy the activities, and the children really look forward to coming. The activities are very educational and I also think it helps to prepare them for school.

Unsolicited other comments included the following:

My child is bilingual. I started bringing him here for story hour when he was one and a half and he really learned to speak English from speaking with (the librarians).

Just to have this program in our community is so invaluable, to have any program like this is just amazing!

The program itself is set up in such a way that the kids don't recognize that they are learning math, but they are.

This section provides data on the impact of the BIG Idea project on librarians, participating children, and participating parents/guardians. Discussion of sustainability is also presented.

Impact on Librarians

Impact on librarians is discussed in terms of their changes in activities being offered over time, comfort levels in providing programming for young children that has strong mathematics and science content, changes in their use of materials, and changes in the resources that they have or make available in the libraries. Responses were obtained from librarians and coordinators through surveys and interviews.

Change in Use of Mathematics and Science Activities Over Time

To determine the extent to which the BIG Idea program helped librarians increase their use of activities over time, repeated measures analyses of variance (ANOVAs)¹ were conducted on data from three points in time (fall 2005, spring 2006, and spring 2007) for all activities. Data from those librarians who completed all three of the surveys were analyzed.

Exhibit 13 shows the means² (1 = never and 5 = once a week or more) for all three data collection points and demonstrates that all but two activities showed statistically significant change over time. The two activities that indicated no significant change were *matching, sorting, naming, and/or describing objects* and *designing and making things*.

Additional analyses (Bonferroni Pairwise Comparisons) were conducted on the remaining 13 activities to find where the significant changes occurred over time. The significant changes in practice occurred from fall 2005 to spring 2007. Although, there were no significant changes in the use of activities from spring 2006 to spring 2007, 13 out of the 14 activities with significant increases from fall 2005 to spring 2006 stayed at about the same levels of use in spring 2007.³

¹ Repeated measures analysis of variance (AVOVA) is a statistical measurement used to determine the differences between groups and within groups when the same measurement is made several times.

² The mean or average value is a measure of central tendency computed by adding a set of values and dividing the sum by the total number of values.

³ There were no significant increases in use of *designing and making things* in fall 2005 to spring 2006.

**Exhibit 13. Changes Over Time in Use of
Mathematics and Science Activities (N = 27)**

Survey Item	Fall 2005 Mean	Spring 2006 Mean	Spring 2007 Mean	F^4 Value	Significance
Matching, sorting, naming, and/or describing objects.	3.15	3.85	3.59	2.213	.149
Talking about same and different.	2.89	3.67	3.67	8.382	.008**
Naming and describing shapes found in everyday environments.	2.85	3.46	3.58	7.694	.010**
Describing and combining shapes to make new shapes.	2.00	3.19	3.19	27.335	.000**
Making prediction.	2.73	3.73	3.58	7.581	.011*
Measuring and comparing sizes, shapes, and events.	2.36	3.24	3.28	12.138	.002**
Making graphs and charts.	1.42	2.35	2.62	28.842	.000**
Designing and making things.	3.42	3.88	3.38	.015	.903
Talking about sequences and patterns.	2.38	3.62	3.65	21.319	.000**
Using words that describe where objects are located.	3.22	3.78	4.00	8.726	.007**
Counting.	3.88	4.24	4.36	5.703	.025*
Using comparative words.	3.16	3.96	4.16	25.000	.000**
Describing how things grow and change over time.	2.19	3.26	3.33	23.483	.000**
Reading science books and doing science activities.	2.19	3.26	3.33	23.483	.000**
Reading math books and doing math activities.	1.67	3.19	3.19	39.733	.000**

Note: ** $p \leq .01$, two-tailed test; * $p \leq .05$, two-tailed test.

Twelve of the 13 librarians who were interviewed reported that, as a result of their participation in the BIG Idea program, they tended to use more inquiry and discovery when working with children, intentionally used mathematics and science vocabulary, or asked the children to observe more and discuss their observations. Several discussed reading more nonfiction books or adding more connections to mathematics and science in their story times.

I have been using methods more during story time to coincide with what is in the BIG Idea program. For example, I did an activity on farm animals and as opposed to just talking about farm animals, I also talked about growth. I am also using more open-ended questions.

⁴ The F statistic provides a basis to test for statistical significance when used in analysis of variance (ANOVA).

I am doing much more inquiry and not so much answer-based teaching.

I'm getting into more details and asking more for observation.

Librarians' Comfort Level in Designing and Implementing Programming With Mathematics and Science Content

Librarians who completed the spring 2007 survey responded to how comfortable they were in seven areas that focused on teaching and using mathematics or science skills and in designing mathematics and science programs for young children. As shown in Exhibit 14, over 80% of the librarians were at least somewhat comfortable in all seven areas while at least 40% of the librarians indicated that they were very comfortable in teaching, using, or designing mathematics and science programs.

