ScienceQuest: Literacy Development Within an Informal Science Education Initiative

An Invited Article

Judith M. Zorfass
Jennifer Dorsen

Abstract

This article describes ScienceQuest, an informal science education program in which small teams of young adolescents meet at community technology centers to investigate science phenomena through "I-Searches." Volunteer coaches create opportunities for teams to explore different areas of science until they find a question they care enough about to investigate; help teams develop a plan for gathering information by reading, watching, asking experts, and doing activities (e.g., carrying out experiments, going on field trips); support information gathering; and help teams construct a website as the culmination of their I-Search.

The article describes the I-Search process; how the approach links to U.S. national standards in science, literacy, and technology; its impact on young adolescents; and common challenges faced by coaches. We also use case data to bring ScienceQuest alive in two ways: the "scrapbook" details one team's effort during the pilot year of our project, and additional short vignettes provide "snapshots" of other teams. We close with an invitation to readers to join ScienceQuest.

Related Postings from the Archives

- I Read, I Learn, iMovie by Randy Yerrick and Donna Ross
- Learning on the Web by John McEneaney
- Dot.com Lessons Worth Learning by Martha Rapp Ruddell
- Space-Age Technology by Joan Maier and Judy Lucas

Introduction

Interviewer: What was your Destination Galaxy website about?

Kevin: It is about aliens and Neptune. I did the aliens part and Winston did the Neptune.

Interviewer: Aliens? Did you find them?

Winston: We did not find them, but we found out some things on the Internet. It is like some people say it is false and some say it is true.

Interviewer: Do you think they are real?

Kevin: Maybe. Well, you never know. So we started off writing down information that we wanted to put in and then we got pictures from all around the Internet -- space.com, that sort of stuff -- and then we put it all together, and then we did some drawings of it, and some imaginations, and some fun facts.

Kevin and Winston, both 11 years old, worked together as ScienceQuest team partners to construct Destination Galaxy. Their website was the culmination of an I-Search, the inquiry-based process at the heart of ScienceQuest, an informal science education project housed at Education Development Center, Inc. (EDC) and funded by the U.S. National Science Foundation.

ScienceQuest reaches out to boys and girls from diverse backgrounds who live in high-poverty urban areas. Currently the program is based in several neighborhoods in Boston, Massachusetts, USA, as well as in smaller cities in eastern portions of the state. By July 2002, we plan to have 10 sites in each of 2 additional cities, and to seed programs in 15 further cities around the United States.

ScienceQuest welcomes young adolescents from ages 10 to 14, regardless of their abilities and needs. The youngsters form teams of 2 to 6 members, some of whom may be succeeding in school, while others may be at risk of school failure or facing the challenge of disabilities. ScienceQuest teams meet after school and on weekends at community technology centers (CTCs). Some CTCs fall under the category of Neighborhood Networks located in low-income housing properties funded through the U.S.

Department of Housing and Urban Development (HUD); others are associated with informal education facilities such as Boys and Girls Clubs, technology museums, or community multiservice centers.

Each ScienceQuest team is guided by one or more volunteer coaches. Recruited from the neighborhood, local universities, and volunteer organizations, coaches include parents, college students, CTC staff, preservice teachers, and frequent CTC visitors. ScienceQuest supports coaches in many ways. For example, in addition to ScienceQuest-sponsored weekend training sessions, coaches can also take advantage of individualized training sessions provided by ScienceQuest staff at their center, subscribe to a listserv created specifically for communication among coaches, access technical assistance by phone or e-mail, and find resources at the ScienceQuest Online Resource Center. On an as-needed basis, ScienceQuest project staff also help coaches connect to on-call science experts and "tech doctors."

In spring 2001, 12 teams met at CTCs located in Greater Boston to participate in the pilot phase of the ScienceQuest project. Each team spent approximately 3 months exploring a "hot topic" in science, using the I-Search process.

Back to main menu

The I-Search Process

Definition, Origins, and Goals | Adapting I-Search for ScienceQuest | Connecting the I-Search to Standards

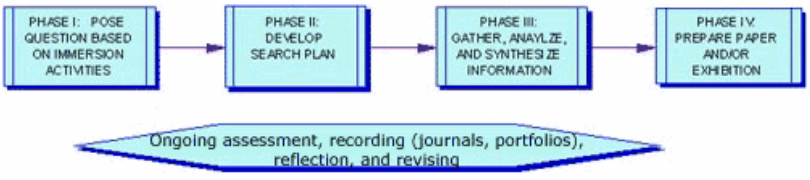
---

What Is I-Search? Definitions, Origins, and Goals

The goal of the I-Search process is to promote active, inquiry-based research as a way of learning and communicating knowledge (Joyce & Tallman, 1997; Kaszyca & Krueger, 1994). Active researchers are meaning makers and self-motivated inquirers, investigators, and seekers of knowledge. Macrorie (1988), who first coined the term "I-Search," defines inquiry as "a genuine itch" that needs to be scratched "until you've quieted it" (p. 100).

