

**The Center for Informal Learning and Schools'
Informal Learning Certificate (ILC) Program:
Professional Development and Community for
Informal Science Educators Working with Schools**

An Evaluation Report

**Inverness Research Associates
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Overview of this Report

Inverness Research Associates served as external evaluators for the Center for Informal Learning and Schools (CILS) from its inception in 2002 as a National Science Foundation (NSF)-funded Center for Learning and Teaching. One of the programs that CILS developed was the Informal Learning Certificate (ILC) for informal science educators (mostly museum-based) who work with K-12 schools. Through this three-year commitment, which involved face-to-face workshops, conferences, and online communication, the ILC program aimed to provide participants with intellectual and professional grounding, community, and a range of tools to improve their work with teachers, students, and school systems. Three cohorts totaling 84 participants completed the ILC program.

Throughout the five years that CILS operated, Inverness Research conducted formative and summative evaluation activities both center-wide and specifically focused on the ILC. This report presents a summary of our view of the ILC, its impacts, challenges, and future opportunities. The report includes the following sections:

- I. Introduction
 - a. National Context – a dearth of professional development opportunities for informal science educators
 - b. Background about CILS and the ILC
 1. NSF’s Centers for Learning and Teaching Initiative
 2. Center for Informal Learning and Schools (CILS)
 3. The Informal Learning Certificate (ILC)
 - c. Evaluation
- II. Program Impact: The Value and Benefits to ILC Participants, Their Institutions, and the Field
- III. Challenges, Lessons-Learned, and Opportunities Going Forward
- IV. Appendix
 - a. Participant Vignettes – Rita Bell and Preeti Gupta

I. Introduction

National Context – a dearth of professional development opportunities for informal science educators

Throughout the United States, there are many types of science-focused informal learning institutions such as science centers and museums, zoos, aquaria, planetaria, botanical gardens, natural history museums, and children’s museums. Capitalizing on their unique talents for stimulating interest and engagement in science, these informal science institutions (ISIs) serve as destinations for school field trips and the general public, and increasingly, they are providing learning opportunities and resources for K-12 students and teachers through teacher professional development, classroom activities and curriculum, and web-based materials. Thus, there is a growing cadre of ISI professionals focusing their educational efforts on making more and better connections with schools, helping to increase the quality and quantity of STEM (science, technology, engineering and mathematics) learning activities for teachers and students.

Until recently though, there have been few opportunities for ISI educators to come together in collegial groups to develop their own professional skills and resources – particularly in the arenas of learning theory, inquiry methods, and workshop design. As with many professionals, museum educators are so busy “doing” their work, they often do not have the luxury of time or the financial/institutional support to contemplate and deeply reflect on their work, the theoretical basis for their work, and ways to improve it. Unlike for other professional groups such as school teachers, there is very little infrastructure in place for museum educators to improve the profession. An “improvement infrastructure”¹ is lacking. There are ASTC (Association of Science and Technology Centers) conferences with relevant workshops, but overall, there is a shortage of organized, in-depth, long-term opportunities for museum educators that would allow them to learn about the realities of “formal” education systems and policies, to be exposed to research and evaluation about formal and informal learning, and to acquire new strategies for working directly with teachers and students. Professional opportunities to reinvigorate, articulate and thereby

¹ The concept of an “improvement infrastructure” is discussed in Dr. Mark St. John’s policy brief, “Building the Foundation for Raising Student Achievement: Investing in an Improvement Infrastructure” on the Inverness Research Associates’ website at http://www.inverness-research.org/abstracts/ab_20071106_gdtf-policybrf.html. Although the article focuses on school systems, the improvement infrastructure concept applies to the informal science education field as well.

strengthen their informal and inquiry approaches to science education have been few and far between for museum educators. The Informal Learning Certificate (ILC) was created to address some of these needs.