To determine to what extent the BIG Idea program helped librarians increase their comfort level in designing, using, and teaching math and science programs over time, repeated measures ANOVAs were conducted on each of seven survey item areas. Exhibit 15 shows the means (1 = not very comfortable, 5 = very comfortable) for the three time periods and indicates statistically significant increases for all seven items surveyed. The additional analyses conducted to reveal where the significant increases were over time indicated the increases in comfort level were between fall 2005 and spring 2006 and fall 2005 and spring 2007. No significant increases in comfort level were detected from spring 2006 to spring 2007, thus indicating that comfort levels remained about the same.

Exhibit 14. Current Comfort Level in Designing, Using, and Teaching Mathematics and Science Activities, Spring 2007

Survey Item	N	Percent			
		Not Very Comfortable	A Little Comfortable	Somewhat Comfortable	Very Comfortable
Teaching mathematics skills to young children	51	--	11.8	39.2	49.0
Teaching science skills to young children.	52	--	7.7	38.5	53.8
Using scientific investigations with young children.	52	--	9.6	42.3	48.1
Using prediction activities with young children.	51	3.9	3.9	33.3	58.8
Designing programs for young children to learn literacy concepts.	52	3.8	5.8	32.7	57.7
Designing programs for young children to learn mathematics concepts.	52	5.8	11.5	42.3	40.4
Designing programs for young children to learn science concepts.	52	5.8	11.5	40.4	42.3

Exhibit 15. Changes Over Time in Librarians' Comfort Level (N = 24)

Survey Item	Fall 2005 Mean	Spring 2006 Mean	Spring 2007 Mean	F Value	Significance
Teaching mathematics skills to young children	2.84	3.56	3.52	12.940	.001**
Teaching science skills to young children.	2.85	3.42	3.62	17.007	.000**
Using scientific investigations with young children.	2.84	3.56	3.60	18.672	.000**
Using prediction activities with young children.	3.13	3.67	3.63	4.600	.043*
Designing programs for young children to learn literacy concepts.	3.21	3.67	3.71	6.273	.020*
Designing programs for young children to learn mathematics concepts.	2.42	3.50	3.58	35.219	.000**
Designing programs for young children to learn science concepts.	2.54	3.50	3.50	29.894	.000**

Note: ** $p \leq .01$, two-tailed test; * $p \leq .05$, two-tailed test.

Coordinators reported that participation in the BIG Idea project had significant impacts on participating librarians. They believed that participation had given their librarians confidence in the areas of mathematics and science and led to much more programming and discussion of mathematics and science concepts.

I think it has been night and day as far as science and math are concerned. I think they didn't realize what an impact they could have. I think a lot of us were science and math-phobic and no longer are. It's amazing what they have been able to do just by taking a story and changing it somewhat. I think if you had asked librarians a few years ago about doing a science program, they would have said, "I don't know anything about science." But now they are gung-ho.

Because so many of our children's librarians do not have degrees, this program has been a boost to their confidence. It helps them come up with additional programming ideas and has increased their confidence with early math and science topics. The librarians got a lot of ideas from each other and from other librarians at the training in Vermont. BIG Idea has led to many other possibilities for programming, too, like the summer reading program.

I think this has changed how they do programming. One of them happens to have a science background so she is oriented to that direction. But in terms of how much she was incorporating math and science into her programming, it wasn't very much. This has changed all of their programming. It has really opened their eyes to the learning activities they can include.

The skills they learned about programming They are more intentional and the activities are more meaningful. This work has transcended into other programs. For example, they think about reading in a very different way.

Library Resources Availability

On the survey, librarians were asked to discuss the different types of library resources that were available from their library for teaching mathematics and science to young children. Exhibit 16 shows the results and indicates that, for the most part, *some to a lot* of these library resources were available from the libraries of participants. More of the librarians indicated fewer professional development activities for librarians were available in comparison to the other resources listed.

To determine the extent to which the BIG Idea program helped increase the availability of mathematics, science, and professional development resources in libraries over time, a repeated measures ANOVA was conducted on each of five survey item areas. Respondents used a 4-point scale to respond to survey items where 1 = not at all and 4 = a lot.

Exhibit 17 shows the results of the analyses and indicates statistically significant differences in all five areas of resources. Additional analyses indicated that significant increases in resource availability occurred during the fall 2005 to spring 2006. The availability of resources stayed about the same from spring 2006 to spring 2007.

Exhibit 16. Library Resources Availability, Spring 2007

The Degree to Which Resources Are Available	N	Percent			
		Not At All	A Little	Some	A Lot
Resources for teaching mathematics to young children.	52	--	3.8	48.1	48.1
Resources for teaching science to young children.	52	--	3.8	48.1	48.1
Resources to help parents teach mathematics to young children.	52	--	11.5	55.8	32.7
Resources to help parents teach science to young children.	52	--	9.6	51.9	38.5
Professional development activities for librarians.	52	--	19.2	48.1	32.7

Exhibit 17. Differences Over Time in Library Resources Availability

Survey Item	Fall 2005 Mean	Spring 2006 Mean	Spring 2007 Mean	F Value	Significance
Resources for teaching mathematics to young children.	2.88	3.42	3.54	23.382	.000**
Resources for teaching science to young children.	2.92	3.42	3.50	13.235	.001**
Resources to help parents teach mathematics to young children.	2.65	3.12	3.15	8.784	.007**
Resources to help parents teach science to young children.	2.62	3.12	3.23	10.191	.004**
Professional development activities for librarians.	2.62	3.12	3.15	7.122	.013*

Note: ** $p \leq .01$, two-tailed test; * $p \leq .05$, two-tailed test.