Based on Macrorie's work, EDC developed and tested a version of the I-Search process for middle school classrooms (Zorfass, 1991, 1996). In Make It Happen! interdisciplinary teams of middle school teachers (English language arts, social studies, science, mathematics, special education, and technology) work together to design and implement thematic, interdisciplinary I-Search units for 11- to 14-year-old students. As shown in Figure 1, the I-Search has four phases of inquiry.

Figure 1
Four Phases of Inquiry in the I-Search Process



In Phase I, teachers engage students in a wide variety of activities, immersing them in the unit's interdisciplinary theme and core ideas as a precursor to posing personally relevant I-Search questions. In Phase II, teachers guide students to develop plans for their searches that involve reading a range of print (e.g., books, magazines, newspapers, and reference materials either online or in hard copy), watching different media (e.g., videos, television documentaries, slide shows), asking people questions (e.g., through interviews, questionnaires, and surveys conducting online or in person), and doing something active (e.g., carrying out an experiment, doing a computer simulation, or going on a field trip). During Phase III, teachers support students as they gather information by following (and revising as needed) their plans and integrating the information collected from varied sources to make meaning. Finally, in Phase IV, teachers help students prepare a report or exhibition that identifies their search question, why the question is important to them, their starting point for research, the information-gathering strategies used, the knowledge gained and what it means to them on a personal level, and how they developed as researchers during the process. References and appendices are also included, as appropriate (Zorfass & Copel, 1998, excerpts available online).

Adapting the I-Search for ScienceQuest

While this structured approach worked successfully in diverse middle school classrooms (Zorfass & Copel, 1995; Zorfass, Morocco, & Lory, 1991; Zorfass, 2001), ScienceQuest project staff recognized the need to modify each of the four phases if I-Search was to be transported to an informal learning situation outside of school, where teams of students would work with volunteer coaches rather than teachers.

We sought ways to modify the I-Search effectively without violating any of the essential elements of inquiry. In Phase I, we retained the concept of having young adolescents explore various topics before agreeing as a team on an I-Search question to pursue. But since the teams would be meeting outside of the confines of a classroom, we recommended giving more weight to initial exploration activities that emphasized action -- for example, going on field trips, doing web searches, talking to experts, and carrying out experiments.

For Phase II, the process of developing a search plan was modified so that everyone on the team would contribute to a single work plan. Also, while teams would still be encouraged to read, watch, ask, and do, we again placed more emphasis on talking to experts, going places, and carrying out hands-on activities.

While Phase IV of the school-based version of the I-Search ended with students producing an oral or written report, in ScienceQuest the culminating product became a website. Each team would be given whatever assistance was necessary to complete construction of its site for publication on ThinkQuest, an internationally recognized Internet project that houses award-winning work from ThinkQuest teams around the world. Given the shift in the final product, we recognized that Phases III and IV were likely to merge. As team members collected and created digital content in Phase III (e.g., downloading material from the Internet, taking pictures using digital cameras, and organizing information using software applications such as spreadsheets), they would naturally be starting to build their websites for Phase IV.

Connecting the I-Search to Science, Literacy, and Technology Standards

We believe that, even within an informal education program such as ScienceQuest, the I-Search process must be a sound vehicle for helping young adolescents acquire concepts and develop, deepen, and expand skills related to science, literacy, and technology standards usually applied to more formal schooling. The U.S. *National Science Education Standards* (National Research Council, 1996) focus not only on development of concept knowledge in particular areas, but also on developing inquiry skills. Depending on the science topic they choose, members of ScienceQuest teams develop concepts as they confer with experts, engage in hands-on activities, and read and watch texts in various media. For example, one team in our pilot study learned about the properties of various materials by constructing a string telephone. Another team went after dark to the city's major park, the Boston Commons, to study the night sky through a telescope. In addition to developing concepts related to astronomy, they also learned about how technology tools such as a telescope can support the work of scientists.

