JASON MULTIMEDIA SCIENCE CURRICULUM'S IMPACT ON STUDENT LEARNING

FINAL EVALUATION REPORT
YEAR THREE

CENTER FOR CHILDREN & TECHNOLOGY

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PREPARED BY
LAUREN B. GOLDENBERG, PH.D.
HAROUNA BA
JULIETTE (CRICKET) HEINZE
ANDREW HESS, PH.D.

SUBMITTED TO
U.S. DEPARTMENT OF EDUCATION,
STAR SCHOOLS PROJECT
AND
THE JASON FOUNDATION FOR EDUCATION

CENTER FOR CHILDREN & TECHNOLOGY
EDUCATION DEVELOPMENT CENTER, INC. 96 Morton Street, 7th floor New York New York 10014 *tel* 212] 807.4200 *fax* 212] 633.8804 *tty* 212] 807.4284 *web* www.edc.org/CCT

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ATTN: REPRINTS
Center for Children and Technology
96 Morton Street, 7th Floor
New York, NY 10017

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cct_reprints@edc.org

EXECUTIVE SUMMARY

This report presents the evaluation findings for Year Three of EDC's Center for Children and Technology's multi-year evaluation of the JASON Multimedia Science Curriculum (JMSC) for the U.S. Department of Education Star Schools Project.

The focus of this year's evaluation was on the impact of the JMSC on diverse student populations, namely, upper elementary and middle school students labeled special needs, at-risk, and gifted and talented, as well as those in heterogeneous mainstream classrooms. The schools and student populations were diverse in terms of geographic location, socio-economic status, linguistic background, race, and ethnicity, and included one school on an Indian reservation, one where 75% of the students came from Spanish-speaking homes, and one on a military base. Researchers conducted interviews, observations, surveys, and assessments at the nine school sites around the country, in a study that involved 12 teachers and over 600 students.

Researchers found that six main themes emerged:

- JMSC influenced students' perceptions of scientists, doing science, and being scientists.
- Hands-on activities from the print curriculum supported student engagement and motivation, helping students be able to grasp complex scientific ideas by making them concrete.
- Multidisciplinary components of the JMSC provided coherence in students' learning through capturing their interest and providing opportunities for collaboration.
- Students appreciated the variety of experiences and access to knowledge that the multimedia components (videos, Live Broadcast, digital labs, Internet research, and other online activities) provided them; students claimed the affordances of multimedia helped them learn better.
- Students with varying literacy levels were able to access complex scientific concepts.
- JMSC use resulted in an understanding of key JASON XIV scientific content, concepts, and technologies.

The evaluation shows that the JASON Project, comprised of an interdisciplinary, multimedia science curriculum, not only engaged diverse students in science learning in ways that students themselves found more powerful than the typical science classroom, but also taught students 21st century skills. Most importantly, the curriculum broadened students' perspectives about what constitutes scientific experimentation and exploration, what real scientists are like, and the value of learning science in their own lives. These aspects of learning science in the upper elementary and middle grades are important, and supply a critical link between diverse groups of students and the field of science.

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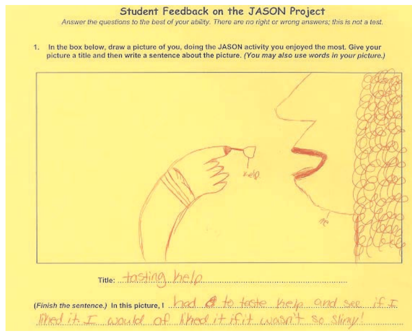


"Tasting Kelp:" I had to taste kelp and see if I liked it. I would have liked it if it wasn't so slimy!
[Grade 7, Cedar Creek]

INTRODUCTION

Walk into Gail Sanderlin's[1] seventh grade science classroom and you won't find students sitting quietly at their desks. Instead, small groups of students are spread over the entire classroom, where strands of green crepe paper hang from the ceiling to simulate an underwater kelp forest. A group of three students stands at the teacher's desk, making faces while tasting an actual piece of kelp. A pair leans over microscopes set up on a countertop, peering at slides of kelp. A group of four fills a plastic jug with water, preparing to conduct an experiment to test which is stronger, a kelp blade or a leaf from a spider plant. Five students crowd around a table, flipping through books about animals that live in kelp forests. Two more sit at computers in the front of the classroom, searching the web to gather information for a project on what Ms. Sanderlin has called "kelp critters." The remaining students sit at desks around the room, writing in hand-made journals about their findings. Whether doing an experiment, collecting data, researching, reading, or writing, each student in Ms. Sanderlin's class is engaged in interdisciplinary science learning about kelp and kelp forests, one of the topics from JASON XIV: From Shore to Sea.

EDC's Center for Children and Technology (CCT) is in the third year of a multi-year study of JASON Multimedia Science Curriculum (JMSC) and its impact on students and teachers. This report documents findings of JMSC's impact on four distinct student populations: (1) students labeled "at risk," (2) students labeled "gifted and talented," (3) students in heterogeneous mainstream classrooms, and (4) students who receive special education services. The report examines the themes common across the nine school sites that participated in the evaluation, paying special attention to how the diverse student populations responded to the various curricula components and pedagogical techniques that are part of the JMSC, as well as to how these students, such as those taught by Ms. Sanderlin, learned science.

[1] A pseudonym. All names and identifying details have been masked to ensure participants' confidentiality and privacy.

Research questions

The following research questions guided this year's evaluation program:

1) Does participating in the project improve students' knowledge of science content?

2) Does participating in the project improve students' knowledge of scientific processes?

3) How students feel about learning science as a result of participating in this project?

To answer these research questions, CCT researchers looked at how JASON-using students view scientists and their work; relate to studying science in general; and respond to and experience the JASON curriculum. CCT also examined the contextual variations that can be found in JMSC use with different student populations. Researchers asked students from nine sites spread across the country to participate in a paper-based activity that assessed their knowledge of JASON XIV content, concepts, and scientific technologies; and to complete a survey that asked them, among other things, to draw themselves doing the JASON activity they enjoyed most. In addition to working with students at these nine sites, the researchers interviewed teachers, and administrators, and observed their classes and field trips.

Our third year of research was guided by questions that followed the findings from the previous year's evaluation, which focused on JASON teachers. In a series of focus group interviews, teachers discussed the impact of the JMSC on students in terms of the ways it benefited students. Specifically, they said the JMSC:

- Improved their students' learning and performance; helped students understand and retain the material.
- Excited them, promoted teamwork among them, as well as helped them with reading, writing, and answering questions.
- Reduced their fear of confronting challenges or ambiguity in classroom activities, and helped them focus on their work.
- Increased students' awareness of the world around them and of everyday science in that world. (Ba, Goldenberg, & Anderson, 2002).

We undertook this evaluation to try to verify, in a systematic and rigorous manner, teachers' claims.

About the JASON Project

The JASON Multimedia Science Curriculum (JMSC), also known as the JASON Project, is developed by the JASON Foundation for Education and currently serves approximately 25,000 teachers and one million students, the majority of whom are in grades four through nine. A multimedia, interdisciplinary, inquiry-based curriculum, JMSC both aligns to state science, math, language arts, geography and educational technology standards, as well as provides a framework through which students can explore real life science. Each year the JMSC selects a unique research expedition site and uses a print curriculum, video, live satellite broadcasts, and a variety of online activities including digital labs and electronic journals to enable students to interact with real scientists and experts as they explore scientific content and concepts.

This year, the JASON XIV expedition, titled From Shore to Sea, focused on the Channel Islands region off the coast of California. The curriculum's "big questions" were: What makes the Channel Islands region unique? How has this region changed over time? How do you measure these changes? How do you distinguish natural change from change caused by humans? Why is it important to have national parks and national marine sanctuaries? The six units or "stories" of the curriculum each begin with a research article on one of the following topics:

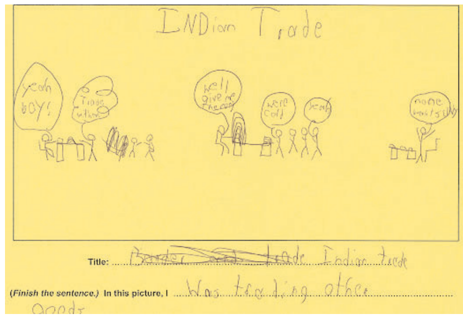
- Geology and Geography
- Channel Islands Culture: Past and Present
- Coastal Ecosystems: Land, Water, and Sea
- Kelp Forest Ecosystems: Monitoring and Management
- Pinnipeds: Monitoring and Management
- Conserving Our Natural Resources: A Balancing Act

Each unit contained a variety of hands-on exercises designed to mirror researchers' work in the field or lab; video segments to reinforce learning by helping students recall and visually organize information; and Team JASON Online activities, which included simulations known as "digital labs" as well as online student journals to enable students to complete digital journals to share with their teachers. The Live Expedition Telepresence is a live broadcast that, in the hopes of the curriculum developers, helps "students become a part of the research team, experience the expedition firsthand, and relate their work to that of the researchers" (JASON Project, 2002, p. TG3).

Unlike "regular science," the JASON Project's Multimedia Science curriculum offers multiple ways for teachers to teach and for students to engage with the subject matter. Instead of every student having a textbook like in most "regular science" classrooms, the JASON Project supplies teachers with a print curriculum from which they can copy pages of readings or activities for their students. In almost every classroom that we observed, the teachers either required the students to maintain organized binders that held all of the JASON materials that were handed out to them, or the teachers provided the students with folders of photocopied pages from the curriculum. In addition, the JASON print curriculum is structured differently than how most textbooks are structured. The six research "stories" or units comprise the print curriculum. Within each story, students conduct hands-on activities, use various multimedia components, online activities such as digital labs, electronic journals, and chat rooms, and learn through multidisciplinary curricular components, which include language arts, math, geography, history, technology, and art. All of these activities are focused around the science content.

How this report is organized

This report is organized as follows: First, we describe the evaluation design and research methodologies. Second, we introduce the nine school sites. Third, we present the major findings, which are essentially the themes common across the sites, organized into two sections, one on student impact and one on teacher impact. Next, we discuss the findings in the context of current research on learning in general and science education in particular. Finally, we end with conclusions and recommendations.



"Indian Trade:" I was trading other goods.
[Grade 7, Hope Middle School]

EVALUATION DESIGN AND RESEARCH METHODOLOGY

The study, conducted during the 2002-2003 school year, is part of a larger, multi-year evaluation research project required from the JASON Foundation by the U.S. Department of Education. It examines the impact of the JASON Project on students' knowledge of science content and process, and students' attitudes about science.

To document and measure the perceptions and understanding of science content and process from students in diverse classrooms in the context of a multimedia science curriculum requires (1) using multiple qualitative methodologies: interviews, observations, surveys, and student activities; and (2) working closely with students, teachers and school administrators. Through grounded assessment tools such as these, students in this evaluation were given the opportunity to demonstrate their understanding of science concepts and processes that move beyond the recall of facts. It also allowed us to use students' experiences of the JMSC as a demonstration of their skills and knowledge to yield reliable and relevant information on JASON student science learning (Honey et al., 1996; Hawkins et al., 1993; Rudner & Boston, 1994).

Building on the above rationale and following up on the research completed during the previous two years[2], approximately 608 students in a total of 30 upper elementary and middle school classes, served by twelve different teachers working in nine school sites, participated in this year's evaluation. The schools and student populations were diverse in terms of geographic location, socio-economic status, linguistic background, race, and ethnicity, and included one school on an Indian reservation, one where 75% of the students came from Spanish-speaking homes, and one on a military base.

[2] See Ba, Martin, & Diaz (2001); Martin, Ba, & Diaz (2001); Ba, Admon, & Anderson (2002); Ba, Goldenberg, & Anderson (2002).

Evaluation design

For this evaluation, we used a multiple-case, embedded study design (Yin, 2003). The main unit of analysis was the use of JASON Multimedia Science Curriculum (JMSC). The embedded cases were the nine participating teachers' classrooms. A case study strategy is appropriate when the context is thought to exert an important influence on the phenomenon, especially when the boundaries between phenomenon and context are unclear. Because it is not easy to separate teachers' implementation of the JASON curriculum from the curriculum itself, nor teachers from their school contexts and student populations, case study research methods are an appropriate choice for this study. Using a case study methodology in this way, we were able to understand the contexts in which the teachers taught while focusing on the impact of the curriculum on different types of students.

Site selection and participants

Teachers and students in nine distinct school sites participated in this year's evaluation, two to three in each of the following targeted groups: (1) students labeled "at risk"; (2) students labeled "gifted and talented"; (3) students receiving special education services; and (4) students in mainstream classrooms. Below, we explain the selection criteria and give background information on the participants.

Last year, in Year Two of the evaluation, a total of 23 educators participated in a series of five focus groups conducted in June 2003 at JASON's National Educators' Conference in Milwaukee. CCT targeted teachers of the student populations listed above as well as homeschool educators. Teachers were assigned to one of these categories based on their responses to a large-scale survey earlier in the year.

In the current evaluation, Year Three, we followed up with teachers from the focus groups. This year's evaluation focus was on the impact of the JASON curriculum on various kinds of public school students. In selecting teachers for follow-up, we followed two main criteria: (a) teachers of grades 5 through 8, who (b) taught in public schools. We then contacted the teachers to make sure they were using the JASON Multimedia Science Curriculum. This resulted in the selection of the nine sites described in Table 1.

CCT researchers followed their institutional review board's procedures for obtaining informed consent for all participating adults and students. In order to be interviewed or to participate in a focus group, students needed a consent form signed by a parent or guardian. Teachers and administrators who were interviewed also signed a consent form.

TABLE 1: PARTICIPATING SITES, 2002-2003 EVALUATION

School[3]	Teacher(s)	Category	Grade(s)	Subject(s)	No. classes	No. students
Brightway Elem.	Helen Tyner	At-risk	5	Science	6	160
Pine Mountain School	Julie Elliott Sarah Morton Susan Frank	At-risk	4-5 6-7 8	All (at-risk)	3	33
John Glenn Elem.	Carol Calloway	Gifted/ Talented	4-6	Gifted/ Talented	1	11
Hunter Hill M.S.	Robert Mercer	Gifted/ Talented	6	Gifted/ Talented	2	38
Hope M.S.	Linda Smith	Mainstream	7	Science	5	104
Sugar Grove M.S.	Sarah Terowsky	Mainstream	7	Science	4	100
Cedar Creek M.S.	Gail Sanderlin	Mainstream	7	Science	6	120
Monroe M.S.	Elise Maple [Rhonda Charles, ESL teacher; Ann Bass, JASON coordinator]	Special ed. [ESL]	6 6-8	All ESL	1 [1]	13 16
Liberty M.S.	Pam Cartwright	Special ed.	6-8	All	1	13
9 school sites	12 teachers				30 classes	608 students

Data collection and analysis

For this evaluation, we collected five main types of data. Interviews comprise our first main type of data. We conducted focus group and individual interviews with students, during which we asked students their thoughts about learning science, their perceptions of scientists and what scientists do, and their opinions about the JASON curriculum. We also interviewed teachers and administrators, asking them about JMSC implementation and its role in the school. Second, we observed classes using JMSC materials. Interview and observation data were collected during site visits to the nine participating schools. Third, a Teacher Use Survey collected data about the specific activities teachers used from the JASON XIV print and multimedia curriculum, modifications to the curricular materials they made, and supplementary activities they created or used. Fourth, we developed a student survey that asked students to draw a picture of themselves doing the JASON activity they enjoyed most, title the picture, and complete the phrase, “In this picture, I …”. Finally, we administered a student activity that focused on JASON XIV science concepts and content. Secondary data sources included artifacts such as student work, teacher handouts, and school-related documents. Details about our data collection and analysis procedures may be found below.