Librarians who were interviewed also reported that they added more mathematics and science books to their collections. Some added more mathematics and science-related manipulatives and materials to their libraries.

Outreach and Partnership Efforts

Many of the respondents said that they had conducted significant outreach efforts, primarily to Head Start programs or to elementary school programs for kindergarteners. Some presented BIG Idea concepts at state conferences for early childhood educators or librarians and others developed outreach materials for day care centers and parents. The following are representative quotes.

I am adding more science books . . . I realize that our “juvie” science collection is outdated. The plans information—everything has changed, of course. I have bought a lot of books already, but I need more . . . The fact that the activities are on science makes kids want to explore more in general.

I looked more “scientifically” when ordering books for the libraries’ collections and added books to beef up the science fair collection. I used a number of activities during outreach in schools. It’s a way for me to draw kids to the library. We planted a garden on library grounds and are planning a weather window. I would like to put in a weather station, and we have been changing the BIG Ideas bulletin board.

I have added more science and math books, not just in nonfiction, but in picture book and easy reader collections. I co-taught a double workshop on the BIG Idea at a state conference for early childhood educators and we reached 30 preschool educators. We taught them about measurement, patterns, sorting, and grouping . . . I have taken the program to several local kindergartens. I took the discovery

kits, my manipulatives, a book or two, and we explored the literature and gave the kids a chance to work with the manipulatives. I have also trained staff at a private preschool where I introduced the program and took the kits.

In terms of outreach, we are trying to not only affect children's lives, but doing professional training on the content of BIG Idea. We have a Book Express Box called Patterns, Patterns Everywhere. It goes to family day care homes, day care centers, preschools, and kindergartens. This box is based on the BIG Idea, and it has been going out every month since we put it together. I have just written an activity manual to go with it. This is under the heading of integration. We were doing Book Express anyway, but found a way to integrate BIG Idea with it. The feedback on the BIG Idea Book Express box is that this is the best one you have done. It is the most popular out of the 32 boxes. We just got funding from the Rotary Club to do a weather and seasons box. In the fall, we did a professional development session at our early childhood conference on the BIG Idea program.

Other partnerships with the community were formed over the course of the past year. Several initiated relationships with nearby institutions whose work focused on mathematics or science: Vermont Institute for Nature and Science, the Delaware Mad Science group, the Nature Conservancy, or Health Science Center Raise-a-Reader program. One librarian was able to take advantage of a difficult circumstance:

We were having construction done on the library while we were working on the building unit. The guys who were working on the construction came out and talked to the kids about what they were building.

Several others formed new relationships with specific day care programs or elementary school programs. Three librarians reported that no new relationships were formed.

Impact on Participating Children

Librarians and parents were asked to identify any impact on participating children that they noticed. All respondents were able to provide at least one example of impact. The librarians most often noticed that children were actively involved and asked more questions during sessions. Children also were more likely to discuss what they had learned the previous week when they came to the next session. Several librarians thought that the children were being better prepared to go to school. Examples of their reports included:

We did weather and brought in an old TV and took out the guts. The kids got behind the screen and did the weather reports. We gave them weather sticks. At the beginning, the kids would get inside and say that the weather's fine. But after the weather lesson in which (the librarian) gave the kids the weather sticks they could hold up with the symbols of all kinds of weather, the kids increased their use of different terms. Plus we were able to ask leading questions. Having props like that stimulates their thinking.

The day we did the lesson on clouds and talked about their shapes, the children came in the next week and told me about the shapes they had seen in the clouds. I think their powers of observation have gotten more finely tuned.

The thing I have noticed the most is that they are more willing to ask questions that don't have answers. I think kids today are so test-oriented, they think everything has an answer. So that's the best thing.

Children are more willing to try new things and are open to explore with the materials. They have developed new ideas about size.

Several coordinators also identified what they believed were impacts on participating children.

From everything I hear, kids are proudly announcing that they are scientists. I think people are afraid of math and science. This program is showing them that it is just everyday curiosity and investigation that anybody can do.

Kids get excited with the ideas of math and science. They see things differently. Story time is more concept oriented.

Children get to school with some of the basic science and math concepts. For example, knowing that $1+3$ is 4 and that $2+2$ is 4. You do that in school, but I think if we start explaining to them when they are young children that there are different ways to get to the same number . . . will increase their understanding of math and science and their willingness to do math and science.

The majority of parents and caregivers in the focus groups reported that their children talked about their experiences with the BIG Idea to other adults and children in the home. The children also were observed to have incorporated the concepts and topics that had been discussed into their play activities. Some children were said to have brought up concepts they learned in the past and to connect the concepts to what they had just learned. Below are some examples of parent or caregiver observations:

They always go home and tell their parents and older brother about the activities they did and parts of the stories.