Phase I immersion and Phase III information-gathering activities often require team members to measure, observe, sequence, categorize, and infer -- all inquiry-based skills identified in the science standards. For example, as spring broke through a cold Boston winter, one team explored by going outside to see if they could discover signs of re-emerging animal life. After collecting evidence through notetaking and drawing, they analyzed what they had found by making categories showing animals' winter survival skills (e.g., migration and hibernation).

Opportunities for literacy development closely aligned with the Standards for the English Language Arts (National Council of Teachers of English/International Reading Association, 1996) are interwoven throughout the I-Search process. Standards 7 and 8 are particularly relevant:

> 7. Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
>
> 8. Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

Each I-Search begins with exploration as a precursor to posing meaningful questions. The inquiry process depends on gathering information from a variety of sources. Because the ScienceQuest teams are based in community technology centers, there is ready access to the Internet, a key information technology tool. Team members become skilled at using search engines and directories to locate information. They also gather information by watching videos, listening to audio clips, and interviewing experts, in addition to reading varied print texts.

Further, ScienceQuest team members naturally carry out English language arts standard 11 as they "participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities." Team members collaborate to decide on a topic to pursue, they share share information, and work together to construct a website. They reflect on their individual contributions, as well as the functioning of the team as a whole.

Other English language arts standards from the National Council of Teachers of English/International Reading Association (1996) document focus on respect for language diversity and the use of each student's first language (English or any other) to develop content-based understandings. The ScienceQuest project also embraces this goal. For example, the team profiled in the scrapbook section later in this article developed a bilingual website, giving visitors a choice of text in English or Spanish. This honored and drew on the language strengths of the bilingual team members.

In the area of technology, the American Library Association and the Association for Educational Communications and Technology (1998) have developed "The Nine Information Literacy Standards for Student Learning". The design, construction, and mounting of ScienceQuest websites are examples of ways that team members meet these standards.

When young adolescents explore, make sense of information, and share what they are learning, they are developing knowledge, skills, and abilities that simultaneously address English language arts, science, and information literacy standards. The ScienceQuest informal learning process is a compelling example of authentic learning, grounded in the interests of young adolescents. And yet, as the examples below show, it also has the power to help youngsters attain additional standards that are valued outside of formal school settings.

Back to main menu

ScienceQuest Alive

The I-Search in Action | Scrapbook | Phase I (snapshots) | Phase II (snapshots) | Phase III (snapshots) | Phase IV (snapshots)

The I-Search in Action

This section of the article captures the I-Search process as it was carried out by teams in Boston-area community technology centers during the ScienceQuest pilot project. Five of the CTCs were located in HUD-subsidized housing, and one was connected to a multiservice community center.

Using attractive flyers posted in buildings and sent through the postal mail, staff at each CTC recruited youth, focusing on boys and girls who came regularly to the center's programs, lived in the neighborhood, and attended local schools. Overall, ScienceQuest team members were 34 percent Hispanic, 35 percent African American, 14 percent Asian, 12 percent European American, and 5 percent Haitian (estimated figures), and were split evenly between boys and girls. Based on informal reports from coaches, we estimate that about 20 percent of the total number of students exhibited a learning disability or might be considered to have attention-deficit hyperactivity disorder (ADHD).

To recruit coaches, ScienceQuest staff used the same strategies as the coaches used to attract youngsters. In addition, there was outreach to local universities and volunteer organizations. Of the 13 coaches who participated in our pilot, 10 were women and 3 were men. They were a racially diverse group: five were African American, six were European American, and two were Hispanic. Three coaches were parents of participants, six were CTC staff people, two were preparing to become teachers, and two were undergraduates at a nearby college.

In our virtual scrapbook below, we invite you to follow the work of one team from the pilot. The scrapbook provides a dynamic picture of how this highly motivated and successful group proceeded through each phase of the I-Search. We also provide "snapshots," short vignettes that capture specific activities carried out by other teams at each phase. Our goal in the next sections is to bring ScienceQuest to life for ROL readers.

Scrapbook: The High Point Village Team

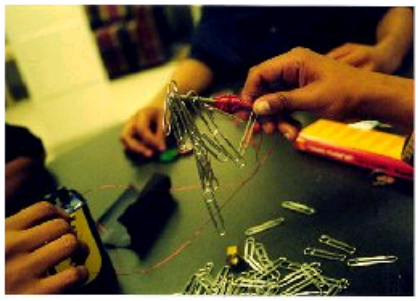
High Point Village is a HUD-subsidized, mixed-income housing development located in Roslindale, Massachusetts, close to the southern tip of Boston. An ethnically and culturally diverse community, it is home to many Hispanic families. For 4 years, High Point Village has operated a community technology center created through HUD's Neighborhood Networks initiative. The CTC offers adults computer classes and sets aside hours for open access to computers. It also provides 12 hours of youth programming per week, which include classes on webpage construction, homework assistance, use of academic enrichment software, journal writing, and computer arts projects.