[3] Pseudonyms are used. All names and identifying details have been masked to ensure participants’ confidentiality and privacy.

Site Visits

Site visits were conducted one to two times at each of the selected sites. The first site visits were scheduled once the teacher began using the JASON curriculum. During these visits, CCT researchers conducted focus group interviews with students; interviewed teachers and administrators; and observed one or more JASON lessons. At four sites, we conducted a second site visit in which we interviewed students individually.

Interviews. Interviews of both students and teachers constituted a key element of this study. The interview as a research tool or method is especially appropriate for understanding the meaning people give to their experiences (Seidman, 1998). The interviews helped us understand science education and technology use from the point of view of the students. Ninety-three students in grades four through seven participated in our focus group interviews across the nine sites (44 girls, 49 boys). Second interviews with 34 (10 girls and 24 boys) individual students were conducted at four sites. Twelve teachers and eleven administrators participated in interviews.

Observations. Classroom observations added to our knowledge about how the JMSC was being implemented and experienced by students. It also contributed to our ability to triangulate the interview data. We observed a minimum of one JASON-related lesson at each site. Whenever possible, we observed more than one lesson. For example, in some sites we were able to see an experiment plus a computer lab activity or multidisciplinary activity. In addition, we attended the Live Broadcast with two of the sites. Researchers wrote extensive field notes on all observations.

Teacher Use Survey. In order to accurately identify JMSC use during the 2002-2003 school year, teachers completed a Teacher Use Survey describing the specific components of the JMSC print curriculum, multimedia components, multidisciplinary activities, and any additional resources used.

Analysis. Data were collected in field logs for each site that included: (a) interview and focus group transcripts; (b) observations and field notes; (c) Teacher Use Survey; and (d) school and class-related documents. A field log for the overall project contained analytic memos and other data analysis products. Qualitative data analysis was used to analyze the field log. Our early writing included analytic memos as well as margin notes in the field log. These writings formed the core of our initial analysis and allowed us to follow up on any leads or questions generated during the data collection process. We followed Yin's (2003) suggestion that analysis first occur in the embedded units (the nine school sites) and then across these sub-units in the main case (JASON use). We utilized traditional methods of qualitative data analysis (Bogdan & Biklen,1992); we coded the data and looked for patterns. We utilized several strategies to accomplish this: typologizing, matrix-making, concept charting, and flow charting. At that point, we looked across the embedded units of analysis and wrote a series of conceptual memos to organize the themes.

Student Visual Feedback Survey

Participating students completed a survey that asked their opinions about the JASON Project. We developed a short, one-page, two-part survey that would be accessible to all students, regardless of literacy level (see Appendix A). Inspired by Russell (1999), the first part asked students to draw a picture of themselves doing the JASON activity that they enjoyed participating in the most. We also asked students to title the picture and to complete the phrase, "In this picture, I ...". The second part asked students if they would like to participate in the JASON Project again the next year, and then explain why or why not.

Student surveys were administered by 10 of the 12 participating teachers. A total of 506 students in 27 classes completed the survey. One teacher "forgot" to administer the survey, while the other claimed the students found the task "too babyish." After the first survey administration to three classes at Pine Mountain School, the survey was revised to have students write a title and brief description of their drawing.

Researchers coded the student drawings along two main dimensions: type of activity drawn, and presence of other people besides the student in the drawing. First, the drawings were coded for (a) the specific type of JASON hands-on activity, (b) information presentation or sharing activity, (c) the specific medium depicted, or (d) specific outside-of-class experience (see Table 2). Drawings were generally coded for only one sub-category but in rare instances some drawings received two codes. For example, if a student showed themselves at the Live Broadcast at the local science center, the drawing received two codes: Live Broadcast and field trip. Second, we coded the pictures according to whether students depicted themselves working on their own, with other students, or with scientists or as scientists themselves. These coding categories were arrived at by reviewing selected surveys from three classes taught by three different teachers, noting the picture contents, compiling a list, and then sorting and categorizing the list contents into the four categories described above.

In addition, we noted whether students indicated that they wanted to do JASON again next year by coding for each "yes" or "no" answer. Because many students, in explaining why they did or did not want to do the project the following year, said that it was "fun," "boring," or "too much work," we coded for these specific answers as well. All survey results were entered into a spreadsheet.

Student Content Activity

The student content activity was designed to assess students' understanding of the key scientific content, concepts, and technologies presented in JASON XIV. In consultation with JASON staff, CCT designed instruments to elicit students' knowledge about: (a) devising research questions; (b) roles of measuring and monitoring; (c) content knowledge about kelp forests, pinnipeds, or plate tectonics; and (d) knowledge about scientific technologies (e.g., the remote-operated vehicle) and how they contribute to helping scientists answer research questions; and understanding of the limits of any one technology, including the need to use multiple technologies to gain more detailed information.

TABLE 2: CODING CATEGORIES FOR STUDENT VISUAL FEEDBACK SURVEY

CATEGORY	CODE	CATEGORY	CODE
Specific activity	Eyes on Ecosystem (estimation, measuring)	Outside class	Swimming/scuba diving
	Kelp Stress Test		Measuring/monitoring
	Blubber Mitts		Digging/exploring
	Pinniped Diving Dynamics		Being at the Channel Islands
	Upwelling Simulation		Going on a field trip
	Eating Kelp		Participating in JASON carnival or fair
	Chumash Crafts or "Trading For Life" bartering simulation	Other	Other
	Tectonic Plates	ROLE	Student on own
Information presentation, sharing, creation	Making a mural		Student with group
	Making a map		Student as/with a scientist
	Making a poster	YES	Yes, "fun"
	Drawing or coloring		Yes, "no homework"
	Doing a presentation		Yes, other
Use of media	Digital lab	NO	No, "boring"
	Writing on the computer		No, "too much work"
	Researching on the Internet		No, other
	Watching JASON video		
	Watching Live Broadcast		
	Reading JASON novels		

In order that the instruments matched the content and concepts that students encountered in class, three activities were developed, each focusing on different content areas—kelp forests, pinnipeds, and plate tectonics (see Appendix A). Each activity was based on a real-life case. The activities placed the student in the role of a scientist about to embark on a research expedition and included four sections: (1) **presentation:** general information about the problem and the research question; (2) **brainstorming:** students generated questions they have about the problem (kelp and pinniped activities only); (3) **planning:** students selected tools to bring on the expedition and explained how they planned to use them along with what they hoped to learn from the tools; and (4) **content knowledge:** students were asked to write what they already knew about the content area. The activities were piloted to evaluate the overall clarity of the layout and the task, the amount of time students needed to complete the activity, and level of difficulty.

Once teachers selected an activity to administer to their class(es), we sent them a packet that included the activities and directions for administration. Teachers administered the activities during the month of April, at a time that was convenient for them in terms of their school calendar. A comment sheet was provided for teachers to note details about how the activity was administered. A total of 29 classes completed the activities described in Table 3.

TABLE 3: STUDENT CONTENT ACTIVITY ADMINISTRATION SUMMARY		
ACTIVITY TOPIC	**NO. OF GROUPS**	**NO. OF STUDENTS**
Plate tectonics: “Geologic Research Expedition	8	185
Pinnipeds: “Operation SOS - Save Our Seals”	8	131
Kelp: “Kelp Forest Research Expedition”	14	205
Combination kelp and pinniped	1	39
TOTAL	31[4]	560

CCT used the student activities for data describing the scientific content and conceptual understandings students derived from the JASON experience. The activities were scored according to the categories of form (how complete was the activity), content, technology use, and scientific process. A category was scored 0 if it was absent from the student’s work or 1 if it was present. The scores were used to evaluate how students in a particular class understood JASON content and concepts.

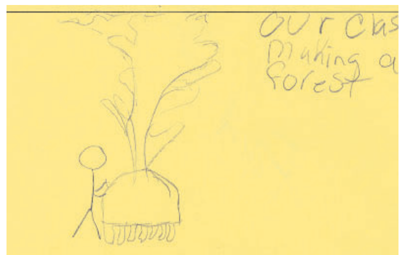
Each class set of activities was read by one of two coders. The coders normed their scoring by reading student samples and discussing the range of student responses for each category. Benchmark student work in each category was selected and a scoring guideline was produced. In addition, coders made qualitative observations about the class set and noted samples of student writing that represented characteristic student answers for that class. Teacher comments were also recorded.

Limitations and challenges

This evaluation design, like all designs, has its limitations. Since the study focused on specific groups of students and teachers, there is no guarantee that their views or experiences are typical. Therefore, causality cannot be established. However, multiple-case studies provide some measure of what Yin (2003) calls “replication logic” (p. 47). This term, used in a similar sense to experimental studies, refers to seeking similar results across multiple cases, or for results that contrast but for predictable reasons.

The challenges faced in conducting this research are common to all who conduct evaluation research in collaboration with schools. First, there was wide variation in JMSC implementation in schools and, therefore, scheduling visits to coincide with the beginning and end of JASON use was a challenge. Second, our instruments – specifically, the Student Content Activity and the Student Visual Feedback Survey – needed to be accessible to students with a wide range of reading and writing abilities who spanned four grade levels. In order to be responsive to the needs of all students in our sample, we designed the instruments with this in mind.

[4] This number does not equal the number of classes due to logistical issues in administering the activities.



"Our Class Making a Kelp Forest"
[Grade 4-5, Pine Mountain]

INTRODUCTION TO CASES

In this section, we briefly introduce the nine school sites that participated in this year's evaluation. We describe the school context along with an overview of JMSC use, and include the commonalities that we noticed across the cases in the same category.

Students in self-contained special education classes

Two cases, **Liberty Middle School** (Pennsylvania) and **Monroe Middle School** (California), focus on how students with special needs experience the JASON Project. Liberty Middle School, which serves a generally affluent student population in southern California, is considered high performing, while Monroe Middle School, attended by students from mostly working class and immigrant families in eastern Pennsylvania, is labeled low performing. In both cases, the special needs students, grades sixth through eighth, are in relatively small (13 to 15 students) self-contained special education classrooms where they receive instruction in core academic subjects. The only exceptions are those students who, depending on their reading and math levels, attend mainstream classrooms to receive instruction in language arts or math. In each case, the teachers, one in her third year of using the JMSC and the other in her first, use the curriculum to varying degrees for several months during the winter to teach scientific content and concepts while reinforcing reading skills.

In both cases, the teachers said that the aspect of the JMSC that had the most positive impact on student learning is the integration of literacy instruction into the curriculum's content. The teachers believed that the inclusion into the curriculum of language arts activities is essential in supporting the development and improvement of students' literacy skills, one of their primary goals. Still, the two teachers admitted that teaching science remained a challenge, as they had neither the training nor the facilities to conduct experiments or set up labs in which the students could participate. Nonetheless, they said that the JMSC ameliorated the process of teaching and learning science by providing hands-on activities and visual aids.

Students labeled "at risk"

The label "at-risk" was applied to students in two participating schools: **Pine Mountain School** (Montana) and **Brightway Elementary School** (Arizona). Pine Mountain School, a PreK through Grade 8 school located on an Indian reservation in the Great Plains region, used JASON in a whole-school manner. All children received exposure to aspects of the JASON curriculum; our research focused on students in grade four through eight. At Brightway Elementary School, the fifth grade science teacher was the only one using JASON. She used JASON throughout the year, supplementing the JMSC with Foss Kit activities and science textbooks. Located in an urban area in the Southwest, approximately 50% of the students at Brightway are labeled as English Language Learners, although the principal and teacher estimate that over 95% of the total student population come from homes where English is not the dominant language.

Three major findings were common to both settings. First, the JMSC "opens up the world" for these students, whether it is through exposure to different cultures, different people, or even different climates, as JASON XIII: Frozen Worlds did for the Brightway students. Second, the hands-on activities in the JMSC print curriculum component, as well as the multimedia components such as digital labs and the videos, help these students learn and remember complex scientific concepts. Finally, the JMSC exposes students to the language of science. Since their reading abilities are, for the most part, below grade level, building up their knowledge of scientific vocabulary is important if they are to have any chance of academic success in the upper grades.

Students in mainstream middle school science classes

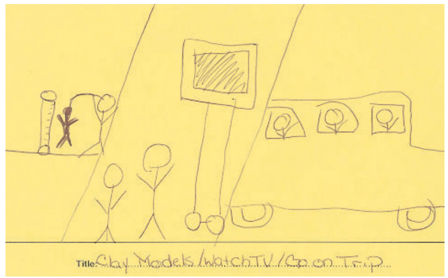
Three cases– **Sugar Grove Middle School** (Wisconsin), **Hope Middle School** (Georgia), and Cedar **Creek Middle School** (Wisconsin) – focus on students who are in mainstream, heterogeneous middle school science classes. Sugar Grove M.S. and Cedar Creek M.S. closely resemble one another because both are not only located in Wisconsin but also considered high performing, and have students populations that are 98% White. Hope Middle School, on the other hand, is unique in that it is a Department of Defense school situated on a military base, and, therefore, deals with a 40 % student mobility rate. In each of the 15 classes across the three schools, students were grouped heterogeneously to include those students with special needs, those labeled gifted and talented, and those considered to be "at-risk." All received science instruction from their designated seventh grade science teacher once a day for approximately a 40-minute period. At Sugar Grove and Cedar Creek, the teachers, both experienced users of the JMSC, teach the curriculum intensely for a few months in the winter, while at Hope, the teacher is newer to JASON and uses it throughout the school year.

Across the three cases, according to students, teachers, and administrators, the multidisciplinary aspect of the JMSC had a positive impact on student learning. Students reported enjoying the collaboration that they witnessed between teachers and that occurred among themselves as a result of JMSC's multidisciplinary character. In addition, students identified the many hands-on activities and the project-based aspect of the JMSC as supports that made learning "easier." The teachers stated that they valued being able to "relate everything to one thing" because "it makes sense to the kids. Administrators appreciated how the JMSC integrated all of the different disciplines, encouraging teachers to work together and helping students realize how science fits into a "bigger picture."

Students labeled "gifted and talented"

Classes of students labeled "gifted and talented" at two schools, **John Glenn Elementary** (Florida) and **Hunter Hill Middle School** (New York), participated in the study. At John Glenn Elementary School, the multidisciplinary and multimedia aspects of JMSC are used throughout the year as one of the gifted and talented program's core curricula. Students from grades 3 through 6 are "pulled out" from their regular classes one day a week for the entire day. They meet in a "portable" classroom used only for that purpose, where JASON-related items fill the bulletin boards. The 10 students can spread out throughout the room or even work on the floor, as they did while creating bathymetric maps out of foam and cardboard. Their teacher, Carol Calloway, is also the school's technology coordinator and so they use the school's multimedia computer lab frequently. At Hunter Hill Middle School, the sixth grade gifted and talented classes have two to three 44-minute periods of "enrichment." There, JMSC's interdisciplinary and multimedia components are also used, but the focus is on science and the curriculum is used intensively for 15 weeks. There are approximately 20 students in each of the two classes. The gifted and talented classes at Hunter Hill take place in a humanities teacher's classroom. Time must be allotted at the end of the 45-minute period for cleaning up and returning the desks to rows. The teacher, Robert Mercer, brings in all supplies, including water; there is no sink in the room. The two gifted and talented programs, at John Glenn and Hunter Hill, are set up quite differently, affecting the way the JMSC is implemented in each of the settings.