If (the librarian) takes a particular topic, he will talk about it later. The next time we read a book about the topic, he will correlate that with what (the librarians) talked about and what he learned.

I have seen them asking more questions and have been noticing them counting and connecting patterns. The measuring was great. They made measuring sticks, and there are tons of those taped up around our house now.

Many parents believed that participation in the BIG Idea sessions helped their children become more interested in reading, mathematics, and/or science. Many parents also stated that

participation helped to reinforce what they have been teaching their children in the home. Typical responses to the question of impact on children included the following:

The science concepts are what he pays great attention to, he is always asking questions about why things happen

(My children have increased their) interest in reading. They start on a subject and they balloon out and want to read more about it.

I find that even though I might have been talking with him about the concepts, it's someone else telling him, and he sees other kids doing it. It's another person saying we can do this and you can have fun with this.

Impact on Participating Parents/Caregivers

Librarians mentioned two types of impacts from participation on the parents or caregivers: high numbers of parents checking out the family resource kits and increased numbers of parents checking out nonfiction books. A few librarians also noticed that parents were more likely to use the language of mathematics and science and/or to ask the children questions about shapes, sizes, colors, patterns, and changes they observed. Examples of impacts provided by the librarians included:

I think the parents are definitely checking out the family kits more and asking about the family kits. Parents like having things like that, things that are practical. They might not always make the connection, but having a family kit or the cards helps them to make connections.

Parents like the ideas and now, for example, expect me to use clipboards. They check out the family resource kits. I recorded 61 checkouts since September and usually all of the kits are checked out.

Parents are checking out more books in both the nonfiction and fiction areas, which I think is a wonderful bridge. So much of the literature for this age group is picture books. To be able to show parents and have them take out a nonfiction book on weather, insects, etc., I think is wonderful. Also, we have wooden puzzles in our library. I am seeing parents not just watch their children put the puzzles together, but talk with them about the color, the shapes of the puzzle pieces, and how many there are.

Parents and caregivers seem more involved. They talk to me about what we do and they want to do crafts with children. They are very supportive.

Coordinators also identified a few impacts on parents and caregivers.

Anecdotally I have heard that families like the program.

Parents do take the activity fliers home. In several libraries, there are parents or retired folks who have an interest in math and science that have become volunteers, some helping with sessions or doing sessions.

When parents and caregivers were asked whether there was anything they learned during the BIG Idea session that they would reinforce in their homes, most mentioned a specific skill such as counting, sorting, predicting, and sequencing. Most parents and caregivers stated that they already read to the children, but they make an effort to choose books that are related to the topics that were discussed. Below are some examples of what the parents or caregivers do to reinforce the concepts:

The collecting and sorting. Kids just naturally do that, and it hadn't dawned on me that you could use it for academics.

The reading part, whatever topics they introduce I try to get more books on the same theme.

Sustainability

All of the librarians who were interviewed said that they would continue to use the curriculum in the future. They believed that the activities were successful and well-received by the children and that the lessons added an important new dimension to children's story times. Factors that would influence the amount of time spent on these activities in the future were the extent to which librarians had time to plan the activities, the age appropriateness of the activities, and the availability of materials. Typical comments from the librarians about sustainability were:

I'll do it forever because the kids love it.

Nothing would keep me from implementing it. If I continue to run story hour, I will continue to try to make it educational.

In this section, results of an analysis of the draft BIG Idea materials developed during the past year is presented.

Quality of Instructional Design of BIG Idea Materials

The draft *What’s the BIG Idea?* materials and guides produced during the past year and distributed in the early spring of 2007 were analyzed using the Benchmarks for Effective Instructional Design developed by RMC Research in 1999. These benchmarks were derived from quality indicators found in the research literature.

The analysis showed that the materials and guides are well designed and meet the criteria listed in Exhibit 18. Evidence and areas of improvement are given for each category of criteria.

Exhibit 18. Quality of *What’s the BIG Idea?* Curricular Materials

Criteria	Evidence and Areas of Improvement
Audience	
<p>The course and objectives meet the needs of target audiences.</p> <p>The level of difficulty is appropriate for target learners.</p> <p>The expectations for learners’ performance are clear (e.g., practice activities, prior knowledge, use of knowledge).</p>	<p>Each section of the <i>What’s the BIG Idea?</i> librarian’s guide identifies math and science skills and concepts and each addresses the targeted audience of young children. The original librarian’s guide developed for the project included specific goals that were not included in this year’s guide. The guide and supporting materials provide clear explanations. The audience focus is on programs and resources for children aged 3-7 and their families. The suggestions for books, programs, and other resources target these learners; however, the many of activities in the librarian’s guide appear geared more for the upper end of that age level, or possibly even for somewhat older children. It is suggested that activities be revisited for age appropriateness.</p>
Objectives	
<p>Course/unit/lesson objectives are clear.</p> <p>Course/unit/lesson objectives are comprehensive.</p> <p>Objectives are described in achievable terms.</p> <p>Objectives address both content and skills.</p>	<p>Objectives for each of the BIG Idea chapters in the librarian’s guide are suggested in the boxed listings of math and science skills and concepts. Last year, the librarians’ guide included goal statements, which gave a more direct specification of objectives. The listing of math and science skills and concepts is comprehensive and indicates how early childhood standards for mathematics and science are practiced in <i>What’s the BIG Idea?</i> It is suggested to provide more specific objectives for each lesson.</p>