Background about CILS and the ILC

NSF's Centers for Learning and Teaching Initiative

The Informal Learning Certificate (ILC) program came about as part of the Center for Informal Learning and Schools (CILS), one of the National Science Foundation's Centers for Learning and Teaching (CLT). The primary purpose of the CLT initiative, from our point of view, having studied several centers and the overall initiative, was to build the capacity of the STEM field to undertake future improvement efforts. That is, CLTs were not intended to provide direct services, but rather to build capabilities to provide services that support national, state, and local STEM education improvement efforts. The long-term goal was to build knowledge, resources, and leaders who could take the initiative in moving the country forward with respect to improving science and math learning for all.

Center for Informal Learning and Schools (CILS)

As part of that CLT initiative, CILS was funded for five years beginning in 2002 as a partnership between the Exploratorium, University of California Santa Cruz, and King's College London. CILS was established to "investigate the nature of informal science learning, and how informal science learning and institutions contribute to deepening engagement, interest, and understanding of science and science education."²

In addition to conducting research on informal learning and the connections between in- and out-of-school science learning, CILS provided: doctoral programs in developmental psychology and science education, a postdoctoral program, a fellowship for natural science doctoral students interested in education, and an annual conference in San Francisco called the Bay Area Institute which brought together researchers and practitioners from the field. To provide leadership and professional development for the museum-based teacher educators, CILS established the Informal Learning Certificate (ILC) program. The three cohorts represented 57 different institutions from around the world.

² Description of CILS by CILS Director, Bronwyn Bevan, July 2007. For more information about CILS, see their website at <http://qt.exploratorium.edu/cils/page.php?ID=23>.

The Informal Learning Certificate (ILC)

As a three year program for informal science educators, the ILC was built around four core workshops, each lasting four to five days. Participants' expenses to come together were paid for through the CILS grant. Workshops focused on particular topics (e.g. learning theory, professional development design, inquiry methods of learning and teaching, and education and school policy). The workshops involved guest leaders from the field such as George Hein (Lesley University), Barbara Rogoff (University of California Santa Cruz), Hubert Dyasi (City University New York), Maria Lopez-Freeman (University of California Los Angeles), Richard Duschl (Rutgers University), and Suzanne Wilson (Michigan State University), as well as the Exploratorium's own Institute for Inquiry and Teacher Institute staff. Most workshops took place at the Exploratorium and occasionally at other institutions around the country. As part of the program, ILC participants also attended and were encouraged to present at the Bay Area Institute each year. Online reading groups discussed current and seminal research and policy studies. An electronic network, a listserv for the ILC, was established and continues to be active.

The ILC program was designed to address the need for professional development of museum educators – those ISI-based practitioners who work with teachers and schools – thereby helping to build the capacity of the informal science education field to better serve schools and to strengthen science teaching and learning in their communities. As the CILS' website states, "The goal of the program is for participants to design and lead stronger, more strategic programs that build on the particular strengths and affordances of informal settings to support the needs and strengths of formal science teaching and learning."

The professional development needs of these ISI-based educators are unique. In the words of CILS Director, Bronwyn Bevan, "They need to be knowledgeable not only about science, exhibits, informal contexts, workshop design, and adult learning; they also need to understand education policy, partnerships, classrooms, issues of cultural and linguistic diversity, child development, and assessment. This knowledge, moreover, needs to be consistently current to maintain credibility in the school world." Thus, an important component of the ILC has been to help build an ongoing professional network that reaches beyond the three year ILC program. As Bevan articulated:

Participants will be part of a sustainable community that deeply understands pressing issues of science learning and education, and the policy and organizational opportunities that impact them. This group will lead the field's development of effective strategies to promote partnerships, programs, and policies that interweave ISIs in the local fabric of science education, making them integral parts of any community's efforts to build scientific literacy and capacity.

Evaluation

Inverness Research Associates served as the external formative and summative evaluator for CILS during its five years. We also organized a subcommittee of CILS Advisors (along the lines of a "Committee of Visitors" or "Review Panel" model) called the Center Review Panel. We assisted this panel of five leaders from the field³ in studying and providing additional independent feedback to CILS.