At both schools, students were able to clearly articulate how JASON Project activities differ from their regular science classes in terms of how they engage with the curricula. For example, when Hunter Hill students were asked to explain why they said learning science with JASON was "more enjoyable," they replied, "We get more facts than a regular science class," and there is "less reading and more hands-on experiments." Further elaborating, students said they remember more by doing things rather than reading about them. Similarly, several John Glenn students noted that in their regular science class, "it's just reading from the textbook." In addition, they said, "we don't really discuss what we are learning in the science book." Because the JMSC is used for enrichment purposes, these two teachers have a lot of flexibility in how they use the curriculum. This poses a challenge in terms of assessment and motivation; since the gifted and talented classes are enrichment, students do not receive a grade. For the most part, however, students are engaged and challenged by the JMSC activities.



"Clay Models/Watch TV/Go on Trip"
[Grade 6, Hunter Hill]

STUDENT IMPACT FINDINGS

This year, the JASON Multimedia Science Curriculum evaluation focused on the curriculum's impact on diverse groups of students. Through conversations with students and their teachers, a student survey, and the content-based student activity, as well as classroom observations and administrator interviews, we found that the JMSC had a positive impact on students in a variety of ways. Despite varying school contexts, different levels of curriculum implementation, and diverse student populations, we saw remarkable similarities emerge across the multiple school sites, in terms of students' perspectives on learning science, experiences with the JASON curriculum, and perceptions of scientists and of doing science. In addition, from talking with teachers and students, observing lessons, and analyzing results from the student surveys and student activities, we learned that three aspects of the JMSC in particular – hands-on activities, multimedia components, and a multidisciplinary curriculum – had a positive impact on students' science learning. Student Content Activity results showed an understanding of the scientific content, concepts, and technologies central to the JASON XIV curriculum.

Presented in this section are the six main themes that emerged from this evaluation:

- JMSC influenced students' perceptions of scientists, doing science, and being scientists.
- Hands-on activities from the print curriculum supported student engagement and motivation, helping students be able to grasp complex scientific ideas by making them concrete.
- Multidisciplinary components of the JMSC provided coherence in students' learning through capturing their interest and providing opportunities for collaboration.
- Students appreciated the variety of experiences and access to knowledge that the multimedia components (videos, Live Broadcast, digital labs, Internet research, and other online activities) provided them; students claimed the affordances of multimedia helped them learn better.
- Students with varying literacy levels were able to access complex scientific concepts.

- JMSC use resulted in an understanding of key JASON XIV scientific content, concepts, and technologies.

Students' perceptions of scientists, doing science, and being scientists

Each year, the JMSC exposes students to scientists, researchers, and other experts working in the field through multimedia components such as the prologue video, Live Broadcast, and web site, as well as through activities in the print curriculum. Across all of the school sites, we found that students' images of what scientists look like and do were affected by their exposure to the curriculum. Moreover, students exhibited a curiosity about the Channel Islands scientists, their work, and personal aspects of their lives. We also found that through exposure to the curriculum, students were able to imagine themselves as scientists.

Images of scientists. When students described their images of a typical scientist and a JASON scientist, they contrasted the two. In the interviews, when asked to picture a typical scientist, students described men or women wearing a white lab coat and working in a laboratory with microscopes and test tubes and chemicals. When asked to picture a JASON scientist, students described men and women wearing shorts and t-shirts who work outside. Some students said that they had pictured scientists as old, but the JASON scientists as young, or as one student said, "all ages." In interviews, the majority of students said that before participating in the project they perceived scientists as "freaky," "old," and "weird with wacky hair," wearing "white robes with pens in the pocket," "big glasses" or "goggles," and "mixing chemicals." Through the videos, live satellite broadcasts, curricular activities, and novels, students said they learned that scientist "work outdoors," "out of the lab," "get dirty," and "wear regular clothes." A student in a gifted and talented class expressed this shift in perception, saying:

> *Before the JASON Project, I pictured a guy in a white lab coat. Now, I know what it [a scientist] is a little bit better. Before the project, I didn't know that there were guys out of the lab."*

Another student in the same class commented in a separate interview:

> *I was just telling Ms. Calloway this a few minutes ago. Before this, I thought scientists were in white coats in labs with their clipboards writing down like b squared equals c squared. I found out that scientist can be really cool.*

A seventh grader from a heterogeneous science class commented:

> *I see a different kind of scientist, people that go in the ocean and discover things — Sylvia Earle in the submarine, Jane Goodall who lived with the apes — not someone trying to look at microscope.*

Understanding scientists' work. In addition, students indicated that their understanding of scientists' work was affected by their participation in the curriculum. Before, students said, they thought that all scientists did was "use test tubes," "experiment," "study at a microscope," and "write down formulas." But from this curriculum, they commented, they learned that scientists do a wide variety of things such as scuba diving, digging, taking samples, hiking, discovering, exploring, using technology, and studying plants and animals. Some students were impressed by what they learned about how scientists were living in the field, "going outside" and "sleeping in tents." Others described the scientists portrayed in the curriculum as people who "learn more about our world," "do understandable things," "look up things that they don't know," "talk in words we understand," and "care about the work that they do."

Imagining being a scientist. This shift in perception of scientists and what they do made students feel that they could better relate to scientists, and even aspire to become one. A student from a special education classroom said, "I would love to be a scientist. Scientists are lucky — they get to travel around the world. I would do anything for it, to get out of the state and get to do the things they do." Several survey respondents portrayed themselves within the research environment "doing" science and working with scientists (see Figure 1).

Moreover, the CCT Student Content Activity, where students generated questions and decided what tools they would need to investigate a problem relating to land movement, pinnipeds, or a kelp forest, were essentially simulations that asked students to imagine themselves in role of a scientist as part of a scientific research team. Participating students across all cases had no problems placing themselves in this role and all were able to imagine actions they might take. For example, a student at Brightway Elementary wrote:

> *I will use a camera. Sow I can tell my mom and Dad and Berathers and Seter. And sow the holl world. And it well be sow beuteful and cool cos I am a scientist.* [5] *[I will use a camera so I can tell my mom and dad and brothers and sister, and show the whole world. And it will be so beautiful and cool because I am a scientist.]*

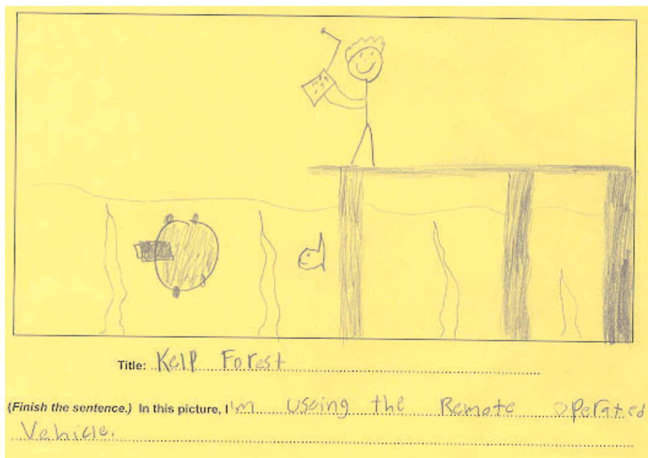
Curiosity about scientists' personal and professional lives. In focus group and individual interviews, students were provided with the opportunity to imagine asking JASON scientists questions. An unexpected finding concerned the questions students said they would ask. While, as expected, students inquired about topics related to the flora and fauna of the islands, such as "What kind of marine life is living off the Channel Islands?" (John Glenn Elementary), "Is there wildlife that you see on this island that is not on any other island?" (Brightway), or "Why are the foxes dying?" (Brightway), interspersed with those questions were ones about scientists' personal lives. Across all school sites, students were curious about how the researchers became scientists, what it was like to be a scientist, and information about their connection to the JASON Project. Typical questions were:

> *Why did they start the JASON project? [Brightway]*

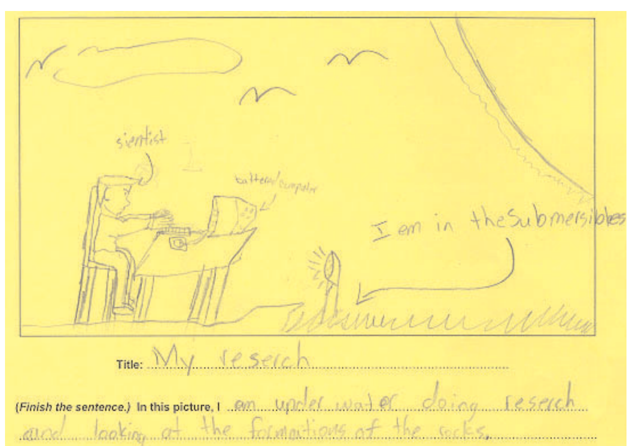
> *How did they discover and get interested in the Channel Islands? [John Glenn]*

[5] Student responses are presented as the writers wrote them, with errors and idiosyncratic spelling and capitalization.

Figure 1: Students as scientists

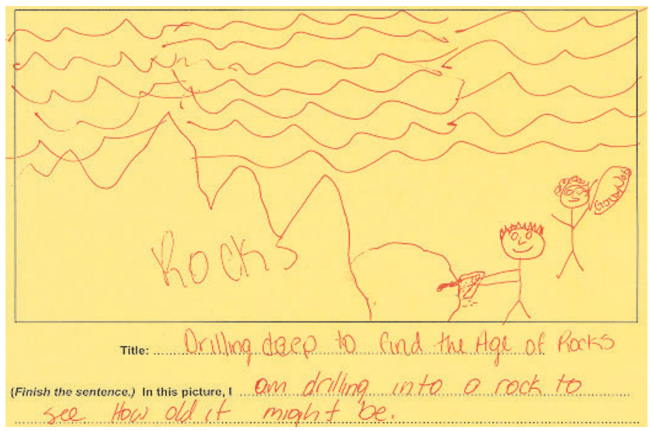


"Kelp Forest:" I'm using the Remote Operated Vehicle.
[Grade 6-8, Liberty]



"My Research:" I am under water doing research and looking at the formations of the rocks.
[Grade 5, Brightway]

Figure 1: Students and Scientists (Continued)



"Drilling deep to find the Age of Rocks:" I am drilling into a rock to see how old it might be.

[Grade 7, Cedar Creek]

Student questions from Cedar Creek illustrate this point. Students from this heterogeneous Grade 7 science class said they were not interested at all in how the islands were formed. Rather, as one student put it, they wanted "to know stories that have happened. Not boring stuff but interesting stuff like when [Dr. Ballard] discovered all these ships. I'd like to know more about what he's been through, not normal questions — not questions about the Channel Islands." Cedar Creek student questions included:

Is it hard to be a scientist? What's it like? What do you do everyday?

Where have you gone? And how hard it is. Do you not get to be around your family a lot?

Most scientists become scientists because they have a dream. Have they accomplished their dreams and how?

Why did they choose the Channel Islands?

Do you get a different feeling when you're underwater?

What's it like being a scientist?

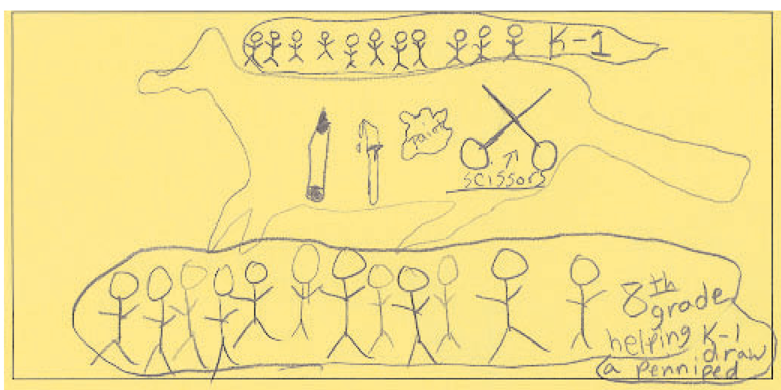
Would you rather be studying anywhere else?

What's it's like to swim in the kelp forest? Is it hard because it's so thick and there are a lot of fish?

Hands-on activities provided engagement and motivation

Teachers chose from the many hands-on activities provided with the JASON Multimedia Science Curriculum to teach the subject matter. Several students explicitly used the phrase "hands-on" during interviews to describe the work and said that they not only enjoyed these activities but that they also helped them to learn and remember. Evidence supporting this finding was found at every school site, in both interviews and surveys. For example, a student from a heterogeneous seventh grade science class said, "I like the hands-on stuff. It makes it a lot easier." At Pine Mountain as at other sites, students created simulated kelp forests as well as life-size representations of the pinnipeds that live there. Nine out of the 10 students from the eighth grade class there chose, in their drawings, to depict the making of a sea lion. In making this animal, they taught the school's K-1 class. One student captioned the picture, "8th graders holding a sea lion and explaining to the little kids." For another example, see Figure 2.

Figure 2: Hands-on activities and collaboration



"8th grade helping K-1 draw a pinniped."

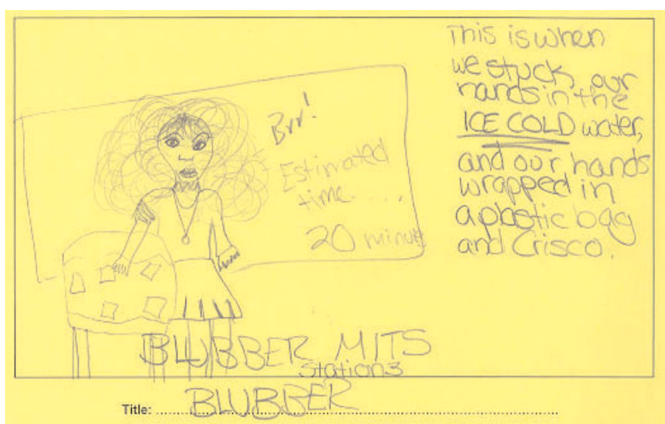
[Grade 8, Pine Mountain]

The JASON print curriculum motivated teachers to incorporate hands-on activities in a variety of ways. For example, the curriculum inspired one sixth grade special education teacher at Monroe to apply for a small grant to purchase hermit crabs for the classroom. Taking care of the hermit crabs gave the students a concrete experience with a living marine organism. At John Glenn Elementary School, the teacher found that the hands-on activities fostered for collaboration amongst the multi-age students in the gifted and talented class. At Pine Mountain School, the literacy coordinator helped teachers in all grades acquire realia such as shells and sand, along with other manipulatives, to help these students, who live on an Indian reservation in the Great Plains region, far from the ocean, better understand marine creatures and their habitat.

Survey results confirmed the popularity of hands-on activities; two-thirds of the students depicted hands-on activities when asked to draw a picture of the JASON activity that they liked the most (see examples in Figure 3).