Criteria	Evidence and Areas of Improvement
<p>Content</p> <ul style="list-style-type: none"> Content is accurate. Content is organized clearly and logically. Content has consistent style, organization, detail level, and perspective. Content addresses real workplace issues and skills that motivate by showing value to learners. Content is sufficient to meet learning objectives. 	<p>The librarian’s guide and other resource materials are focused on important concepts in mathematics and science. They are well-organized and easy to understand, even for novice teachers of these content areas. The discussion about topics gives valuable knowledge and perspective both on the content and how children engage with that content. Probes and questions in activities provide for inquiry-based mathematics and science learning. Some misconceptions may arise, however, given the verbiage being used, especially since the acquisition of vocabulary is a goal. For example, in the description of a thermometer, instead of “red line” perhaps a more meaningful and appropriate term would be “red column” or “red bar.” In the Number and Operations investigations called <i>Is it the Same?</i> and <i>One is a Snail Number Sentences</i>, the use of symbol cards or = and + can lead to misunderstandings. If one thinks of the pattern as 1, 2, 4, 8 . . . , maybe 8 is missing from the picture with 1, 2, 4 and maybe 1 is missing from the picture with 2, 4, 8. Perhaps the picture would better convey the pattern and missing number if a space were left for the missing numeral card. The use of symbol cards for = and + can lead to misunderstandings in the Number and Operations investigations called “One is a Snail Number Sentences” and “Is it the Same?” The equal sign is a most important symbol in mathematics, and research indicates it is a very poorly understood symbol. Experiences as early as kindergarten often lead to these misunderstandings. Considering the addition symbol, a problem with operations sometimes referred to as “adding apples and oranges” is that quantities with different units do not combine by addition. Developers may wish to revisit these activities to add clarifications.</p>

Instructional Design

Course developers are qualified for design and content.

Course is prototyped during design (tested by learners and evaluated during the process).

Activities used are appropriate for learners, subject, and objectives.

A variety of instructional approaches are used (exposition, media, simulations, discussions, practice, etc.).

Lessons are balanced between explaining, applying knowledge, and evaluating.

Instruction is logically sequenced.

Sufficient conceptual information is provided before the skill/performance information.

Course elements are complementary to and enhance each other.

There are adequate opportunities for meaningful learner interactions.

The instruction is appealing, interesting, and motivating.

The design deliberately engages learners through inquiry, discussion, demonstration and feedback, and so forth.

Learners can ask/answer questions and share viewpoints.

Activities are responsive to the learning styles and needs of audiences.

Repetition is used to reinforce key material.

Provision is made for review/improvement of course purposes and activities.

Developers and advisors have considerable experience and expertise in the areas of mathematics, science, literacy, and early childhood education. Field testing of materials is taking place has occurred and is taking place in numerous diverse library sites. Activities in the librarian's guide are engaging and aligned with mathematics and science early childhood standards. The activities use a variety of age-appropriate and appealing materials. They are designed to engage children through active learning with stories, dramatics, questioning, discussion, demonstration, observation, exploration, and prediction. Drawing on direct physical and social experiences of children, they extend and elaborate the informal science and mathematics interests and abilities of young children. As mentioned earlier, many activities appear geared more for the upper end of the 3-7 age group or older. It is also not clear what adaptations, if any, are available for children with disabilities. It is suggested that some ideas be provided for activities for younger children.

Presentation

Packaging is professional and compact.
Paper layout is clear, well-organized, and visually appealing.
There are many graphics and pictures and they are appropriate for the audience and task.
Materials are viewable for long periods of time (colors are light and bright).
Grammar and spelling are correct and clear.
Vocabulary is clear and free of cryptic abbreviations and jargon.
Text is clearly written and easy to follow.
Materials are detailed enough, but not overly detailed.
There are multiple culturally relevant and sensitive examples.

Materials include a librarian's guide, parent kits, take-home activity cards on different topics, and other resources and manipulatives. Librarian kits are still being developed, so the librarian's guide referred to here is a working document. Overall, the presentation in the librarian's guide is well-organized and visually appealing with an appropriate amount of illustration, information, and white space on each page. Graphics and pictures relate well to the material and audience. There is useful boxed information such as: *Math and Science Skills and Concepts*; *What's needed*; *In Programs*; and *As a Discovery Center*. The use of boxed information is not consistent from section to section. For example, there is a *What's needed*: box for each suggested activity in the Weather and Seasons section, but this is not the case in other sections. Each chapter of the guide could benefit from a Vocabulary page similar to the one in the Numbers and Operation chapter. The selection of books mentioned in Weather and Seasons section seems to be missing ones on wind and clouds. The librarian's guide is clearly a working document and should be carefully edited as there are a number of corrections that need to be made. For example, the Numbers and Operation chapter seems to be split between part of it being at the beginning and most of it at the end of the guide; the wording is off in places (missing words); and there is not always consistency in titles (e.g., Programs is sometimes capitalized and sometimes not in the boxed information).