High Point CTC staff Dana and Diana, shown at right, enjoy working with youth and watching them develop. They have told us that they like to understand how young adolescents think about the world and are fascinated by the questions they ask. Dana's interactions with youth are guided by her philosophy of valuing their existing knowledge. She explains, "Kids always come to something with prior knowledge, and you can't forget that. It might be an incorrect explanation [of a phenomenon], but you have to consider that in the equation when people are learning." Dana and Diana were excited about implementing ScienceQuest because it furthered their goal of helping youth learn about their world, appreciate science, and develop technology skills. They came to ScienceQuest with relevant experience: they had already coached a ThinkQuest Junior team to create a lively, animated website about Latin Dance.

Two high school students served as assistant coaches. Their motivation came from an interest in expanding their own skills, helping younger children, and receiving school credit for community service.

The High Point Village ScienceQuest team was born when four young adolescents from the housing development attended an informational meeting in March 2001. The team consisted of three 9- and 10-year old boys and one 11-year-old girl. All team members were Hispanic and spoke English and Spanish, although some had stronger English language skills than others.

Phase I: Immersion



As soon as the team formed, it plunged right into an immersion activity to begin exploring areas of science in order eventually to identify a topic of interest. The coaches handed out small toys, such as magnetic marbles, magnifying glasses, and prism slides, to each team member. They invited the boys and girls to "examine the object, play with it to learn how it works, and then describe what you found out to the others." Later, they asked, "What more do you want to know?" The assistant coaches kept track of the team's questions on a posterboard hanging on the wall. Before the session ended, team members recorded in their journals what they had learned and what more they wanted to know.

Over the next few meetings, the team continued to engage in activities and keep a running record of questions on charts and in journals. For example, in reflecting on the activity called "Magic Arcs," Darrius wrote as follows in his journal:

> I learned that when I look at one arc it looks bigger but there both the same. I would like to learn about optical illusions. Why are they different colors? I care about this question because I wont [sic] to learn.

In early April, the team took a field trip around the High Point Village neighborhood. Walking slowly through the housing development, their task was to discover signs of animal life in the just-thawed ground. Before the walk they had posed the following questions:

- How do animals spend the winter?
- What are they doing now that the weather is warming and the snow melting?

Barbie was particularly interested finding out about cats in the neighborhood. On a page prepared by the coaches for notetaking, she wrote "I learned more about nature. That cats are small animals. Why can cats fit in smal places? I wont to learn about it." Picking up on the growing enthusiasm spearheaded by Barbie, the coaches engaged the team in other activities related to the cat family, and particularly large cats. Dana recalled, "As we casually talked about how lions and domestic cats are related, Barbie had tons of questions, and her questions sparked more conversation with the other team members." They became fascinated with lions and passionate enough to agree on lions as the

topic for their joint quest. Dana smiled when she told us, "In retrospect, perhaps it was the lions who found the team." Naming themselves "The Mane Team," they were now ready to plan their search.

Go to snapshots of other teams at Phase I

Phase II: Planning

At a later meeting, the Mane Team discussed how to learn about lions by reading, watching, asking, and doing. Finding literature to read would not be hard: they could search the Internet, find newspaper articles, and the use the two online encyclopedias available at the CTC. One coach even suggested reading some of Aesop's fables to add a literary lion to the mix. But it was the "doing" part of the plan that most interested the team -- and for these children, doing meant going on a trip to the zoo. This field trip became the top priority on the team's search plan.

Go to snapshots of other teams at Phase II

Phase III: Gathering and Integrating Information

The trip to the zoo was scheduled for May. Dana called ahead to arrange to have a zookeeper guide them through the lion section. In preparation, the coaches guided the team to gather preliminary information and develop questions to ask the zookeeper. In the encyclopedias and at relevant websites, the team found some good basic information. This became the springboard for brainstorming the questions they would ask. To add a bit of sparkle to the question-generating activity, the coaches supplied black paper and silver pens.