Furthermore, students said they learned differently in the JASON Project than they learned in their regular science class. Because many of the students either participated in the JASON Project for three to four months and did "regular science" throughout the rest of the school year, or had JASON as part of a pull-out enrichment curriculum, they were able to distinguish between what they did and how they learned in the JASON Project with what they did and how they learned in their regular science class. Even though science learning and the implementation of the JASON Project played out differently in each site (i.e. students in one site worked on the JMSC on Tuesdays within the context of their gifted and talented program, while receiving instruction in science within their regular classrooms throughout the rest of the week), students across multiple sites reported that they liked participating in the JASON Project more than "regular science" because "it's more interesting" and "you don't have to read all the time."

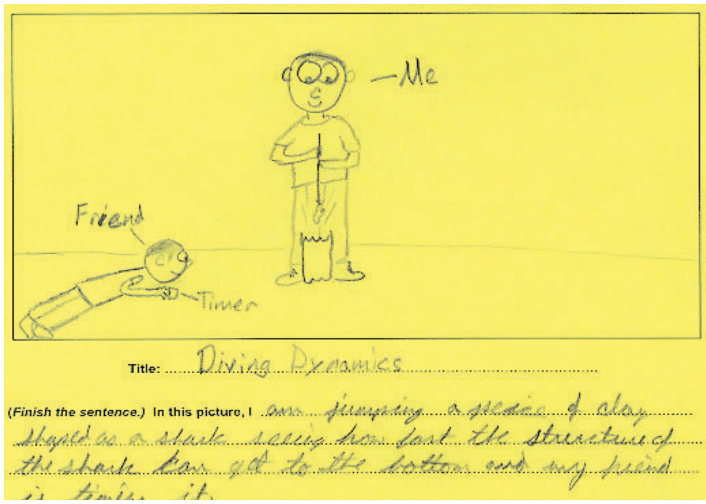
Figure 3: Hands-on activities and direct experiences



"Blubber-Blubber Mitts Stations:" This is when we stuck our hands in the ice cold water and our hands wrapped in a plastic bag and Crisco.

[Grade 7, Sugar Grove M.S.]

Figure 3: Hands-on activities and direct experiences (Continued)



"Diving Dynamics:" I am jumping a piece of clay shaped as a shark seeing how fast the structure of the shark can get to the bottom and my friend is timing it.

[Grade 7, Hope M.S.]

Students generally characterized learning "regular science", as "reading from a textbook," which most said was "boring." Specifically, students contrasted the hands-on quality of the JASON curriculum with what they do in a regular science classroom. Many said that in other science classes they spent time reading from the textbook, taking notes, and watching the teacher perform demonstrations. A fifth grade ELL student highlighted the difference, saying, "It's really hands-on. When we do the JASON Project, she lets us touch the water and see how it feels." He noted that in his regular science class, "The teacher does it, quick. We don't touch it. We just watch." A sixth grader in a once-a-week gifted and talented program also made the distinction:

> *Science here [with JASON], we do in more detail and you can place yourself in that position, where in the regular classroom, it's just, you're reading from the textbook and it's just, just reading. And here [with JASON] you can actually do things so you can learn more about it, so you'll be more into it.*

Many students reported that they liked doing the curriculum's experiments and labs, and that through doing them they were able to learn more and remember it. A seventh grader in a mainstream science classroom remarked, "Labs are always fun…You get to do more hands-on stuff." His classmate continued, "With labs it's more explained to me rather than when someone just tells me about it. I'm more of a hands-on learner. I understand it better."

Multidisciplinary components provided coherence

The JASON curriculum is multidisciplinary, covering academic disciplines such as math, language arts, history, culture, and geography in addition to science. Some students said that they enjoyed the collaborative atmosphere produced by the multidisciplinary aspect of the curriculum, and others reported liking activities in which the main focus was something other than science, such as literature, history or art.

Among our nine sites, the multidisciplinary aspect of the curriculum came into play in two main ways: (a) in self-contained classrooms, such as the special education classrooms at Monroe M.S. and Liberty M.S., as well as those at Pine Mountain School and the gifted and talented pull-out program at John Glenn Elementary, and (b) in schools that did what we call "whole-school JASON," wherein the whole school, in the case of Pine Mountain and Monroe, or a specific group of multidisciplinary classes, as at Sugar Grove, utilized the JASON multimedia curriculum. However, even in science classrooms where the science teacher was perhaps the only one in the school using JASON, teachers incorporated reading and writing activities to some degree. Science teachers also collaborated with English language arts teachers, providing them with JASON-recommended novel titles.

In almost all of the schools that we visited, students reported that they liked reading the novels related to the curriculum. Three of the novels related to curricular themes, such as watersheds, ocean voyages, exploration, while two depicted the lives of Native American children in the Channel Islands area. Many of the students who stated, "I love to read," said that they especially enjoyed the young adult novels, like Island of the Blue Dolphins. Even some students who explicitly told us that they did not like to read or were "bad at it" reported that they learned scientific concepts from reading – or being read to – one or more of the five recommended novels such as 20,000 Leagues Under the Sea, often provided in an abridged or adapted format (see Figure 5 on page 29).

An example of how the multidisciplinary aspect of the curriculum worked to promote collaboration occurred at Sugar Grove Middle School in the Midwest where four seventh grade teachers – the language arts teacher, the math teacher, the social studies teacher, and the science teacher – work collaboratively with a group of approximately 100 students in what is called a "house." The house is home to the four teachers' classrooms and a commons area where students can meet to collaborate on projects. During the winter months when the whole house was involved in enacting the curriculum, students and teachers worked together to create a kelp forest environment, complete with sea urchins made from styrofoam balls and colored toothpicks, to decorate the commons area. Before beginning to teach the curriculum, the teachers in the house decided which units and lessons each one would cover. One student described how the project works there: "We're all doing the Channel Islands, but we're all doing different subjects of the Channel Islands." His classmate continued, explaining that, "in each classroom, we're doing different things." But, as another student added, "You're always tied together. It's not like back and forth. It's not oceans to famous writers." CCT researchers observed these students performing experiments on kelp in science, presenting group research on the Channel Islands in social studies, reading JASON novels in English, and working on JASON-related projects in the commons area.

At Pine Mountain School, a K-8 school on an Indian reservation, teachers also value the multidisciplinary aspect of the curriculum. The literacy coach, who also functioned as an informal JASON coordinator, drew upon a document, "Primarily JASON," for ideas about adapting and extending JASON activities for the lower grades as well as for the students' reading levels in the upper grades. Teachers reported that their students, almost all of whom are Native American, related extremely well to the curricular pieces that focus on the history and culture of the Chumash people, native to the Channel Islands. In one of the activities that teachers and students reported to be popular, students engaged in a role-playing simulation designed to help them understand how humans use the marine and coastal resources in the region. Working in groups, students had to decide which resources to trade with other groups for food, clothing, and valuable materials that they would need during the winter months. Teachers said that through activities such as these students were able to learn and connect to the Chumash people, whom students felt possessed similarities to their own traditions, culture, and history. One teacher said, "When you talk about the native people of an area, [the students] can identify with that." Data from the student survey confirmed this, as one out of every five students at this school chose to depict activities related to the Chumash people or culture.

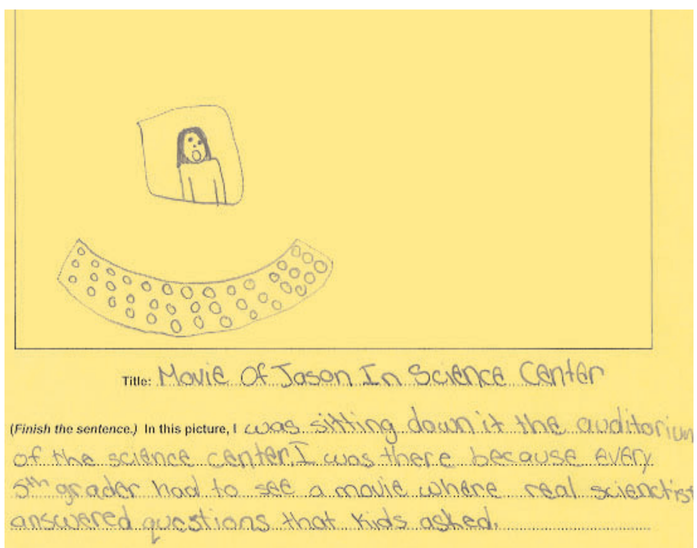
Multimedia components provided access to material

Students appreciated the variety of experiences that the multimedia components of JMSC – the print curriculum, videos, Live Broadcast, digital labs, Internet research, and other online activities – afforded them. All of the participating schools in this year's evaluation utilized the multimedia components to some extent. The prologue videos, used in all classrooms, were the most utilized. In all but two sites, students experienced the Live Broadcast either through a PIN site visit or through other means, such as teachers taping the broadcast from the National Geographic channel or using the JASON-produced post-broadcast video. Also popular were the online activities provided through Team JASON Online; at eight of the nine sites, students engaged in online activities. In many classes, teachers encouraged students to use a presentation program, such as Powerpoint, to make their final JASON presentation or poster. Students in several classes also used the Internet to research their projects, either through links from TJO or their own Internet research.

Throughout the interviews and on the surveys, students reported that they enjoyed watching the video or Live Broadcast, participating in online simulations known as "digital labs," doing independent research on the Internet, reading books, and communicating with other students online. Almost twenty percent of the survey respondents drew a picture of themselves engaging in some kind of multimedia component of the curriculum; examples can be seen in Figure 4. Most of these illustrations revealed students doing research on the Internet or participating in digital labs. A sixth grade student in a gifted and talented enrichment class noted, "Actually here we watch live expeditions on JASON too and that's a lot better than reading from a book about it. You actually see it happening, see what they're doing."

At Liberty Middle School, the teacher utilized all of the multimedia components to provide the sixth through eight grade students, all labeled special education, with multiple entry points into the subject matter. Due to disparate reading abilities of the students in her classroom, the teacher found that students struggle to learn the content if text is the only means by which the content is presented. The teacher in this classroom believes that technology provides a platform from which all of her students can better understand the material and better complete the tasks that they are asked to perform. By navigating through the project's web site, participating in the digital labs, watching the videos, researching on the Internet, reading in groups from text on the computer, writing collaboratively on the computer as well as writing in the JASON Journals, and listening to adapted versions of related novels read aloud, the students have more ways to access the content than they would were they solely reading from textbook. In addition, because this teacher is working in a self-contained special needs classroom where she is expected to teach all of the core academic subjects, she finds it challenging to conduct labs, experiments, and hands-on activities. The multimedia components of the curriculum, therefore, become all the more important for her students to be able to engage in science learning. In contrast, there was no computer use in the other special education classroom we visited, at Monroe M.S. However, in that class, the videos and novels were featured prominently.

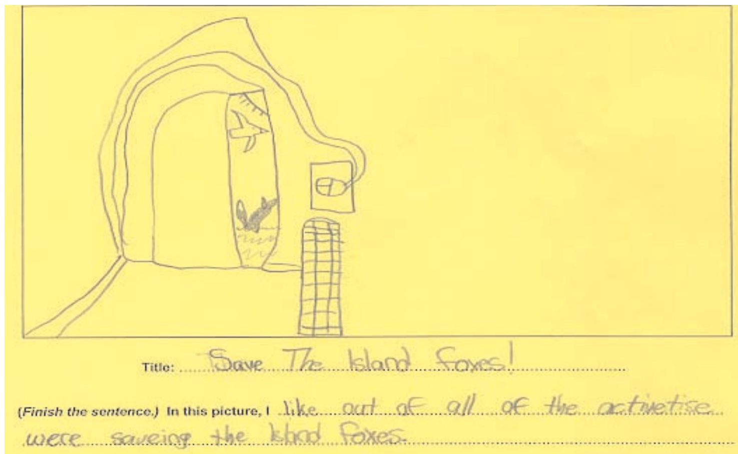
Figure 4: Multimedia activities



"Movie of Jason in Science Center:" I was sitting down in the auditorium of the science center. I was there because every 5th grader had to see a movie where real scientists answered questions that kids asked.

[Grade 5, Brightway Elementary]

Figure 4: Multimedia activities (Continued)



"Save The Island Foxes!:" I like out of all the activities saving the island foxes. (N.B. This is a TJO digital lab.)

[Grade 5, Brightway Elem.]

Video. Video is easy for teachers to use and a powerful influence on students. Access to television and video equipment was not an issue for the teachers in our sample. As shown above in the section on students and scientists, the prologue videos introduced them to the idea that scientists can come in a variety of ages, colors, shapes and sizes, and can work outside of the lab. Students vividly remembered the JASON prologue videos and described them in interviews.

Live Broadcast. At four of our nine sites, students attended the Live Broadcast at their local PIN site. At three of the sites – Cedar Creek, Sugar Grove, and Hunter Hill – all students participating in the JASON Project attended the Live Broadcast as part of the culminating activities. At Monroe, however, students were selected for Live Broadcast attendance by their teachers; the special education students were not invited to attend.

The JASON XIV Live Broadcast was memorable for some students because it was a field trip outside of the school. Students from Monroe especially felt excited; about five students were chosen from each science class to attend the Saturday field trip to the PIN site located at a NASA installation. (Note, the students in our evaluation were not included in the field trip.) For other students, such as those in the two gifted and talented classes at Hunter Hill, it was memorable for the fact that it was a "boring" field trip. Students expressed these sentiments in a post-broadcast discussions as well as in their student surveys. For instance, one student wrote, "We need more experiments to do at the broadcast, instead of sitting down watching the boring show. The JASON Project needs to be spiced up." Hunter Hill students had the opportunity to meet and speak with a JASON XIV Student Argonaut from their district; this special opportunity did not change their views about the Live Broadcast.

Several factors might explain the differences in experiences. At some PIN sites, the hour-long broadcast is the total experience, while at others, the broadcast is combined with other field trip activities. Some PIN sites operate out of schools while others are located in a planetarium or on a university campus. The Live Broadcasts seem to be especially motivating for teachers. Yet, overall, student impact is negligible. Robert Mercer complimented JASON on improvements made to the Live Broadcast and Telepresence events over the years. He also lauds his PIN site, saying, they "do a good job of getting kids involved" during the event through assigning jobs like assistant M.C.'s, computer technicians, and video technicians. However, he notes, "still kids complain. They're used to Disneyworld. Their expectations about production values outstrip the ability of the school to provide them." Another long-time JASON using science teacher, Sarah Terowsky, told us, "I enjoy the broadcasts but many of the kids do not. I'm not sure how to make them understand how neat that is."

Nonetheless, through viewing the Live Broadcast, students were able to see scientists and researchers, as well as student and teacher Argonauts, in action. We believe that this contributes to the students' changing perceptions about scientists and doing science.

Computers. Computers were used in several ways in all the participating classrooms save the one at Monroe. The main computer uses were: (1) TJO-digital labs (seven sites); (2) TJO-Student Journals (four sites); (3) Internet research relating to JASON XIV topics (five sites); (4) presentations (three sites). Several teachers mentioned that they would have had students participate in message boards, had they been functioning. Teachers were generally pleased with the jason.org web redesign but disappointed that the message boards did not work. Chats – real-time conversations with authors and researchers – were not used by any of this year's evaluation participants. Timing of the chats was cited as a major obstacle.

According to both teachers and students, computer use served a variety of functions. For example, for students in isolated environments like those in the community served by Pine Mountain School, the JASON Project was a way to expose students to the world outside, and the Internet was an integral part of that strategy. With a stable Internet connection for the first time, students were able to do Internet research on their class animal. Said one of the teachers, "Next year, we hope to use the computers a lot more for assessments, chats, journaling and message boards." At Pine Mountain, computer use and, indeed, JASON activity use was not uniform among teachers. The more experienced JASON teachers used the most components, and the teacher new to JASON, and to the school setting, used fewer components.