Specifically for the ILC strand of CILS, we (Inverness Research) observed and participated in ILC workshops; interviewed ILC participants and conducted focus groups; spoke informally with ILC participants at other CILS events; surveyed ILC participants in years two and four (2004 and 2006); interviewed staff; and monitored the ILC listserv. Two Center Review Panel members focused primarily on the ILC strand. They interviewed participants, observed workshops, spoke informally with participants at other CILS events, and helped analyze survey data. Inverness Research and the Center Review Panel both gave a great deal of formative feedback to the CILS staff which they incorporated along the way into the evolving ILC program. The following sections of this report highlight some of our combined summative findings.

II. Program Impact: The Value and Benefits to ILC Participants, Their Institutions, and the Field

Based on our five-year study and collection of data, as well as that of the Center Review Panel, we found the ILC to be of great value and benefit to participants and their institutions. Furthermore, we found the ILC to be an important model

³ The Center Review Panel included Leona Schauble, Jim Minstrell, Carol Lee, Alan Friedman and Hubert Dyasi. Each member brought a different perspective and expertise to their CILS review from their work in developmental psychology, professional development, science and mathematics learning, educational research, equity and diversity, schools, and museums.

of a program that contributed to the field. That is, it added to the improvement infrastructure for informal science education. We see the program's impacts falling into several main categories: personal and professional; programmatic (e.g., the number, quality, and reach of the participants' programs); institutional; and more broadly, impacts on the field. Before going into further detail about each impact, we first briefly outline key design features of the ILC that we believe led to its overall success and that could be useful for modeling future programs.

Key Design Elements of the ILC Program

The ILC had unique design features that evolved over time and were critical to the success of the program. Some of these elements were intentional, others were characteristic of CLTs more broadly.

- As part of CILS, the ILC created a **rich intellectual milieu** for professional exploration, teaching, and learning for museum educators and professional developers. ILC participants were challenged intellectually through activities, readings, and discussions, and throughout the program they “rubbed elbows” with university faculty, post doctoral fellows and doctoral students, nationally-renowned informal science institution executives, scientists, researchers, and policy leaders. The milieu or environment created through CILS and the ILC was one of active exploration, examination, and grappling with profound questions about the nature of learning, as well as pragmatic ways to improve informal science education's contributions to STEM learning.
- **Exposure to research**, and the relationships that developed between researchers and practitioners, created new knowledge and connections for the ILC participants that were unlikely to have otherwise happened.
- The **cohort model** – through which 30-35 ILC participants started the program at the same time and continued through the three-year progression of workshops together – proved to be an important feature of the program, as it strengthened both personal and professional bonds and created community.
- Participants were **thoughtfully chosen** according to their roles at their institutions and their potential as leaders in the field. In general, they were practitioners who would benefit most from this type of experience

and were likely to incorporate new knowledge, skills, and resources into their work.

- In each cohort, participants often **came in pairs** from their institution so that through their common experiences, they were more likely to share and support each other, and continue their development back at home.
- The ILC program series was a **developmental and progressive sequence of workshops** and professional development experiences, each one building on the other.
- Each workshop provided **time for discussion and reflection**; exposure to **current research**; and opportunities for participants to **share and critique** one another's programs and practices.
- The ILC program **built on previous work** of Exploratorium's Institute for Inquiry and Teacher Institute programs, both with long histories of doing inquiry professional development well. CILS built upon this legacy and used the knowledge gained through these programs wisely.
- Each year, ILC participants were involved with the **Bay Area Institute**, which extended and deepened their connections to the rest of the CILS network as well as with non-CILS participants from the fields of informal learning, science education, and K-12 education.
- CILS leadership also took advantage of common professional conferences such as Association of Science and Technology Centers (**ASTC**) to convene special meetings and social gatherings of ILC participants.
- There were **online reading and discussion groups** in between workshops.
- An **ILC listserv** evolved over the years to include all the ILC participants, and became more and more active as a place to share ideas, questions, announcements, and experiences. It remains a somewhat active and highly responsive listserv.
- The ILC worked to develop **hybrid leadership** – that is, people who are grounded in both informal learning and had knowledge of K-12 school realities, policies, and politics.