Belgianny was shy about his English and wrote his questions half in English and half in Spanish. Barbie's questions for the zookeeper spilled forth: "Is that lion a male or a female? What kind of lion is that? What kind of food does it eat? How much does it eat? Does it have a lote of babies? How could you tell if it is a male or a female just by looking at it?" In addition to being armed with questions, the team wanted to ensure that information would be recorded. This motivated an ad hoc practice session with the video camera, the technology tool of choice to document the visit.

No one on the team was disappointed when the day of the trip finally arrived. The zookeeper who served as a guide answered their specific questions. Team members recorded information by using the video camera to film their favorite animals, and supplemented this strategy by taking notes and drawing pictures. Later, back at the center, each team illustrated a favorite lion fact, annotating the drawing with informative captions.

As the team members expanded their knowledge about lions, they posed more questions. To continue gathering information, they returned to the reference materials and reviewed their video footage. The coaches integrated stories of lions into their activities by reading fables. Shortly after the zoo visit, the newspaper reported that one of the lions had died. The team was able to talk about this difficult aspect of the life cycle.

Go to snapshots of other teams at Phase III

Phase IV: Website Construction

As text and graphics were gathered and stored during Phase III, the team was also beginning website construction. But now, as the children officially entered Phase IV of the I-Search process, they faced a decision: Should they create the website in English or Spanish -- or both? This question emerged from a discussion of language use and comfort levels that involved not only the team members, but also members of their community. For example, Belgianny, whose first language was Spanish, was very shy about his written English. Because the goal of the website was to teach others about lions, the team decided to build a website with both an English and a parallel Spanish version. Although this would mean double the work, they agreed it would also mean double the payoff. They felt good about being inclusive, about ensuring that both English and Spanish speakers would be able to access and learn from their website.

Everyone had a role to play in constructing the website, based on her or his individual strengths. Delegated roles included writing the text in English, translating it into Spanish, creating the overall design, and planning the navigation and technical aspects. The completed website includes facts about lions, fables, information on conservation, information about the team, and a guest sign-in page.

Go to snapshots of other teams at Phase IV

Back to main menu

Evidence of Success

Across the 12 teams participating in our pilot study of the ScienceQuest model, we found evidence of success in five areas:

1. Development of inquiry skills
2. Development of science concepts
3. Development of literacy skills and knowledge
4. Development of collaboration skills
5. Development of technology skills around website design (many of these skills, especially those that apply to working with content, could be seen as literacy skills as well)

Table 1
Examples of Success from the ScienceQuest Pilot

Category	Example of Success
Inquiry skills	Team members demonstrated their ability to: · pose questions to launch their investigation · gather information by talking to experts who visited their CTCs, worked at museums or zoos, and provided expertise online · synthesize information gathered from varied sources
Science concepts	Team members developed knowledge related to: · animal life · astronomy · water quality and bacteria · uses of the elements in everyday life · ecology

	· conductivity
Literacy skills	Team members demonstrated their ability to: · extract information from books, articles, websites, literature available at science facilities · keep journals to record the inquiry process · organize information · present information in English and Spanish · provide oral explanations
Peer collaboration	Team members demonstrated their ability to: · take turns · share resources · take responsibility · negotiate (e.g., which questions to pursue, how to divide tasks, what the website should look like) · discuss information and help one another construct knowledge
Technology skills in website design	Team members learned how to: · create tables and charts using software tools · embed images using web composition tools · organize content · make links within their sites and to external sites · take audience needs into account · develop navigational structures

In addition to increased skills, the coaches also reported widespread development of positive self-esteem among team members. For example, according to one of the coaches, members of last year's ScienceQuest team became "famous" at their CTC for having completed websites on ecology and robots. While self-esteem is critical for all young adolescents, it is especially important for youth living in high-poverty urban areas. The overall sense of pride felt by these adolescents spilled over into the attitudes they were developing toward science and technology. For example, one girl expressed a keen interest in engaging in a new search for information on rabbits and constructing another website. Members of another ScienceQuest team asked if they could join this year's team to carry out another I-Search.