Hope Middle School embarked on a school-wide laptop program, shortly before the evaluation began. Several of the students there reported that they use computers more with the JASON Project than they do with other curricula. One student explained, "We use [laptops] for research and the digital labs, like to track [the pinniped] migration route on the computer."

Digital labs. The digital labs, which are in essence simulations, helped students understand complex science topics through combining visual aids, animations, and text with interactive exercises.

However, our observations showed that not all digital labs were equal. "A Year in the Life of a Northern Elephant Seal," a simulation of satellite tracking technology that allowed students to observe migration patterns, "Navigating the Channel Islands," which had students pilot three boats from different eras across the channel, and "Save the Channel Island Foxes," where students made nature preserve management decisions with the goal of maintaining a viable endangered species population, did indeed "explain things to [students] in a way they can understand," as Helen Tyner at Brightway characterized the digital labs. A contrast was the lab on the Food Web, part of the Earth systems science series of digital labs. There was little interactivity in this lab, and the students we observed at Brightway had a difficult time accessing information from the text on the screen or from the animation.

Electronic journals. Student Journals were another TJO activity used by students and teachers. Using the online journals, students write on a teacher-assigned topic. The assignment is turned in electronically to the teacher who can then view them through TJO's Teacher Center. Teachers can respond to journal entries, and grade them if they wish. Teachers in the evaluation who used the journals used them a similar manner to those who had students complete traditional paper journals, such as those in Cedar Creek. Teachers read over the journal entries and responded to them. Teachers reported that students enjoyed the journals, an assertion supported by evidence from student focus groups and interviews. Helen Tyner at Brightway had students write a paragraph two to three times during each unit. She noted:

> *I'd be able to respond to [students] and I would know if they got the main idea. If I got a response like, 'I learned if you clicked this button, then this would happen.' No, that's not it. I wanted the deeper concepts. I wanted to know what they knew and remembered…. Their journals were awesome. When I could get into the journals, that was great. A blessing. I wouldn't even give quizzes.*

Teachers who used the student journals expressed frustration about the technical difficulties and resulting freezes. Overall, the revamped jason.org website raised challenges at our participating research sites. Even at the most resourced places, teachers gave up on the message boards, though they had proven popular in previous years. During several site visits, teachers were on the phone with JASON.org staff, trying to figure out where the problems were.

Internet research. Teachers also had students do Internet research on a research topic. Generally, students started with links at jason.org to help them find information on their topic. In addition, teachers provided students with additional websites, such as ocean.com. Students performed Internet research on their own as well. For example, students at Cedar Creek worked on a "kelp critters" project, in which each student researched a sea animal that lives in Channel Islands. One student chose a type of anemone called "light bulb turnicate" because, according to him, "It can zap stuff." Students explained that some of the animals they chose, such as the turnicate, were very specialized, and, so, they could not always find information on them in books. Students at Liberty enjoyed using the Internet to find information about the specific Channel Island that they had chosen to research, and appeared to have few difficulties navigating the sites pre-selected by the teacher or those they found through search engines like Google.

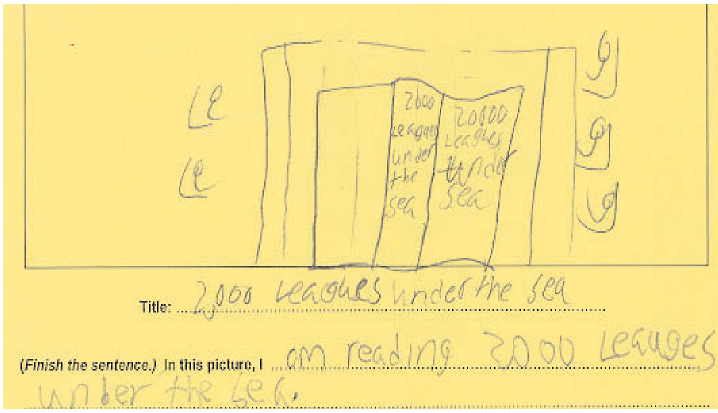
Presentations. Preparing a report and presentation on a topic related to JASON XIV was an activity conducted in nearly all the classes we visited. Several teachers gave students the option of using presentation software such as Powerpoint to organize their material. Some students in each group did this; moreover, teachers in the two gifted and talented classes uploaded student presentations to class web pages.

Accessing complex scientific concepts was possible for all students

Teachers made many adaptations and some substitutions to the JMSC materials to suit their students' needs. For example, the JMSC spurred Elise Maple from Monroe to find substitute texts appropriate for her special needs students' reading levels. Instead of using the research articles, Maple chose "Water Life," part of Steck-Vaughn's Wonders of Science series, which is designed to offer older students who are "limited readers," in other words, who read on a second to third grade level, "core science concepts … at a level they can manage" (Steck-Vaugh, 2003). For a novel, the district's JASON coordinator helped her find an adapted version of Jules Verne's 20,000 Leagues Under the Sea (Verne, 1992; see Figure 5). Both texts distill information to one page or less, and contain traditional reading comprehension exercises such as multiple choice and fill in the blank items. In contrast, the students in Pam Cartwright's class at Liberty used the original texts for the JASON research articles and the novel Island of the Blue Dolphins as a read-aloud. Both teachers had students read from the informational texts, sentence by sentence, with other students following along – in Cartwright's case, highlighting the text as well.

Teachers in several other classes used a variety of scaffolding tools to help students access information from the informational texts like the research articles. Both Gail Sanderlin from Cedar Creek and Linda Smith from Hope created concept maps for students to fill in as they read. Helen Tyner at Brightway paid special attention to activating students' background knowledge before they began reading. And Carol Calloway at John Glenn created a word wall of scientific terms for her students that highlighted prefixes, suffixes, and roots in different colors (see Figure 6).

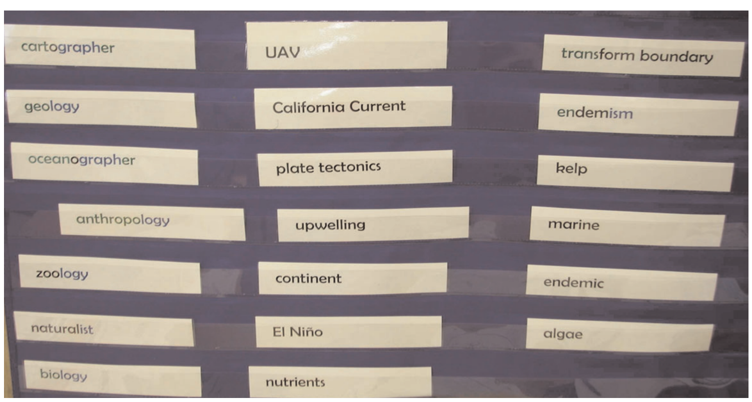
Figure 5: Reading a JASON novel



"2,000 Leagues Under the Sea:" I am reading 2000 Leagues Under the Sea.

[Grade 6, Monroe M.S.]

Figure 6: Word wall



There is evidence in our evaluation that students of varying literacy levels were able to access complex scientific concepts. Students completed the range of tasks in the Student Content Activity (e.g., asking relevant questions about the research problem, describing technology use, connecting technology use to answering the research question, or providing accurate content information), regardless of reading and writing ability.

> *I will probley use the animal tags to idefey one from another one. So I can keep trace of them so we no wher they go. I will aso use the satellites to find them easyer and chack at them. [Pine Mountain, Grade 8]*

> *The movement crack and made a vocanic. Then when they go back together they get up on each other. [Brightway]*

Students in some classes used sophisticated vocabulary, especially in the pinniped and kelp activities. For example, for kelp students wrote about stipes, holdfasts, and algin. For pinnipeds, they wrote about molting, blubber, and pups. Linda Smith's classes at Hope Middle School were notable because several students used sophisticated vocabulary for terms for seals:

> *The word pinna means (feather or wing) and pedes means ("feet"). [Hope M.S.]*

> *There are two types of Phocids and Otariids. Otariid consist of different types of seal lions and Phocids are different seals. [Hope M.S.]*

Additional evidence for students' understanding of scientific content is found in the section of the Student Content Activity that asked students to describe scientific technology applications. Some of the students in the eighth grade class at Pine Mountain drew pictures of the technology use such as SCUBA diving, and a student in Ms. Tyner's class at Brightway Elementary depicted measuring and multiple uses of technology in a drawing.

Results from the student survey and student interviews support the claim that JASON helped students access scientific content and concepts, regardless of their reading and writing abilities. In response to our directions, "draw yourself doing the JASON activity you enjoyed the most," most students drew themselves doing a hands-on science activity (36%) or using one of JASON's multimedia components (16%). Some students drew themselves engaged in a social studies activity such as "Trading for Life" or creating Chumash crafts (14%) or reading a JASON-related novel (1%). Others drew themselves engaged in creating or delivering a presentation (9%). A small number of students drew themselves in a non-science situation, such as a school-wide carnival created around the JASON theme (>1%).

Understanding scientific content, concepts, and technologies

In order to assess students' understanding of the JASON XIV scientific content, concepts, and technologies, we created and administered a set of three activities, related to the topics of kelp forests, seals, and land movement. Results from these Student Content Activities showed that JMSC use resulted in understanding scientific content, concepts, and technologies, especially related to kelp forests and pinnipeds. Students also exhibited an understanding of measuring, but less of an understanding of monitoring. As demonstrated above, even students with limited literacy skills gained an understanding of complex scientific ideas. In this section, we present findings divided into the following areas:

- Knowledge of content
- Measuring and monitoring
- Asking research questions
- Scientific technologies

Knowledge of Content. Students had a fair amount of content knowledge about the Student Content Activity topics, which mirrored the major JMSC curricular topics. In the final section of each activity, we asked students to "tell us what you already know," about kelp forests, land movement, and pinnipeds like the Hawaiian Monk Seal. Student described many details, such as how deep seals can dive and how fast kelp can grow. There were examples of relatively high-level content knowledge in the tectonic activity:

> *I know about how the land moves. It moves by tetonic plates . The tetonic plates are inside the Earths' crust. And the tetonic plates are moved by hot magma. [Brightway Elementary]*

For the most part, however, students gave the least content information in the tectonic activity, and often gave incorrect information (e.g., when water moves, it causes earthquakes):

> *The land movmen is by the wether and the water. Because if the water is strong enough and the weeather is really wind it would make the islands move. [Brightway Elementary]*

Measuring and Monitoring. Overall, students provided more evidence that they understood the concept of measuring as a research strategy than there was for monitoring. For example, students mentioned measuring sea temperatures, or using quadrats and transects:

> *The way I can use the thermometer is I can put it in the water and see what the tempature is then I can put it in the water about 3 or 4 years later and see how the tempature changed. [John Glenn Elementary]*

> *A quadrant because I can count how many black sea urchins there are now to see if it has increased. Then I would find out how much did the population increace (if I get the record befor it changed from good to bad.) [John Glenn Elementary]*

> *I will use the animal tags to count the population. It will show how often the seals are changing (population). … [Hunter Hill M.S.]*

When monitoring is mentioned, it is often indirect; in other words, students mentioned measuring the water temperature and seeing if it increases or decreases, but usually don't explicitly comment on monitoring. Again, tectonics activities had the least discussion of measuring and monitoring as a scientific research strategy. Ms. Sanderlin's seventh grade students at Cedar Creek Middle School discussed measuring and monitoring much more than in Ms. Tyner's class at Brightway Elementary (monitoring mentions at Cedar Creek ranged from 20% to 60% per class, versus less than one student per class at Brightway). A rare example of this include a student proposing to plant a flags and seeing if it moves:

> *I could use a computer to see if its moving and a flag to see if it gets farther. [Brightway Elementary]*

> *At Cedar Creek, a student suggested using maps for monitoring:*

> *I would use different kinds of maps to figure out if it has moved or it has stayed in the same spot for a wile. [Cedar Creek]*

Another student at Cedar Creek suggested monitoring with the question:

How many years ago was this picture taken? [Cedar Creek]

Asking research questions. Almost all students, across classes, were able to ask questions that relate to the research problem. Many students also directly questioned information that the Activity provided about the local context:

Did the fishing company use drift nets to catch fish and accidently catch seals and the seals got an infected cut and died? [Hunter Hill]

What is going to happen to the kelp bed when there is a Japanese kelp in the area? [Monroe, ESL Class]

An exception was the Grade 6-7 class at Pine Mountain. Only half of those students asked questions that relate to the research problem. In addition, students generally did not refer back to their research questions in the subsequent section, which asked them to describe how they would conduct their research. In the teacher use survey, Ms. Morton indicated that she did few JASON activities with the Grade 6-7 students, relative to the other upper elementary and middle school teachers in the school.

Scientific technologies. Almost all students were able to accurately describe how many of the technologies are used (e.g., SCUBA, so that I can go underwater), but most students did not discuss in detail how different technologies could be used, or how the use of the technology might help answer the research question (e.g., scat analysis, to see if the seals are eating something that is killing them). Half or fewer of the students across all the sites tied together technology use, as in this example where students describe the technologies they would use to answer their research questions concerning the slow death of a kelp forest or Hawaiian monk seals, respectively:

The quadrat for the life in the square (how much life is in the area) and the scuba equipment to put the quadrat down and research. [Cedar Creek]

If I wanted to inspect a particular seal, I would have to tag it and then use the satellites to track where it has been over a period of time, and for how long it has been there. [Sugar Grove]

Many students suggested additional technologies to bring on their research expedition, and described creative ways that they would conduct their research:

I would use the Ex ray Machine to find out if there eating plastics or metals that have been dumped in their area. [Hope Middle School]

To check the oil spill, I shall bring scuba gear and analysis tools to test how thick the water is. Second I would get permission and test the oil on a seal. Next I would see how long it has taken to die. [Hunter Hill Middle School]

For all of the activities, students often mentioned technologies they might bring in addition to those suggested in the activity. These additional technologies varied from the scientific, such as a notepad and pen that could be used underwater, to the mundane, i.e., notebook, pencil, food, toys, cell phone, friend. Students explained their use; for example, "toys, so I won't get bored" and "notepad, so I can record what I see."

Few students (approximately 3%) mentioned how the use of one technology helps overcome the limits of another. Some exceptions were the following:

> *I will probley use the animal tags to idefey one from another one. So I can keep trace of them so we no wher they go. I will aso use the satellites to find them easyer and chack at them. [Pine Mountain, Grade 8]*

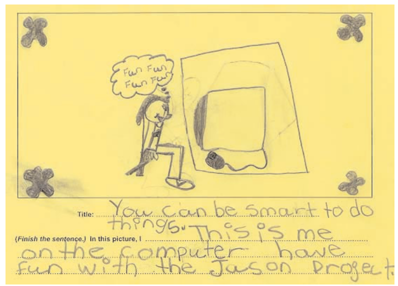
> *[ROVs] are also very good, because they can go down deeper in the water than we can even with scuba gear, so they could see more to help us learn more about the sea loins world. [Sugar Grove]*

Overall, students who completed the kelp and pinniped activities exhibited a greater understanding of the role of scientific technologies than did those who completed the plate tectonics activity. In fact, students discussed relatively few techniques for researching tectonics, surprising to us since the unit contains an activity on creating a model of land movement and a video on the use of the magnetometer, which both emphasize using tools to understand land change. Students who did the tectonic activity also often gave incorrect information about technology use (e.g., rock drill: to see how old the rock is), and gave relatively little explanation about how the technology can help answer the research question. Some of their methods were also incorrect (e.g., fill a hole with water to see how it moves).