Respondents' suggestions for improvement are provided in this section.

Librarians' Suggestions for Improvement

Librarians were asked what suggestions, if any, they had for improvement. About a third of the respondents thought the program was fine and offered small suggestions for improvement. Others struggled with adapting materials to multiple age groups and recommended that the Vermont Center for the Book help them with this aspect of program implementation. A typical response was:

We have the Web site to talk to each other. We have super support. If I have a question, I can e-mail Wendy or Sally and get an immediate answer. We have a core group of 20 librarians in the state who are a support network. Also if we make a suggestion for a book they haven't thought of, they are positive about that. There is nothing I would improve.

A few offered specific recommendations for improvement. In their own words, suggestions from the librarians included the following, categorized for commonalities:

More suggestions for implementation were offered:

For people who are not trained in teaching, even more ideas for how to implement the program would be helpful. Even lesson plans would be helpful. I always end up going beyond the manual to go on the Internet and get more ideas for teaching.

Continue using fiction books, but make them a little easier to use with younger children. For example, use books with shorter and simpler sentences.

The materials and topics are excellent. Maybe providing more ideas of what to do with the topics. They provide so much information, but a few more activities would help. My challenge is that I have a wide range of ages, from 2 all the way up to 12. I am never sure what I am going to have to deal with. If there were more ideas for how to extend the activities, maybe more activities that meet the standards for 9, 10, and 11 year-olds.

While the BIG Idea has been designed for a preschool audience, having it adapted to a school-aged audience or a special needs audience has not been addressed. A lot of our manipulatives, for example, are not accessible to special needs children. Many objects could be bigger or bolder and some materials are too little for special needs children to pick up. It would be fun to see ways we could include a more diverse group.

Some of the skill levels are above the kids we get, and it would be good to learn how to adapt.

Improve the Family Resource Kits

Putting the kits in see-through containers would be good. I have trouble with storage, but that's not so much a BIG Ideas problem. . . . I could use help with organization of materials.

It would be nice in the kits if they had more instructions for parents. Also, the kits are big, so if they could include a couple of books and more manipulatives, that would be great. But mainly, parents need more ideas for what to do with the stuff in the kits.

Provide Additional Activities or Materials

Continue to add to the bibliographies.

As I think of the way we do story hours, maybe a stronger emphasis on verbal things. Maybe a flannel board, songs, some kind of dramatic activity so the kids can act out the story. Things like that versus the hands-on manipulatives. Maybe there could be a greater emphasis on dramatic play, finger plays, and songs.

We need better advertising materials like bookmarks. We could also use an information sheet to copy. The graphic does not work for me. It is not attractive or enticing to children or for their parents. Also, I'm not happy with the layout on the parent cards.

I could use more materials. Also the speaker who said not to bring in Disney Science I did not agree with. I think the pizzazz does have its place and gets children's interest.

The activities are good and the books are good, but I still think sometimes it seems they don't have an understanding that some of the activities will not work in a library environment. For example, if you have 30 kids, it's difficult to do some of the activities. That is why the integration in an important strategy for us—trying to figure out how to incorporate the activities into our normal activities.

Also, they could provide more ideas about how to organize centers. For example, recording the children's responses is something we want to do with each center. They could give more help with ideas on how children can record their responses.

Coordinators' Suggestions for Improvement

In their interviews, coordinators were also asked if they had suggestions for improvement. Their recommendations were:

Make it year round so that librarians can incorporate ideas into their summer reading programs.

I would like to see more bilingual resources, more activities in Spanish, or more books written by Latinos. I would especially like more parent resources in Spanish.

Maybe because it's a new program, it seems like things don't get developed as quickly as possible. But that's not a criticism. We understand it because we are a trial group. Everything they have done has been outstanding.

I would like a little more communication. For example, if I knew that progress reports were not being submitted, I would have done something about it. Maybe the coordinators could receive the progress reports. I would also like to see more consistency in the progress reports in terms of format, frequency, and regularity.

Additional Comments

Librarians and coordinators who were interviewed were asked if they had any other comments. Nearly all of the additional comments were positive, but a few had some negative reactions about specific aspects of the program. Their comments are presented here verbatim.

Don't promise us things that you can't deliver. For example, they promised us that we would have the parent kits by February. I told the parents they would be here, and they were disappointed. Don't give us the earliest date. Also, this is my problem, but I have a terrible time writing the reports. As a one-person library and there are lots of us, I just can't seem to find the time.

It's a great program and it fits my style.

I think they are amazing and I think they have done a great job.

I have been involved in quite a few programs and this is one of the better ones.