Our conversations with the volunteer coaches also revealed their own sense of accomplishment. Many coaches had no prior knowledge of the I-Search, and few (outside of the CTC staff) were skilled technology users or website designers. Yet all of the coaches either acquired the skills and knowledge needed to guide the teams or found new ways to access support and assistance. One of the most positive outcomes for the coaches was the joy they felt in seeing individual children flourish as learners and thinkers. This, after all, was what had motivated them to volunteer as coaches. The following quotes capture the perceptions of three coaches:

> For me it was watching Laura and her process. At first, Laura was timid with computers; she did not like computers. And now she gets online and has a ball. She is the happiest person. We told her and her team to take the AlphaSmart [portable keyboard] with them everywhere they go. Laura had that glow. She was so excited. (Adreene, Roxbury MultiService Center)
>
> They learned to work together, because they were from different backgrounds -- I mean ethnic backgrounds. It was fun to watch them growing together, from day one to now, the final celebration. This is the fun part. (Paul, Castle Square Tenants Association)

> What I liked so much about SQ is the way that we went about helping the kids learn how to ask questions. I think the biggest gift you can give kids is not giving answers but encouraging their questions. So if you can help them ask questions and then show them the way to find the answers, you are giving them curiosity!... That is what the quest is all about. (Dana, High Point Village Computer Lab)

Back to main menu

Challenges

The story captured in the scrapbook and supplemented by the snapshots makes the inquiry-based I-Search process look fairly easy. That is a tribute to the coaches, CTC staff, and the participating boys and girls who devoted time and effort to the project. But in reality, those carrying out a science-based search that culminates in the development of a website -- whether they are working in an informal setting or in a school -- find that they face a common set of challenges. Below we describe six fundamental challenges that we have found emerge time and again from setting to setting. The purpose of this section is not only to identify these challenges, but to provide insights about how coaches, teachers, and project staff can successfully overcome them.

Challenge 1: How do you help team members find questions they are passionate about so that the inquiry process can be sustained?

> A question that the learner is really passionate about is the engine that drives active research. The desire to investigate an intriguing question is at the very core of inquiry, active research, and the I-Search. We might assume that finding such questions would be a breeze for adolescents, considering their natural inquisitiveness and blossoming conceptual abilities (Lipsitz, Mizell, Jackson, & Austin, 1997). But our work reveals that while some youngsters are eager questioners, others have difficulty generating questions that stem from their own curiosity. This is not to suggest that they lack curiosity -- just that they have difficulty formulating questions.
>
> Adolescents engaged in an I-Search process are more likely to pose questions they are passionate about when their coaches and teachers immerse them in motivating activities in Phase I. These varied learning experiences should involve active experimentation, construction, and simple playing around with ideas, concepts, and phenomena. As part of the activity, coaches, teachers, and even peers should ask young adolescents to reflect on what they are doing and learning. They can help inquirers develop question-posing habits by inserting one simple question into each activity: "What more do you want to know?" By reflecting and posing questions after each Phase I immersion activity, team members are more able to pose a question they care about to launch their search.

Challenge 2: How do you find the right balance between inquiry and structure?

Inquiry is by definition an open, exploratory process. Thus, inquiry should be as unencumbered with constraints as possible. But at the same time, teachers want to provide the kind of support for carrying out an inquiry process that promotes success and prevents potential frustration. This is one sound reason for relying on a field-tested approach, such as the I-Search process. The I-Search process, with its four phases of inquiry, provides the kind of structure active researchers need for starting out on the inquiry pathway, proceeding through the gathering and organizing of information, setting a goal, and working toward a culminating activity in which the goal is realized.

When coaches and teachers make the I-Search process explicit to youngsters, the adults find that they are better able to create safe and supportive learning environments. The other side of the coin is figuring out how to avoid taking too much of a lead. When teachers or coaches are too directive, they can run the risk of robbing adolescents of a sense of ownership over the exploration process. It helps when the adults think of themselves as behind-the-scenes directors, mentors, or guides. By taking a supportive but secondary role, they are able to give adolescents control over their own searches, room to wiggle around content, permission to take some wrong turns, opportunities to follow some unusual pathways, and a chance to be self-directed learners. Yet, at the same time, by following the four-phase inquiry pathway, students cannot go too far afield. As a process, the I-Search offers learners built-in flexibility that fosters inquiry within safe boundaries.

Challenge 3: How do you access a rich base of materials and resources to support and enrich the inquiry process?

The inquiry process is resource hungry. Depending on the phase of inquiry, teams (whether in classrooms or less formal settings) need to access different types of materials and resources. For example, the materials and resources needed to carry out immersion activities might involve a trip (including free admission passes) to science museums, zoos, and aquariums; connections to scientists in person and online; raw materials and equipment for experiments; journals in which to take notes; books and articles to read; websites to visit; and so on. Once the children have generated the question that will guide their search, they need access to multiple sources of information -- websites, experts, videos, books, etc. When the time comes to design and construct their websites, coaches need to access material resources (e.g., web design tools) and human resources (e.g.,. technical experts and support staff).