Possible explanations for this variation of performance include the fact that few classes that actually completed the plate tectonics activity (8 classes out of 31 total; 185 students about of 560 total); the plate tectonics activities occurred early in the curriculum and, therefore, students were more distanced from the content and concepts of that unit; and, six of the eight classes that took the plate tectonics activity were fifth graders, a large proportion of whom are considered English language learners.

Conclusion

The findings clearly demonstrate that the JMSC impacted the participating students in myriad ways. It influenced students' perceptions of scientists, doing science, and being scientists. Moreover, hands-on activities from the print curriculum provided engagement and motivation, helping students grasp complex ideas by making them concrete. In addition, multidisciplinary components of the JMSC provided coherence in students' learning through capturing their interest and providing opportunities for collaboration. Students with varying literacy levels were able to access complex scientific concepts, and appreciated the variety of experiences and access to knowledge that the multimedia components (videos, Live Broadcast, digital labs, Internet research, and other online activities) provided them. Finally, JMSC use resulted in an enhanced understanding of scientific content, concepts, and technologies. However, it would be hard to understand these findings without knowing how teachers used the JMSC in their classrooms, and under what circumstances. Therefore, the next section will describe how participating teachers implemented the curriculum.



"You can be smart to do things:"
This is me on the computer have
fun with the Jason Project.
[Grade 6-8, Liberty M.S.]

TEACHERS AND THE JMSC: USE AND CONTEXT

In this section, we identify a number of common themes, drawn from our interviews and classroom observations, that characterize teachers' experience with the JMSC under diverse contextual situations, school and district environment, and communities. These common themes are organized into four areas: (1) teachers' backgrounds; (2) teachers' training and use of the JMSC in the classroom; (3) classroom context and JASON use; and (4) external influences, such as school organization, district resources as well as local and state test requirements, on teachers' use of JASON.

Teachers' backgrounds

Most of the teachers who participated in this year's evaluation were white and female, and had either a master's degree or an undergraduate education level. Most of them, as full time teachers, teach science to upper elementary and middle school students from diverse ethnic and racial backgrounds (White, African-American, Latino, and Native American). These teachers participated in JASON on average for six years, with a range of one to 12 years, and were from eight states: Montana, Arizona, Florida, New York, Wisconsin, Georgia, Pennsylvania, and California.

Teachers' training and use of JMSC

Most of the teachers participated in local professional development workshops, which were held in early fall. Teachers were introduced to the year's curriculum and shown how to engage in some activities with their students. Their assessments of the training workshop were positive. Teachers who were trained at the local level or the JASON National Education Conference supported other teachers at the school level in their implementation of the JASON curriculum. One teacher, referring to two colleagues, said: "These two have been tremendous with JASON. I have to say how much I appreciate them both sharing and showing me things."

In the nine schools, there was a high degree of use of the curriculum and a well-integrated use of its different components across most of the topic's six main storylines. For example, one special education teacher said:

We use what's in the video and I have other books that have seals and sea lions, and sea otters. Simple activities. We'll do this unit [she showed a simplified science textbook called Water Life, from the Wonders of Science series], and I'll relate it back to the Channel Islands."

Of the curriculum's six main storylines – geography & geology, Channel Islands culture, coastal ecosystems, kelp forest ecosystems, pinnipeds: monitoring and management, and conserving our natural resources – two, geography and geology as well as pinnipeds, were used in all nine schools. To convey the content and concepts that comprised JASON XIV, teachers videos, research articles, digital labs and other TJO activities, print curriculum exercises, and student self-assessment activities (see Table 4). The video resources were used in all of the schools. In the Coastal Ecosystems story, none of the teachers used the assessment tools or TJO. In addition to the print curriculum, videos, Live Broadcast session and TJO activities, teachers had their students write online journals, participate in JASON's Quilt Project, and read the JASON novels.

TABLE 4: TEACHERS' USE OF THE JASON XIV CURRICULUM

STORIES	NUMBER OF SCHOOLS BY STORY (N = 9)	NUMBER OF SCHOOLS BY ACTIVITY (N = 9)
1 Geography & geology	9	Research articles (8) Videos (7) Exercises (6) Digital labs (4) Assessment (3)
2 Channel Islands Culture	8	Videos (7) Research articles (6) Digital labs (6) Exercises (4) TJO (3) Assessment (1)
3 Costal Ecosystems	8	Videos (7) Research articles (4) Exercises (2) Assessment (0) TJO (0)
4 Kelp Forest Ecosystems	8	Research articles (6) Videos (7) Exercises (5) TJO (4) Assessment (2)
5 Pinnipeds: Monitoring & Management	9	Videos (8) Digital labs (7) Research articles (6) Exercises (5) TJO (4) Assessment (2)
6 Conserving our natural resources	8	Videos (6) Digital labs (5) Research articles (3) Exercises (2) Assessment (2) TJO (1)

Classroom context and JMSC use

> *"Jason does it well: to allow people to turn it into a mixed bag that works for them…It allows you to pull what you need." – Robert Mercer, teacher of students labeled gifted and talented*

With its hands-on, multimedia curriculum, the JASON Project makes it possible for teachers to teach science to student populations with diverse educational needs (e.g., gifted and talented, general education, at-risk, and special education) from different geographical and economic backgrounds. The JMSC allows teachers not only to address their students' diverse learning modalities but also by influencing their teaching practices from a teacher-centered to a student-centered approach when using the JASON materials.

Influenced teaching practices. The JMSC positively influenced teaching practices in two ways: (1) helping non-science teachers teach science, and (2) helping teachers whose teaching approach is largely teacher-centered use a student-centered approach during their use of the JMSC.

JASON makes it possible for non-science teachers, called upon to teach science, to prepare themselves to teach it. Four of the 11 teachers who participated in this study but were not trained as science teachers found the JMSC materials accessible and engaging. Pam Cartwright, a special education teacher, said the JMSC "gives me a lot of ideas about how to integrate the science with the language arts. It's taught me things, gives me an excitement I can transmit to the kids."

JASON also influenced teachers' instructional practices, especially their pedagogical approaches, specifically, collaboration among their students. Teachers, even those who had a more teacher-centered approach, spoke about how JMSC activities enabled them to foster collaboration among all their students. For example, one teacher whose approach to teaching is largely teacher-centered used multiple JASON materials (e.g., activities from print materials and digital labs) and got her students to work together on tasks. In a special education classroom students cut, pasted and colored a map of the Channel Islands, working independently after listening to the teacher and doing a more directed activity. Teachers required their students to learn actively about science during JMSC classes, rather than just read about it. As a consequence, these teachers' students said that showing, not telling, is a more effective teaching and learning process for them.

Addressed students' educational needs. Whether using the digital labs, print curriculum, hands-on activities, or collaborating with colleagues to engage in an active interdisciplinary use of the curriculum, teachers are constantly devising successful ways to apply the JMSC. Below are some examples.

- Teachers assigned art projects and incorporated visual elements into the JASON Project activities as a way to help students engage with JASON XIV science content and concepts. In fact, most teachers decorated classrooms, common areas, or hallways with things related to this year's JASON theme and research expedition site, such as a sea urchins made out of Styrofoam balls or real conch shells. One teacher at a school on an Indian reservation in Montana explained why visual aids are important to her students' learning:

Most kids don't relate to this stuff. You have to bring in visual aids to show what it is… With the hands-on and the pictures, they don't rely so much on reading ability. It opens up worlds to them. The Crow are visual. They didn't have written language until the late 1800s. The kids can be intelligent without reading.

At another school in Pennsylvania, where students made a diorama, and a mural about kelp on a giant piece of butcher paper that they hung in the hallway outside of their classroom, the teacher noted, "I thought that they were going to balk at [making the mural], but they had a really good time doing it, so they got really into it." Several teachers taught students about the structure of a kelp plant by instructing them to craft small models out of clay and pipe cleaners, an activity from the JASON print curriculum.

- Teachers created hands-on stations, most of them based on JASON print curriculum activities, in which students worked in groups of two or three. In one example, the stations, all based on the same content area (kelp), had students doing different things. For example, in one station they did an experiment (kelp stress test); in another, they used microscopes to conduct observations; and in another, they created a three-dimensional model of kelp. Special education students engaged in more hands-on art activities than students from general education classrooms.
- Teachers employed an array of literacy techniques to reinforce students' reading skills and strategies. We found this to be especially prevalent in classrooms with students labeled "special education" and "at-risk," who needed to be learning similar scientific content as the general education students, but it extended to most regular education and gifted and talented classrooms as well. Teachers underlined or highlighted certain passages before photocopying research articles and giving it to the students. They used visual aids to help students understand complex scientific concepts and content, and to expose them to new geographies and cultures. One teacher, for example, made many modifications to the curriculum, such as using books and worksheets that were more suitable for students' reading levels, and asked many questions to ensure comprehension. Other teachers utilized various strategies for their students to learn and practice the vocabulary in the JASON curriculum. In a self-contained special education class in California, students used highlighter markers to accent key vocabulary words, while in a regular education classroom in Wisconsin, students practiced the vocabulary by completing crossword puzzles made by the teacher. At a school on an Indian reservation in Montana, teacher and students created sentences using the JASON vocabulary that remained on the classroom bulletin board, so students could see the words and practice reading them throughout the duration of the Project. One of the teachers there commented, "Vocabulary is a real weakness… We do a lot of activities, like sorting and categorizing. Then we keep it up on the wall… It helps to cement these ideas in words." Teachers made worksheets and graphic organizers for their students to complete, based on the JASON readings, that emphasized some of the more difficult concepts. A teacher from Georgia said, "I make worksheets because if I tell them to go home and do the reading, they won't do it. Sometimes, I copy the reading from my binder where I underlined important points and that seems to work better." When suitable,

they made available adapted versions of the JASON novels for their students. In a self-contained special education classroom in Pennsylvania, for example, students read an adapted version of 20,000 Leagues Under the Sea that included pre and post reading activities in each chapter. The ESL teacher also used an abridged version of the same novel, assigning vocabulary and sentences for homework.

- Teachers asked their students to work independently using the computers to research the island of their choice, with a partner or a group of three. In one instance, even though some of the students' reading and writing abilities were limited due to their disabilities, they could contribute to the group through using the technology.

In sum, some teachers said that they had "to lower the level" of some of the curricular content and activities so that their students could access and engage in the subject matter. At Pine Mountain, they used the "Primarily JASON" resource materials to do just that. Most teachers said that they liked the level on which the curriculum was written, and preferred to adapt the materials for their students rather than having a "watered-down" version. A few teachers – the special education teachers in particular – suggested that the JASON Project include modifications and adaptations for students with special needs, students who are performing well below grade level, and English Language Learners (ELL). One special education teacher said, "It would be nice, not only for special ed but also for ESL to have a parallel curriculum… They could pick and bullet point the core facts of what [JASON] want[s] kids to get out of the curriculum. They could provide more activities on the third grade level. Honestly, the special ed kids don't go beyond the 4th grade reading level."

External influences on JMSC use

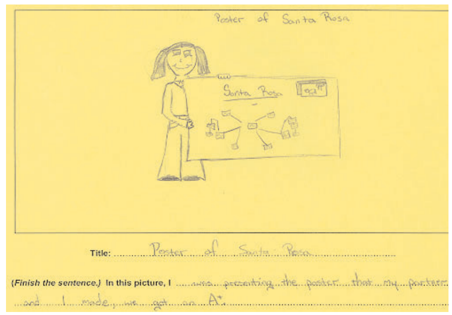
As stated above, teachers participating in this study served not only a diverse population of students but also worked in a multitude of contexts unique due to school organization, district resources, and local and state test requirements, all of which influence how teachers implement the JASON Project. For example, one teacher worked in a self-contained special education classroom with 13 students, and another teacher worked with180 students across 5 classes with long teaching blocks (1 hour 20 minutes per block). Teachers were able to use the flexibility of the curriculum format to implement it in different district conditions. For example, one teacher in a gifted and talented program (Mercer) is not a faculty member of the school but rather, reports to the district's Director of Exceptional Education. His students are identified in elementary school as eligible for the gifted and talented program based on their test scores and overall school performance. He met with sixth grade students two periods, one week, and three periods, the next. As an 'itinerant' teacher with no permanent classroom or office, he had to carry everything with him, including materials for experiments and demonstrations. Moreover, he did not have ready access to a computer lab, so he had a hard time implementing the multimedia aspect of the JASON curriculum. Mercer told us he continued to use the JMSC year after year because he could pick and choose different aspects of the curriculum for enrichment purposes. Another teacher in a gifted and talented program (Calloway) had her own classroom, but only taught the grade 3 through 6 students participating in the program on Tuesdays. Because she was also the technology coordinator, she had easy access to the school's computer lab and so was able to integrate technology and digital literacies along with teaching JASON. Having her own classroom and ready access to the computer lab made it easy for her students to conduct JASON-related technology activities.

Teachers used the multidisciplinary aspect of the JMSC to team-teach and reach a large number of students. For example, a team of four teachers teaching science, math, social sciences, and reading in one of the participating schools worked with 100 students grouped heterogeneously for JASON classes even though they were grouped by ability outside of JASON activities.

Extra resources and technology supports helped teachers in their use of the JASON materials. For example, having recently received wireless laptop computers for all of the seventh grade students, the science teacher in a Department of Defense school found that she could deliver aspects of the curriculum that require technology with ease.

Concerns about local and state test requirements, especially science tests, have increased drastically in the JASON schools over the last two years or so since the enactment of the No Child Left Behind legislation. As core actors in this issue, teachers felt limited in their implementation of JASON curriculum in their classrooms. One teacher said: "We skipped those [oral presentations of students' works]. It was PSSA [state test] time and we just never got back to it." Several schools were participating in the piloting of new science tests in their states. Under these circumstances, teachers want the JASON Foundation to develop standardized test samples and show how they correlate content-wise with the state science tests. Some JASON teachers responded to this assessment challenge by developing their own assessments and looking at other science assessment tools that were aligned with the JMSC. Also, some teachers used the TJO teacher tools to generate test questions that mimic standardized tests.

Each of the JASON teachers who we visited worked not only in different communities, districts and schools, but also in a unique teaching situation. Whatever their situation, however, the JASON teachers were not only able to incorporate the JASON curriculum within their classes, but also able to concentrate on the particular needs, interests, or requirements of their students. As we found in our first year's evaluation (Ba, Martin, & Diaz, 2001; Martin, Ba, & Diaz, 2001), the success of the JMSC impact on students depends on the teachers as well as the adaptability of this innovative and evolving curriculum.



"Poster of Santa Rosa:" I was presenting the poster that my partner and I made, we got an A+.
[Grade 7, Hope Middle School]

DISCUSSION

The multiple ways the JMSC impacted students and teachers, outlined in this report, are important and relevant insofar as they offer a response to the challenge to provide "scientific literacy for all." The concept of scientific literacy for all is central to current national science policies and standards (Education Trust, 2003; National Research Council, 1996) but has not been addressed by most K-12 science programs (Songer, Lee, & Kam, 2002). Ensuring that each and every student gains scientific and technological literacies, and reaches high academic standards not only requires educators to examine their assumptions about teaching and learning science (Kahn, 2003; Lee, 2001) but also calls for a curriculum that supports educators in meeting students' varied needs in multiple and innovative ways.