I am tickled pink that Delaware got to be a part of the project. Our discovery kits go out with great regularity. In the entire time we have had the kits, we have only lost one shoelace, so the parents are taking great care of them. Also, the program has made me think about objects we can add, not just with funds from the BIG Idea, but with our own funding. In the new library, I have asked that the area on my desk where I put displays be lowered to a level where even the youngest child can reach the manipulatives.

I think overall, this has had a huge impact. We do not have a materials budget and we have a \$200 program budget. The cumulative effect—you become really aware; it's been big. The family kits have been so great. That was a first for us—families have taken them home, teachers have also, so you are getting a lot of cross-over in terms of use.

I think it's great. I think they have done a great job. It has opened our ideas to things we haven't thought of. The conference last year was phenomenal and not only gave me a chance to learn about concepts I had forgotten. Plus there is a certain level of camaraderie that you get. We are working in these libraries in small towns and you feel like you are alone. So there's a sense of camaraderie that comes.

One thing I remember from what I did last year, I found that at the end, it was good to leave time for the children to explore the materials on their own. Last year, with the building unit, for example the kids took it on themselves to build a city on one of the tables.

Before we started BIG Idea, I had noticed that my programming had become kind of routine. I was doing different kinds of programs, but a lot of them were either holiday or literature-based. It didn't occur to me to incorporate science or math. I hadn't thought that the read-aloud aspects were compatible with science and math. But I found out quite the opposite. This program opened up whole new possibilities for me and that added a spark to what we are doing. The program will go on forever here.

Just that I think it's a spectacular program and I hope the funding continues. I just think it's really important for kids to get this kind of start. They are picking up all this information, and we are not pushing it down their throats. For example, we don't say, "We are going to teach you about the life cycle of a plant," but instead "Today we are going to learn about butterflies!" And they think it's fun and learn from it.

I don't know how I got so lucky to be chosen but it has made an enormous difference in our libraries and our system. We are willing to be guinea pigs anytime.

Conclusions and Recommendations

The Vermont Center for the Book has continued to make substantial progress toward meeting its goals. Nearly all of the librarians originally involved in the project have implemented many of the curricular approaches and activities they learned in professional development sessions. In addition, the project has scaled up, as librarians have shared their experiences and taught other librarians in their states how to implement the ideas and lessons from the *What's the BIG Idea?* guide.

Professional development this year focused on the implementation of science activities. Librarians were provided with information and had opportunities to practice and share ideas for implementing story hours for young children that addressed concepts, such as numbers and operations, building and construction, weather, and change over time. During the course of the year, librarians also received additional materials individually selected from lists of items related to lesson implementation, parent kits, and ongoing support from their state coordinators and from the staff at the Vermont Center for the Book. A Web site was maintained to provide bibliographies and other supplementary materials and ideas for participants and the group initiated an interactive forum at the Web Junction site.

This evaluation utilized multiple methods to collect data on implementation and impact. Results showed the following:

Professional Development

Librarians received most of the professional development during the Burlington meeting in December 2006. The librarians rated the professional development for implementation as being excellent in most areas. They reported that they found the information provided on science exploration and the opportunity to network as being most valuable. They also liked the tips and tools provided that helped them to improve their skills and knowledge. Most believed the professional development materials and approaches prepared them well for implementation, stating that the conference was well-paced, enjoyable, and useful. They particularly appreciated the expertise of the presenters and the materials provided to them. A few felt that they did not learn as many new ideas as they had in the past and some were concerned that the content being taught was too sophisticated for children in the age ranges they served. All of the respondents reported that the support offered by the Vermont Center for the Book was exceptional in its quality and responsiveness. Most respondents used the Web site for downloading bibliographies and ordering materials. Few used Web Junction and those that did access the site did not find it to be very valuable.

Quality of the New Materials

The draft materials were rated for quality using benchmarks for effective instructional design, and were found to be excellent in most areas. They were appropriate for the audience, well-organized and accurate in content, designed by experts, engaging, professional, and easy to

follow. Specific suggestions for improvement focused on presenting objectives consistently and adding ideas for children who were younger or older than the intended audience.

Implementation

All of the librarians reported using at least some of the materials provided by the Vermont Center for the Book. Most typically, librarians implemented the curriculum several times a month. Activities that were used most often included using words that described the location of objects, counting, and using comparative words. Activities used least often were making graphs and charts and designing and making things.

Observations revealed a wide range of fidelity to the curriculum. Some implemented all of the activities as presented in the guide, but most supplemented them with activities of their own. Most often, the supplements included songs or finger plays. Librarians tended to make the activities fun for the children, reading books with expression, providing encouragement, managing the session well, providing appropriate feedback, and using mathematics and science vocabulary. Librarians less often provided information to parents or caregivers about how to extend learning in the home or conducting hands-on activities with the more sophisticated science skills embedded within them. The lack of fidelity often meant that the lessons did not have the intended depth of experience.

Librarians occasionally addressed the mathematics and science standards for young children, but did not do so in a systematic way. When they did address standards, it was typically because they were following the curriculum. Few of the supplementary activities they added included standards, and several of the activities they did not use from a given lesson were the ones that addressed the most standards. Similar to results from the past, librarians explained two reasons for innovation: their own comfort levels with materials and preferences for other materials and the wide range of ages of the children being served in the sessions.