- The ILC program represented a **leadership development** strand of CILS that we see as consonant with CLT theory. The **multi-year involvement** and long-term connection to the Center (CILS) helped build knowledge, resources, connections, and leadership over time through shared experiences, and resulted in a network of leaders.

Personal and Professional Impacts

Our data show that the ILC program made significant contributions to the professional development of leading informal science educators. Many personal gains were also cited and valued by the participants. Survey results⁴ in 2006 from all three cohorts showed 96% of the participants rating their overall ILC experience, personally and professionally, as good or excellent.

In the survey, two participants summarized the significance of their experience by saying,

The workshops changed my life! It [the ILC] gave me much greater depth, insight, and a totally new way of looking at education. As a person who has been in this field many years, this brought me into the 21st century programmatically and educationally. I use this knowledge in every phase of my work now. Also the networking was invaluable. Through this, I broadened my range of programming and content, received validation, encouragement, and some great ideas.⁵

Being part of the larger community [CILS] – having opportunities to talk and discuss, learning new aspects and skills of the profession, and feeling part of a larger group of like-minded motivated individuals – gives me tremendous confidence and opens many more horizons for my learning and sharing.

In terms of the type of informal science educators that the ILC attracted, our surveys showed that ILC participants represented an active force of museum educators working with schools in a variety of ways:

- The majority of ILC graduates personally conduct more than six workshops with teachers per year.

⁴ Inverness Research conducted two online surveys of ILC participants – one in 2004 (N=50) and one in 2006 (N=64).

⁵ The quotes in this report came from surveys, interviews, and focus group discussions. In some cases, they have been lightly edited for clarity and to maintain anonymity.

- The great majority of ILC graduates work with more than 50 teachers per year (and nearly half worked with more than 100).
- The types of programs or workshops that ILC graduates conduct include:
 - One-day content/pedagogy workshops (76%)
 - 3-4 hour content/pedagogy workshops (65%)
 - Several-day content/pedagogy workshops (59%)
 - 1-2 hour content/pedagogy workshops (57%)
 - Field trip orientations (41%)
 - Week-long content/pedagogy workshops (39%)
 - Multi-week content/pedagogy workshops (24%)
- The types of teachers they worked with range from Pre-Service (67% of ILC participants work with Pre-Service teachers) to Post-Secondary (26%), and included other types of educators as well. The majority of ILC graduates worked with Middle/High School and Elementary School students (91% and 89% respectively).

These museum practitioners, many of whom were the directors of education departments in their institutions and who designed and provided professional development for teachers as part of their work, became more sophisticated in their understanding about ways their work can contribute to informal and formal science education. They were also clearly growing in an intellectual and professional sense, taking advantage of the learning opportunities afforded them by the CILS program. As the Director of CILS, Bronwyn Bevan observed:

The [ILC] community, which has blended to include all three cohorts, has become incredibly supportive of one another, raising people's professional profiles, aspirations, and practices.

That sentiment was reflected in the following participants' statements:

The ILC community provided me with resources - a wealth of opportunity and information - for how to create meaningful and effective professional development for teachers. I can send out a message on the list-serve and get 25 answers from different institutes that all might be grappling with the same problem. I have made contacts, through the ILC, with leaders in the field of education (both informal and formal). These contacts will open many doors when I look for professional growth in the future.

The opportunity to work with other professionals in this field is phenomenal. We are all so isolated, geographically and professionally. When we get together, we

learn that our problems are universal and can be solved in a variety of different ways.