The JASON Project addresses some of the abovementioned challenges through, first, its high quality science curriculum (i.e., multimedia and multidisciplinary components, hands-on inquiry activities), and second, a flexible curricular format for teachers to use as they see fit in our own classroom contexts. In this section, we discuss how the JASON Project as an alternative science education program addresses two key dimensions to achieve the high standard of "science for all:" scientific literacy and teacher quality.

Scientific literacy

Broadly defined science literacy is:

> *[B]eing familiar with the natural world and respecting its unity; being aware of some of the important ways in which mathematics, technology, and the sciences depend upon one another; understanding some of the key concepts and principles of science; having a capacity for scientific ways of thinking; knowing that science, mathematics, and technology are human enterprises, and knowing what that implies about their strengths and limitations; and being able to use scientific knowledge and ways of thinking for personal and social purposes. (Rutherford & Ahlgren, 1990, p. x).*

Central to scientific literacy is science inquiry (Songer, Lee, & Kam, 2002; Songer, Lee, & McDonald, 2003), which helps students gain skills like questioning, explaining, and making prediction. Research shows that this type of inquiry process and support has a strong impact on students' understanding of scientific concepts and content (Bransford, Brown, & Cocking, 2000; White & Fredericken, 1998). Here, we discuss scientific literacy in terms of (a) scientific inquiry skills, (b) learning experiences and environments, and (c) the literacy in scientific literacy.

Scientific inquiry skills. At the core of the JMSC is the idea of making visible the scientific inquiry process to teachers and students via video, Live Broadcast, hands on activities, and simulations. The JASON Project's approach to scientific inquiry encompasses the attributes of the National Science Education Standards' definition of inquiry:

> *[T]he diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. … [And] the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world. (National Research Council, 1996, p. 23)*.

The JMSC provides teachers and students with opportunities to engage with science by doing it, and thereby increase their understanding of how science works and is connected to other social sciences disciplines. In the JASON context, teachers require that their students learn actively about science during JASON classes, rather than just read about it. As a consequence, students say that showing, not telling, is a more effective teaching and learning process for them. In the JMSC as well as in the National Science Education Standards, the ultimate goal of inquiry-based and hands-on activities is to have students "engage in many of the same activities and thinking processes as scientists" (National Research Council, 2000, p. 1), as well as become more interested in real world science topics.

Through JMSC hands-on activities and exposure to various aspects of the scientific inquiry process, participating students were impacted at least in two ways. First, they demonstrated an increased understanding of the culture of science, and second, they showed an increased motivation to learn.

One of the powerful ideas to emerge from the findings is the positive influence of the JMSC activities on students' perceptions of what scientists look like and do. Students were able to re-imagine scientists as people who spoke, looked, and acted "normal," as opposed to the stereotypic image of an older white male scientist wearing goggles and a pocket protector in his lab coat. Moreover, students were able to picture themselves as scientists in a research environment.

There is little research on the topic of students' images of scientists, although a few studies have been conducted on student-scientist partnerships. Student-scientist partnerships generally take on one of three forms. In the first two, students collect data as part of a larger scientific project (e.g., Tinker, 1997) or apprentice "at the elbows" of a scientist (Barab & Hay, 2001, p. 98). In the third, students perform curricular activities in their classrooms that somehow involve scientists (e.g., Mistler-Jackson and Songer, 2000). JASON is of the latter category. Research published on these projects does not specifically report findings on students' images of science. However, as part of his research on elementary school students' images of scientists and science, Brandes (1995) used a variety of research techniques, including having students complete a drawing task called the Draw-a-Scientist Test (Chambers, 1983, cited in Brandes). He introduced an "image of science" framework that can be used to understand the impact of the JMSC on students. Brandes suggests, first, that "cognitive and affective developments [in students' images of science] may go hand in hand" and, second, that this framework could be used to integrate findings from the research on "children's ideas about the nature of science and the role of affect in science learning" (p. 62, italics in original).

Student motivation, especially for young adolescents, is critical to their staying focused in school and learning about science (Anderman & Midgley, 1997). Lumsden (1994) noted, "Unfortunately, as children grow, their passion for learning frequently seems to shrink. Learning often becomes associated with drudgery instead of delight. . . . . Many are physically present in the classroom but largely mentally absent; they fail to invest themselves fully in the experience of learning (p. 1). The JASON Project is very aware of the importance of students' attitudes and beliefs about learning, which need to be taken into account in the design and development of the JMSC each year. Our findings show that the JMSC motivates students to learn about science as well as see how scientific ideas and skills are applied in real word situations through access to relevant and "fun" inquiry activities, multimedia tools, videos, and a Live Broadcast. As a consequence, students in our study with low academic achievement, special needs, and diverse linguistic backgrounds are engaged and excited about learning. The JMSC helps dispel the myth that they cannot get motivated and learn about science.

Learning experiences and environments. The challenge for teachers and educational systems – especially those serving diverse populations of students – is how to create learning experiences and environments suitable for all students, such as those who receive special education services, are labeled "at risk," come from diverse linguistic or cultural backgrounds, or are labeled gifted and talented.

The JMSC helps teachers construct learning experiences congruent with what Bransford and colleagues refer to as the four essential elements for learning environments: learner-centered, knowledge-centered, assessment-centered, and community-centered (Bransford, Brown, & Cocking, 2000 p. 133). Furthermore, the curriculum seeks to expose students to "real science". In other words, it aims to teach them that scientists from a variety of fields collaborate and that their work is complementary; that multiple sources of data are necessary; that generating questions and collecting evidence are important; that scientific inquiry takes place over time; and that the scientific process is not linear (C. Joyce, personal communication). This mirrors effective practices of such projects as the Chèche Konnen project (Rosebery et al., 1992, cited in Bransford et al.).

While science education reform documents acknowledge that the challenge is to help all students reach high standards, they do not explicitly address issues of how such reforms might need to be adapted for different student populations (August & Hakuta, 1997; Chèche Konnen Center at TERC, 1999; Garcia, Ku, Reyes, 2001). Some members of the research community are highlighting the need to make science education accessible to linguistically and culturally diverse students (e.g., Lee & Fradd, 1998; Lee, 2001, 2003) and to students with special learning needs (Kahn 2003). Despite these efforts, little research about how to promote science learning and achievement for all types students is available. Lee (2003) notes, "Research is still at the stage of conceptualizing issues that need empirical testing" (p. 480). Moreover, the American Association for the Advancement of Science's Project 2061 has made clear that middle school science textbooks are not up to the task of helping students learn key ideas in science (Kesidou & Roseman, 2002; Roseman, Kesidou, Stern, & Caldwell, 1999). Indeed, one communique about the project is titled, "Heavy books light on learning: Not one middle grades science text rated satisfactory by AAAS's Project 2061" (Project 2061, 1999).

The multiple media of the JMSC resulted in increased student engagement and understanding. A host of recent papers and reports, as well as the No Child Left Behind Act of 2001, reinforces the importance of core subjects, including science, as the cornerstone of a "good" education. In our increasingly media-rich world, participating and contributing to all aspects of 21st century life, including science learning and scientific discovery, requires that young people become digitally literate interpreters and users of new media (Honey, in press). Moreover, the Partnership with 21st Century Skills (2003), a public-private organization comprised of business and education leaders, states that people "need to know how to use their knowledge and skills – by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating, collaborating, solving problems and making decisions" (p. 9). The JMSC works to further these goals.

Literacy in science literacy. Providing scientific inquiry skills and creating exciting learning environments are not sufficient to achieve "scientific literacy for all." Students' low literacy levels explain their limited access to science concepts and content. To achieve the support necessary for these students to learn science, we need to better understand the literacy practices involved in science literacy:

> *Oral and written science communications are multidimensional involving language, physical gestures, mathematical symbols, graphic representations, and visual adjuncts. Whereas there has been some recognition given to the value of using discussion, argumentation, reading, and writing to help students construct understandings of science, limited research exists on how the nature of science influences the characteristics and content of oral and written discourse, what language processes scientists use to construct science and to inform different audiences of their work, and how these processes can be applied in science classrooms to promote science learning … (Hand et al., 2003, p. 609).*

The findings in this report add to this area of inquiry. Students who participated in the evaluation intuitively understood that science is about "doing," not "reading." The hands-on activities, multiple media, and multidisciplinary aspects of the curriculum worked together to foster a better understanding of scientific concepts. Nonetheless, as Hand and his colleagues point out, science cannot be "done" without reading and writing. All teachers in our study incorporated some aspects of literacy scaffolding and reading instruction into their teaching of the JMSC. The JASON Project might consider, however, adding more explicit directions concerning reading and literacy to the Teacher's Guide portion of the curriculum in order to help teachers maximize students' scientific learning.

Teacher quality

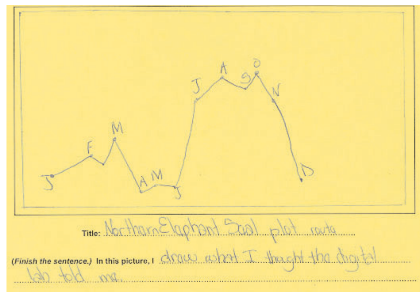
The No Child Left Behind Act of 2001 contains provisions that emphasize the role of teachers in closing the achievement gap in American schools. The Education Trust (2003) states, "Teacher quality is the single most important factor in determining the success of children in school, more than race, poverty, or any other outside influence" (p. 2). This is especially true for teachers serving academically at-risk or special education students. According to the Education Trust, there are disproportionate numbers of uncertified, out of field, or inexperienced teachers being assigned to schools and district serving poor and minority students. Most schools serving underserved students lack effectively trained teachers, and adequate science and technology resources, including a lack of quality multimedia science curriculum materials shown to foster inquiry-based approaches for teaching and learning. For example, one report claims: "One of the most important causes of African American students' low achievement in school is inappropriate teaching strategies which make it difficult for them to reach their full potential, thus alienating them from school" (Teel, et al., 1998 cited in Songer, Week, & Kam, 2002). Moreover, students eligible for free and reduced lunch had lower scores on the 2000 NAEP science assessment than in 1996, and in grades 4 and 8, students in central city locations had among the lowest scores (U.S. Department of Education, 2001). There is clearly much more to be done in finding qualified science teachers for students, especially for minority and low-income students, special education students, and academically at-risk students.

Science educators today face mounting pressures not only to adhere to state science standards and frameworks but also to create rich opportunities for students to explore scientific content and concepts, think critically, and use technology to facilitate project work (Yeh, 2001). How teachers accomplish this, given the barriers they face, such as inadequate preparation to teach inquiry-based science (National Science Foundation, 1996), requires a constructive response. One approach is to engage students and teachers in multimedia projects embedded in real science explorations. In this model, teachers can learn alongside their students how to apply inquiry-based pedagogical methods and how to manage and guide projects that employ multiple media. Such projects provide intellectual and material scaffolding for teaching with new media in an educational climate that stresses traditional accountability measures while also demanding technology-integration.

The JMSC is such a response. It offers teachers and students a unique opportunity to learn about how the earth and space systems support life and about the technologies used to study the earth-space system. It provides educators and students with high quality materials that help meet this challenge. The components of the JMSC, namely, the multiple media, the hands-on inquiry activities, and the multidisciplinary aspects of the curriculum, act in concert to reach different kinds of learners. Moreover, the components feature professional scientists and other experts engaged in scientific work, thus exposing students to different scientific fields along with the tools and technologies used in those fields.

Teachers who use JASON Project materials appreciate the JMSC as a rich and flexible resource for teaching and its alignment to national and state standards. Teachers are able to adapt the curricular activities to tailor them for their particular students. Teachers are supported in this effort by the way the curriculum is structured. In the JASON context, teachers see themselves as learners and are excited about the benefits they believe JASON provides for their students as well as for themselves. They feel supported to use technology in the classroom. Further, they value the hands-on activities, and the connection to a community of researchers.

In our second year evaluation of the JASON Project (Ba, Admon, & Anderson, 2002; Ba, Goldenberg, & Anderson, 2002), most JASON-using teachers clearly indicated that the JMSC had a powerful impact on their teaching practices in the following ways. The project (a) introduced them to technology integration; (b) provided the benefits of a well-integrated multimedia curriculum; and (c) made classroom management easier. The findings from this evaluation show that the JMSC equally impacts students in a positive manner.



"Northern Elephant Seal plot route:"
In this picture, I draw what I
thought the digital lab told me.
[Grade 7, Hope Middle School]

CONCLUSIONS AND RECOMMENDATIONS

This report offers a view of the processes involved in teachers' use of the JSMC in diverse classroom settings, and of the program's impact on students. To investigate how the JMSC impact students' science literacy, it was critical to have students at the center of this year's evaluation and find out from them how the JASON curriculum fosters their interest in, and perception and understanding of, science. The report outlines the aspects of the JMSC that students experienced and valued in their schools and classrooms.

Our work has shown that the JASON Project, comprised of an interdisciplinary, multimedia science curriculum, not only engaged diverse students in science learning in ways that students themselves found more powerful than the typical science classroom, but also taught students 21st century skills. Most importantly, the curriculum broadened students' perspectives about what constitutes scientific experimentation and exploration, what real scientists are like, and the value of learning science in their own lives. These aspects of learning science in the upper elementary and middle grades are important, and supply a critical link between diverse groups of students and the field of science.

The evaluation substantiated teachers' claims about the positive impact of JMSC materials on their students. Moreover, our research over the last three years has consistently shown that JASON curricular materials engage different types of students and teachers. In addition, as we showed in the discussion section, these findings are supported by the bodies of literature in scientific literacy for all as well as learning environments and teacher quality.

Recommendations

Over the past three years, the JASON Foundation for Education has proven to be responsive to evaluation findings and subsequent recommendations. In order to continue to broaden the impact of the JMSC on diverse classrooms, we propose the five recommendations below.

- Because, as we have shown, literacy is a key element of scientific literacy, we recommend that the JMSC include more explicit literacy strategies into the Teacher's Guide as well as in the local and national teacher professional development efforts. For example, the JASON Project should provide a list of activities such as word walls, using chart paper effectively in the classroom, and creating scaffolding tools such as graphic organizers.
- The JASON Project should disseminate more widely Primarily JASON, a guide to adapting JASON for younger learners. Teachers at Pine Mountain School used the document and found it to be extremely useful in modifying the curriculum for all of the at-risk learners at the school, up to the 8th grade. Teachers at other sites, who taught students with special learning needs or at-risk students, were not aware that this document existed and suggested that such a document be made available.
- To help students remember the various scientists and experts that take part in the year's expedition, we recommend that JASON make available large posters of the researchers' pictures and biographies for classroom use.
- We continue to recommend that JASON make scholarships available for teacher attendance at NEC.
- Due to the problems that schools had this year accessing the JASON website, we recommend more site-based user testing before launching changes to jason.org.

In sum, special attention ought to be given to providing ways for diverse students, i.e., at-risk, gifted and talented, and students who receive special education services, as well as students in heterogeneous mainstream classrooms, to access the JMSC content and concepts.

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APPENDIX : INSTRUMENTS

1) Student Content Activities (Kelp, Seals, Land Movement)

2) Student Visual Feedback Survey

3) Interview Protocols (student focus group, second student interview, teacher interview, administrator interview)

4) Classroom Observation Protocol

Kelp Forest Research Expedition

You are a JASON scientist who studies kelp forests.