Parents and caregivers were uniformly positive in their perceptions of the sessions. They strongly agreed that their children enjoyed the activities and were highly engaged. Most of them helped their children with activities during the session and took home many of the books and activities that were demonstrated or used during the story hour session.

The parents, caregivers, and librarians also reported heavy use of the parent kits. The kits were said to be among the most popular items that the library loaned out and they were all returned intact. Additional kits were ordered in several sites, providing another testimony of their popularity.

Impacts

Surveys showed a statistically significant change over time in the use of mathematics and science activities by the participating librarians in 13 of the 15 areas measured. Largest differences over time were found for:

- Describing and combining shapes to make new shapes;

- Making graphs and charts;
- Talking about sequencing and patterning;
- Using comparative words;
- Describing how things grow and change over time;
- Reading science books and doing science activities;
- Reading mathematics books and doing mathematics activities.

The two areas where little change was reported were matching, sorting, naming, or describing objects, which was already high during baseline measures; and designing and making things, which was rated low for implementation and remained low over time.

Statistically significant differences were also found in librarians' self-reported comfort levels in working with young children in all areas related to mathematics and science. The greatest impact occurred during Year One of this project, and the impact was sustained over time. Similarly, librarians made more mathematics and science materials available to children and their families, and also provide more professional development in mathematics and science to other librarians. Differences over time for both of these areas were statistically significant during the first year and were sustained over time.

Librarians continued to report that they ordered and used more nonfiction books in their work. In addition, they often presented information about what they had learned to other librarians, Head Start programs, and other outside organizations, such as day care centers. Several also expanded the program into the summer, concentrating on more science activities.

Both librarians and parents/caregivers noted impacts on the participating children. These children were reported to talk about mathematics and science more often in the home, sharing what they learned during the session. Children also were observed asking more questions during sessions. Several reported that they felt children gained more skills and knowledge related to kindergarten readiness.

Librarians and coordinators also mentioned the impact on parents and caregivers, noting an increase in both the use of the parent kits and the number of nonfiction books that were checked out. Several parents reported that they were more likely to use mathematics and science vocabulary in the home and that they reinforced skills such as predicting, sorting, and sequencing.

Sustainability

All of the participants reported that they were likely to sustain the BIG Idea sessions over time. They liked the programming and materials, noted the positive reaction of the participants, and felt that the value of the programming was high. Factors that could influence the implementation of the program included the amount of planning time needed, the age appropriateness of the activities, and the availability of the materials.

Recommendations for Improvement

Overall, the project is exceptionally well-organized and well-received. Most of the recommendations for improvement that came from the librarians revealed the value of the program in that they wanted more materials, more activities, and more family resource kits. Some specific areas where improvement may be made are the following:

- **Provide information within the curriculum for ways to vary program delivery depending upon the age of those children in the sessions.** This remains the largest implementation challenge for librarians. Most of the librarians serve children from aged 2-5 in their story-hour sessions. It would be helpful to provide information on how to tailor the materials to be appropriate for children at different developmental stages, especially since some of the ways that the librarians are currently doing so results in diminishing the depth of the information or decreasing the likelihood that standards are being addressed.
- **Explicitly discuss implementation of specific activities and implementation quality during professional development or support sessions.** Librarians reported being comfortable and confident in their ability to offer the activities during their story hours, but observations revealed significant variation in implementation quality. Hold discussions either in the professional development sessions or on Web Junction about common implementation challenges and what to do to address them. Gently nudge the librarians to address standards more often and to use the vocabulary and inquiry strategies. Help them to see the importance of adding depth to their sessions.
- **Provide more opportunities for librarians to share implementation practices.** Librarians liked the professional development sessions and the opportunities to network, but they particularly wanted more time to share practices with each other. However, since the sharing session last year was not always on target for implementing mathematics and science activities, it may be useful to have a structured sharing session around mathematics and science, asking librarians to share specific ways to address standards rather than for enhancements in general.
- **Provide more bilingual resources and ideas for other special populations.** Librarians, particularly those in Houston, would be very appreciative if parent kits and other materials were provided in Spanish so that they were more accessible to the audiences they serve. In addition, materials that could be more easily used by children with disabilities were desired.
- **Give librarians information and materials to give to parents on the ways they can reinforce learning in the home.** The children were reported by respondents to be excited about what they learned, discussing activities in the home. Help parents or caregivers to extend this learning by giving librarians specific ideas or materials to give to the parents or caregivers.
- **Add information to the family resource kits to help parents with their use.** A few librarians mentioned that they thought the kits were terrific, but that the parents did not

always know how to use them. Since there is a lot of room in the boxes, additional information could be added.

- **Develop training-of-trainers materials.** Many of the librarians either have or would like to provide training for others in their states. Help them by providing high quality training-of-trainers materials to ensure that they are focusing on the important parts of the curriculum and the rationale for the activities provided.