A first cohort participant who later was invited back as a guest speaker in an ILC workshop, spoke of the significant impact this way:

As I have become involved in CILS ILC, first as a participant and now as a discussant, I have moved from feeling like an outsider in professional development, to feeling like a skilled practitioner, to feeling like a part of a national community of leaders in the field. Without the jump start from CILS I would have put my head more into the sand of my daily work instead of trying to change some of the things about how we were working with teachers that were discouraging me at my institution.

ILC graduates benefited in numerous ways by the exposure to research they received through the program. According to our surveys of ILC graduates:

- 92% said they became familiar with key research in the field that they didn't know about previously
- 84% said they learned of research findings relevant to their own setting
- 74% said they connected with others interested in research about their field
- 70% said they put research findings to work in their own setting
- 58% said they became better able to communicate to colleagues outside of CILS the uses and value of research
- 54% said they were better able to judge the relevance of research to their field due to their CILS/ILC experiences

Illustrating the value of this kind of exposure to a research-rich milieu, the following participants stated:

CILS has provided me with great opportunities to work with very knowledgeable and inspiring professionals – educators, researchers, evaluators, and administrators, as well as graduate students and post-doctoral students. I feel the exposure to learning theory, school policy, in addition to the already mentioned benefits of delving deeper into inquiry, have led me to a deeper understanding of education in our society, both in the past and the present. I have brought those ideas back to my institution, and hope to be able to explore more about these critical issues with my colleagues, so that we can all share a stronger foundation on which to build.

The people I met in the ILC community have made me feel validated in the work I'm doing. They shared brilliant insights which have come from their years of practice in the field. Since I came to this via a career in formal education, this group has helped steer me away from many pitfalls. Their passion for learning has inspired me. Though I often question researchers, they lead the way in identifying the things that truly are best practices.

Speaking of the ILC participants and impacts that the ILC had on those "practitioners", the Center Review Panel for CILS concluded:

Practitioners learned the language of researchers, and their new confidence in their understanding of basic learning theory and research prepared them to converse and even argue with confidence. In every case, the practitioners who were interviewed cited specific examples of having incorporated what they had learned (principally on the theory and practice of inquiry modalities) into their personal and institutional work, including their work with K-12 teachers.

Programmatic Impacts

From surveys, interviews, focus groups, and informal conversations with ILC participants, our data show that the ILC experience is having a positive impact on the quantity and quality of participants' programs back at their home institutions. For example, on surveys, most participants commented that they are in the process of improving their work with teachers, or increasing their work with teachers. Several commented that they have increased their focus on inquiry in their work with teachers, and have created programs that are much longer and deeper than they had previously. Moreover, some are now emphasizing data collection and incorporating research and research-based practices in their programs, which was not a consideration before.

Speaking of programmatic impacts spurred by their ILC experiences, participants said:

Teaching teachers is much more of a priority for my institution now, which has allowed me to spend more time developing relationships with schools and universities. We have developed an MOU with the university, whereby we can teach the methods courses and are working towards having student teachers within the museum.

The inquiry institute was a powerful motivator of change for me. It helped me put classroom instruction in a new context, which enabled me to reshape my professional development work with teachers.

We are now much more closely focused on inquiry and modeling good pedagogy.

Because of the ILC I now have an Inquiry Team. This team offers an average of 5 workshops per year at our museum on the use of inquiry. I also individually present workshops locally, regionally, and at the state level on the integration of inquiry, science, and the arts.

The work I do with teachers has changed as I have learned more about inquiry-based science, study-trip design and learning theory. The research has helped steer me in new directions and at times validated what I am doing.

We have moved from one-time three-hour programs paid for by individual teachers to grant-funded multi-year ongoing programs. Enrollments have grown from nearly zero to more than 100 teachers [annually]. I had already begun some of this transition at the time I joined CILS, but there is no question CILS has provided a lot of support for making this change.