Coaches and teachers need to think ahead about what is needed, where it can be found, what it might cost to acquire the resources (in terms of both money and time), and how to acquire these resources. The thinking-ahead part of the equation is critical. Nothing can dead-end a search process more quickly than not having the necessary resources in the right place, at the right time. Coaches and technology center staff report that when they reach out to colleagues, supervisors, families, board members, and the community (e.g., libraries, local businesses), they are pleasantly surprised to find them responding by offering materials, resources, and time and skills.

Challenge 4: How do you surround yourself with experts who can fill in critical missing parts?

The ScienceQuest process draws on people who have knowledge of science, technology, and inquiry, those who understand literacy development, and those who can work well with adolescents. We have not yet met a superhero who embodies all of these characteristics, but we have seen the power of collaboration. Every coach or teacher needs to seek out and invite in individuals who bring necessary skills and knowledge. In fact, this is one of the key responsibilities of the coach: to identify the missing pieces and find people who can supply what is needed. Ways to find collaborators include advertising in flyers, networking, talking about the project, contacting local universities, and having the students or team members help recruit talented and interested people. In addition, there are resources in the areas of science content and web development that coaches can find online and via e-mail.

Challenge 5: How do you determine how long to keep the process going?

When identifying approximate start and end dates for an I-Search project, coaches and teachers need to capitalize on the natural momentum inherent in the process. The challenge is finding just the right amount of time -- not cutting the search short or extending it too long. If too little time is set aside for the inquiry process, then adolescents will not be able to carry out all phases. If the process lingers too long, then inquirers can lose interest and abandon their work before it is completed.

While there is no fixed number of hours, days, or months for an I-Search, it seems that in the informal setting, 8 to 12 weeks of once-weekly meetings are needed. In middle school classrooms, 6 to 10 weeks seem more appropriate.

It is helpful if coaches and teachers take into account the following factors when they determine how long the project should run: age and number of participants, complexity of student-selected topic for the search, availability of materials and resources, amount of help and support available from others, and time of year. Some coaches have found that while all teams members came to the CTC during the winter months, voluntary attendance dwindled when the warm days of spring arrived. We have also found that initial estimates of time needed for the development of the website need to be multiplied by a factor of two or three. Even websites with only a few pages are labor-intensive endeavors. Coaches want to avoid having team members leave behind half-finished websites. It is too tempting then for the adults, instead of the adolescents, to complete the work, thus violating the learner-centered goals of the entire experience.

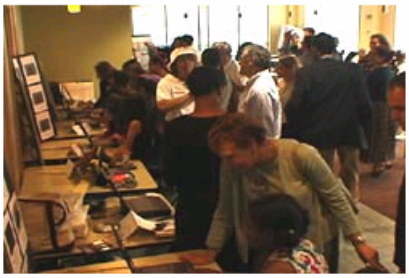
Challenge 6: How do you know when the work is good enough? What are the indicators of a "good" ScienceQuest team and project?

At minimum, "good" in a context of inquiry-based learning means that young adolescents on the team do the following:

- Generate science-related questions that are personally meaningful
- Gather information from varied sources
- Apply information-processing skills to integrate information

and make meaning
- Develop science concepts based on scientifically accurate information from a variety of sources
- Work cooperatively as a team
- Develop a website that clearly presents accurate information, has a clear navigational structure, and uses accepted language conventions

Setting and sharing goals and criteria for success serve a critical purpose. This way, coaches and team members know explicitly what is expected of them and can plan how to work together to toward a common outcome. Coaches are better able to determine what kinds of support their teams will need in order to be successful. For example, goals make clear what materials must be obtained, which experts need to be involved, what tools must be acquired, and what is expected for website construction. By the end of the project, team members should feel justly proud of their work -- work that required effort and thought, and that reflects real learning. When clearly stated goals are met, individuals develop an authentic sense of personal reward. This is the basis of developing self-esteem.



The purpose of describing how we have addressed basic challenges is so that others can benefit from the lessons we have learned that allow inquiries in classrooms, computer centers, and at home to be successful. Exploration can be exhilarating and gratifying for the adolescents involved, as well as for the adults who guide them. Having seen students' eyes light up with discovery, witnessed boys and girls united in learning about a topic, and noted how young adolescents puff up with pride when they give audiences a tour of their websites, we recognize how wonderful active research can be when it works well in an informal setting with the support of dedicated volunteers.