Your Research Question:

What is the health of the Tasmanian Kelp Forest?

In order to answer your question, you will need to think about what data you want to collect and the tools you will use to study your question.

The documents we've included in this Expedition Planning Notebook will help you do your research.

Good Luck!

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Part 1: What do you want to monitor?

Here is a picture of the kelp forest in Tasmania, Australia. It looks good, but satellite photos from past years show that the size and number of kelp beds have dropped dramatically. There is no long-term monitoring project.

Your job is to study this kelp forest and determine how healthy it is this year. Since you are only going to visit the forest for a short time, you can only study a few things.

Brainstorm: Starting your Research

We know a few things about this kelp forest already. In the past few years, scientists have noticed several things:

1. *A warm water current from Eastern Australia has raised the temperature of the ocean in this area.*
2. *The number of black sea urchins has increased.*
3. *A type of Japanese kelp has entered the area.*
4. *There has been an increase in commercial fishing.*

What questions could you ask to help you start your research? Write those questions below.

Research Questions

Example Question: *Is the high temperature killing the kelp?*

1. ____

2. ____

3. ____

4. ____

5. ____

Part 2: Kelp Forest Research Project Equipment List

Now that you know what questions to ask, it's time to plan your research! Put a check next to each tool you think you will need. Then describe how it will help you do your research.

Bring it? (If so, put a √)	Tool	How it will help you do your research
Example √	**Remote Controlled Airplane** (UAV)	*I can use it to take pictures above the ocean and collect information about the canopy layer of the kelp forest.*
	Thermometer	
	Quadrat and Transect	
	Remote Operated Vehicle (ROV)	
	Microscope	
	SCUBA equipment	

Is there anything else you think you should bring for your research?

Part 3: Planning Your Research

You are almost ready to go!
Now that you know what equipment you need, it's time to plan your research. Answer the question below.

Question: *How will you use the tools in your equipment list? What do you hope to learn with them? Discuss at least two of your tools.*

Part 4: What do you know?

Before you go on your trip, tell us what you know already about kelp forests.

☺***Thank you for your help!*** ☺

EDC Center for Children and Technology

Operation S.O.S
(Save Our Seals!)

You are a JASON scientist and are going out to help other scientists study a group of Hawaiian Monk Seals on an island.

Your Research Question:

Why are the Hawaiian Monk Seals dying?

In order to answer this question, you will need to think about what could be harming the seals, and the tools you will use to study the problem.

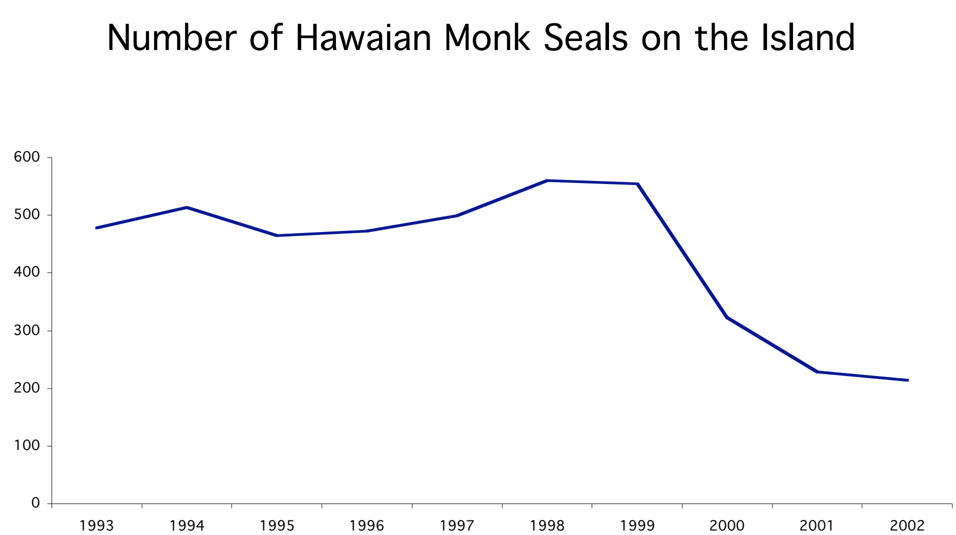
The documents we've included in this Expedition Planning Notebook will help you do your research.

Good Luck!

Part 1: The Problem

On the left is a photo of some Hawaiian Monk Seals. Cute, huh? On the right is a photo of the island where you'll be going for your assignment.

As you can see from the graph below, the number of seals on the Island has dropped since 1999. Scientists are worried that if this continues, the entire population of seals on this island may soon be gone.



Part 2: Brainstorm: Starting your Research

We know a few things about the island already: Around the time that the Monk Seal population started declining, several things happened:

1. *Scientists recorded extremely warm ocean temperatures in the area.*
2. *A fishing company started fishing these waters.*
3. *An oil tanker sank not too far from the island.*
4. *Scientists started noticing larger numbers of whales in the area.*

What questions could you ask to help you start your research? Write those questions below. Consider questions about the seal's predators, their food supply, and their ecosystem.

Predators
Example Question: Are more animals eating the seals? **1.** **2.**
Food Supply
1. **2.**
Ecosystem
1. **2.**

Part 3: Planning Your Research

You're almost ready to go!
Now that you know what questions to ask, it's time to plan your research! Look at your equipment list and answer the question below:

Equipment List		
Charts	Maps	Quadrat
SCUBA gear	Animal Tags	Transect
Thermometers	Satellites	Binoculars
ROVs (Remote Operated Vehicles)	Scat & Stomach Analysis Tools	UAVs (unmanned aerial vehicles)
Is there anything else you thing you should bring for your research? If yes, write them below.		

Question: *How will you use the tools in your equipment list and what do you hope you'll learn with them? Discuss at least two tools. (You can continue writing on the next page.)*

The activity continues on the back page.

Part 4: What do you know?

Before you go on your trip, tell us what you know already about pinnipeds like the Hawaiian Monk Seal.

☺**Thank you for your help!** ☺

EDC Center for Children and Technology

Geologic Research Expedition

You are a JASON scientist and are going out to study the land movement of a coastal area.

Your Research Question:

What has the land movement been in this area?

In order to complete your mission, you will need to think about the tools you will use, and how you will go about studying the area.

The documents we've included in this Expedition Planning Notebook will help you do your research.

Good Luck!

EDC/Center for Children and Technology 96 Morton Street, New York, NY, 10014

Part 1: Your Equipment

Here is a satellite image of the area you will be studying. As you can see, there is evidence of land movement—mountains, islands, and ridges along the coast.

Part of being a good scientist is knowing what tools you will need for your trip. The equipment chart on the next page will help you plan for it.

Directions for Filling out the Equipment List on Page 2

1. *Put a check next to each tool you think you will need.*
2. *Describe how it will help you do your research.*
3. *Add any other tools to the list you think you may need.*

Expedition Planning Notebook

Equipment List

Important to Bring? (If yes, put a √)	Tool	How it will help you do your research
√	Submersibles (submarines like "Alvin")	I'll travel to the ocean floor, observe, and collect samples to learn about the rock formations under water.
	Rock Drill	
	A magnetometer and computer	
	Models	
	Maps	

Example

Is there anything else you think you should bring for your research?

Part 2: Your Research Plan

You're almost ready to go!
Now that you know what equipment you need, it's time to plan your research! Choose at least two tools from your equipment list. How will you use them to learn more about land movement in your area?

Part 3: What do you know?

Before you go on your trip, tell us what you know already about land movement.

☺***Thank you for your help!*** ☺

EDC Center for Children and Technology

STUDENT VISUAL FEEDBACK SURVEY

Student Feedback on the JASON Project

Answer the questions to the best of your ability. There are no right or wrong answers; this is not a test.

1. **In the box below, draw a picture of you, doing the JASON activity you enjoyed the most. Give your picture a title and then write a sentence about the picture. *(You may also use words in your picture.)***

Title: ……………………………………………………………………………………….

(*Finish the sentence.)* In this picture, I ………………………………………………………………………………………

…….

…….

…….

2. **Would you like to do JASON again next year? *(Circle one)* YES NO**

Why or why not?…….

…….

…….

☺***Thank you for your help!*** ☺

EDC Center for Children and Technology

STUDENT FOCUS GROUP PROTOCOL

The Class & JASON

1. What other classes/subjects do you have? (*On board/post-it paper, list the students' main subjects*) Rank these subjects in your head. 1=favorite, 5=least favorite. (*After a minute*) How did you rank science? *Write on chart paper*. Why did you put science where you did?
2. What kinds of things do you do during the science period? / how would you describe a typical science period?
3. How do you like your science class? What's the best thing about it? Worst?
4. Is this JASON stuff any different from the other stuff you've done? (probe for examples, activities, reactions)
5. Do kids outside your class know about this JASON stuff? Do you talk about it? What do you say about it?

Impressions about Science

1. What do you think science is?
2. What does it look like when a scientist is working? What do scientists do? *Then:* What does it look like when a JASON scientist is working?
3. This year JASON is studying a group of islands off of California. What kinds of questions would a scientist ask about a group of islands? If you were a scientist, what kinds of things can you imagine doing to study the islands?

Student Identification w/ Science

1. Does science have anything to do with your own life? How?
2. What does a scientist look like? *Then:* What does a JASON scientist look like?
3. Can you imagine being / would you like to be a scientist?

Wrap Up

1. You've been great, and we've talked about a lot. Is there anything we missed / you want to add? Do you have any questions?
2. Thank you for taking the time to talk with us.

SECOND SITE VISIT INDIVIDUAL STUDENT INTERVIEW PROTOCOL

1. Student Engagement

- Let's say that I am/we are new students in your class and your teacher asked to you to explain the JASON project to us. How would you explain it?

- Tell me about one JASON activity that you remember. (What did you like about the activity? What didn't you like about it? I.e. working with my friends, reading the book)

- What other kinds of activities do you do with JASON?
    1. Using the computer (digital labs, electronic journals, message boards, poster research projects, other)?
    2. Reading novels?
    3. Watching videos?
    4. Attending the Live Expedition?
    5. Doing individual research projects?

2. Student Learning

- Is doing JASON different than what you learn in your regular science class? If so, how?

- Has your picture of what a scientist looks like and does changed since doing the JASON project? How?

- Does anything you do outside of school ever remind you of something in the JASON project?

TEACHER INTERVIEW PROTOCOL

1. What do you think are some of the most effective means (strategies?) for teaching science? (or how would you describe your approach to teaching science?)

2. What do you want your students to understand about science? How does Jason support your approach to the teaching of science? Is there anything unique about JASON that you can describe to us (what is the value that JASON adds for students, as opposed to other science curricula)?

3. What are the ways that you've seen your students learn best? How does Jason play into this? How does JASON's approach affect student learning? (how does it support student learning?)

   How do you think the specific JASON components (e.g., video, digital labs, other online activities like live chat & message boards, live broadcast, hands-on, other print curriculum) play into this?

4. Have you noticed changes in your students that you think relate to JASON?

   Can you think of any past students who reacted in a strong manner to JASON, either positive or negative?

   Tell us about a success in student learning that you think may be somehow related to Jason.

   Have you seen JASON have an impact on any students in particular? Can you tell us more about that?

5. Have you noticed any changes in classroom dynamics since you started using JASON? For example, is classroom management more or less difficult, how does it affect student interaction, do certain students get left out or left behind? What particular aspects of JASON do you think cause these differences?

6. Can you talk about the ways, good or bad, that JASON has affected your students? For example, science knowledge, scientific inquiry skills, use of technology, interest in science or other subjects, confidence, enthusiasm, creativity, learning process, grades, performance, curiosity, etc.

   How have these effects spilled over into other subjects (perhaps because of interdisciplinary approach)?

   Can you describe your current class/current students to us? Can you recommend particular students for us to talk to or keep an eye on?

7. Have you experienced any obstacles in implementing JASON? Can you talk about these specifically in terms of how these obstacles impact students' ability to get the most out of JASON/ student learning with JASON? For example, lack of supplies, lack of time flexibility, access to tech, level of reading comprehension, etc.

8. Describe how you assess what your students are learning in terms of JASON?

   Is it different from how you assess your students outside of JASON?

9. If you were evaluating JASON, what would you look at to see JASON's impact on students?

10. Do you have any recommendations about the design, content, etc. of JASON that would increase its impact on students?

11. Anything else you want to tell us about Jason?

ADMINISTRATOR INTERVIEW PROTOCOL

1. How did JASON come to your school? How long has it been used?

2. Can you describe the technical infrastructure of your school …
   - Present state / Funding/History/Future goals

3. Has involvement in the JASON Project spurred tech infrastructure development?

SCHOOL AND COMMUNITY

4. What makes your school special?
   - Special advantages?
   - Special challenges?

5. Can you describe the community your school serves?
   - rural/urban/suburban
   - ethnic
   - income levels
   - parental involvement with school
   - students' family lives
   - are students all from local community or are some bused in?
   - other

6. What has been the reaction to JASON in the school?
   - Administrators
   - JASON teachers
   - Non-JASON teachers
   - JASON Students
   - Non-JASON Students
   - Parents

ASSESSMENT & EVALUATION

7. How is science evaluated in your school district/state? (grades tested, kind of test)

8. How does your school district/state evaluate schools?

9. Has this been constant for a while or recently changed?

10. Describe any new initiatives, reforms etc. that have been implemented in your school.

11. Have these initiatives, or forms of evaluation had an impact on the implementation of JASON? (i.e. is it more difficult for teachers to integrate JASON and partake in new initiatives?)

12. How does your school stand in terms of performance?

13. How does the school rate in relation to other schools in district?
    - Is the school: Improving | Declining

14. Has involvement with JASON had an impact on performance (i.e. do JASON classrooms perform better or worse?

STANDARDS

16. Briefly describe the kinds of standards your school and students are required to meet.

17. Is it more or less difficult for teachers to integrate JASON and meet district or state standards?

CLASSROOM OBSERVATION PROTOCOL

JASON Story/Activity(ies)

Goals of activity (if stated by teacher)

Total number of students: _________

Females _____ # Males _____

Brief description of students:

Sketch of Classroom (indicate location of students, teacher, technology and other resources):

Descriptive Snapshots taken in 15 Minute Intervals

#	Time Strt	Description of Activities Observations…	Comments…	Quick Code Summary* (check if occurring)
				o S: working in groups o S: groupwork with tech o S: design/produce w/ tech o S: research w/ tech o S: communicate w/ tech o S: presenting/teaching ------------ o T: lecturing o T: Introducing concepts o T: open-ended questioning o T: demoing tech o T: reviewing/reflecting o T: guiding exploration o T: adapting to stu needs o T: consulting stu grps ------------ o J: video o J: hands-on activity o J: tech: digital lab o J: tech: message board/chat o J: research o J: Science o J: Math o J: Lang Arts
				o S:working in groups o S:groupwork with tech o S:design/produce w/ tech o S:research w/ tech o S:communicate w/ tech o S:presenting/teaching ------------ o T: lecturing o T: introducing concepts o T: open-ended questioning o T: demoing tech o T: reviewing/reflecting o T: guiding exploration o T: adapting to stu needs o T: consulting w/ stu grps ------------ o J: video o J: hands-on activity o J: tech: digital lab o J: tech: message board/chat o J: research o J: Science o J: Math o J: Lang Arts