Back to main menu

An Invitation to Join ScienceQuest

If you are interested in implementing the ScienceQuest model in an after-school program, at a community technology center, or in your classroom, please do not hesitate to contact Jennifer Dorsen via e-mail at jdorsen@edc.org.

Back to main menu

References

American Library Association/Association for Educational Communications and Technology. (1998). Information literacy standards for student learning. In *Information power: Building partnerships for learning*. Chicago, IL: American Library Association.
Back

Joyce, M.Z., & Tallman, J.I. (1997). *Making the writing and research connection with the I-Search process*. New York: Neal-Schuman.
Back

Kaszyca, M., & Krueger, A.M. (1994). Collaborative voices: Reflections on the I-Search project. *English Journal, 83*(1), 62-65.
Back

Lipsitz, J., Mizell, H., Jackson, A., & Austin, L.M. (1997). Speaking with one voice: A manifesto for middle-grades reform. *Phi Delta Kappan, 78*, 533-540.
Back

Macrorie, K. (1988). *The I-Search paper*. Portsmouth, NH: Boynton/Cook.
Back

National Council of Teachers of English/International Reading Association. (1996). *Standards for the English language arts.* Urbana, IL/Newark, DE: Authors.
Back

National Research Council. (1996). *National science education standards*. Washington, DC: National Academy Press. Available: http://www.nap.edu/catalog/4962.html
Back

Zorfass, J. (1991). *Make it happen! Inquiry and technology in the middle school curriculum*. Newton, MA: Education Development Center.
Back

Zorfass, J. (1996). *Make it happen! Inquiry and technology in the middle school curriculum* (rev. ed.). Newton, MA: Education Development Center.
Back

Zorfass, J. (2001). Sustaining a curriculum innovation: Cases to make it happen! In J. Woodward & L. Cuban (Eds.), *Technology, curriculum and professional development: Adapting schools to meet the needs of students with disabilities*. Thousand Oaks, CA. Corwin.
Back

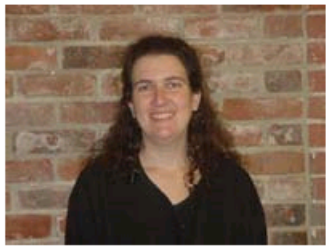
Zorfass, J., & Copel, H. (1995). The I-Search: Guiding students toward relevant research. *Educational leadership, 53*(1), 48-51.
Back

Zorfass, J., & Copel, H. (1998). *Teaching middle school students to be active researchers*. Alexandria, VA: Association for Supervision and Curriculum Development. Excerpts available: www.ascd.org/readingroom/books/zorfass98toc.html
Back

Zorfass, J., Morocco, C.C., & Lory, N. (1991). Make it happen! A school-based approach to integrating technology into the middle school curriculum. In: F. Betts & V. Hancock (Eds.), *Curriculum handbook*. Alexandria, VA: Association for Supervision and Curriculum Development.
Back

About the Authors

Judith Zorfass (e-mail Jzorfass@edc.org) is senior director of strategic planning and associate center director in The Education Development Center for Family, School, and Community. In her 15-year tenure at EDC, she has been principal investigator or project director for numerous research, curriculum development, product development, professional development, and dissemination projects. She is currently the principal investigator for the ScienceQuest project. She describes over a decade of work in implementing the I-Search in her book *Teaching Middle School Students to Be Active Researchers* (written with Harriet Copel, Association for Supervision and Curriculum Development, 1998). She holds a doctorate from the Harvard Graduate School of Education.



Jennifer Dorsen (e-mail Jdorsen@edc.org) is the project director for ScienceQuest. She has worked as a teacher, nonprofit administrator, trainer, and community organizer for over 15 years. She establishes partnerships among community-based organizations, including public access cable stations, start-up technology centers, and Boston Cyberarts, Inc. Other work includes teaching adults English as a second language, leading teachers in curriculum development and school reform efforts, and managing a political campaign in Somerville, Massachusetts. She holds a master of education degree from the Harvard Graduate School of Education and a Massachusetts Secondary English teaching credential. Between 1997 and 2001, she was on the board of directors and steering committee of the Community Technology Centers Network (CTCNet).

Back to top

Citation: Zorfass, J.M., & Dorsen, J. (2002, March). ScienceQuest: Literacy development within an informal science education initiative. *Reading Online, 5*(7). Available: http://www.readingonline.org/articles/art_index.asp?HREF=zorfass/index.html

---

Reading Online, www.readingonline.org
Posted March 2002
 ISSN 1096-1232