Our survey results showed that programmatically:

- Nearly half of the ILC graduates reported that the amount of work they do with teachers increased since they started the ILC
- More than half reported that the type of work they do with teachers changed considerably since they started the ILC program
- A significant number of graduates reported that the ILC program contributed greatly to their changes in:
 - Vision or goals for their work with teachers (54%)
 - Priorities for their work with teachers (41%)
 - Ways they evaluated or assessed their teacher programs (41%)
- Fifty five percent of graduates said that the ILC contributed greatly to their leadership abilities and confidence in designing and implementing partnerships with local schools.

One ILC graduate summarized programmatic impacts this way:

The benefits are seen in the numbers. When I arrived at this museum from another museum, I had zero students and zero teachers in my programming. This school year my programming has brought in 6,300 students and I have trained

almost 200 teachers. There is usually a waiting list. It's not me. It's the power of the CILS and ILC programming.

Institutional Impacts

While perhaps harder to measure, beneficial impacts on the ILC participants' institutions were also in evidence from our surveys, interviews, focus groups, and informal conversations with institutional leaders (Executive Directors, CEOs, and other supervisors of ILC participants). These impacts included more motivated and empowered staff, increased connections with local schools and universities, increased numbers of programs offered, greater connection to a national network of ISIs and thus more recognition from their community/higher profile, as well as improved success with fundraising.

From our surveys, ILC graduates reported becoming empowered and motivated in their institutions through their involvement in CILS.

- 55% said that the ILC contributed greatly to their abilities and confidence to take on leadership within their own department at their institution.
- 60% said that the ILC contributed greatly to their abilities and confidence to take on leadership in their own institution beyond their department.
- 76% of participants reported that the ILC program to a great or very great extent contributed to their leadership in collaboration or partnership with other museums.
- And 80% said that they felt empowered to take on leadership designing and implementing partnerships with local schools.

Speaking about institutional impacts from CILS and the ILC, participants said:

CILS has brought both our professional development and education programs to a higher level of professionalism and a much deeper level of inquiry. The language of inquiry permeates what we do in senior staff planning and is working its way into the floor coordinators and even the volunteers. The CILS ILC program helped me shape a professional development program and proposal that brought more than \$1 million in professional development to the poorest district in our region. Beyond the specifics, it's very hard to measure or even describe how much it means that the two top-ranking education staff, the Director of Education and the Director of Professional Development, are both participants and now speak a common language, have read the same papers, and can now finish each others' sentences and collaborate easily around a common language and vision. It has

quite literally transformed each of us individually, our work relationship, and our Center [science museum].

I cannot begin to say how often I have given information to our staff that came to me through the CILS network. It has helped to make me a valuable "resource" within my own organization. Also, my professional colleagues in CILS have been an invaluable sounding board for me on numerous issues and I to them. Additionally, many of their institutions have been contacted as potential collaborators with grant proposals. I am quite confident that the individuals I have worked with in CILS will remain colleagues and contacts throughout my professional career and we will utilize each other's expertise, advise, and collaborations on an ongoing basis. TRULY, TRULY, TRULY AN INVALUABLE PERK of my CILS participation.

ILC has provided me with the opportunity to network with informal educators that have been both an inspiration and a source of ideas and even specific exhibits as we undertook a major expansion and reorganization of our Center's [science museum's] educational program. George Hein's work with us has profoundly influenced my own ability to connect my own practice to constructivist theory and has also provided a critical resource to frame my work with teachers. Since three of us are [ILC] participants, it has also given the professional development, exhibits, and student education programs at our Center [science museum] a common language of inquiry. Finally, the ILC has completely removed the sense of isolation I used to feel in my work. I feel that the work I do is now part of a collaborative international community with shared values and vision and it is impossible to put into words how valuable that is.

Our institution has a very small education department, but it is the state's premier museum. My participation in the Exploratorium's CILS program has given us an elevated level of respect from our administration and peers.

Some months ago a group of our staff moved to an offsite office to develop a new collaboration between the museum and a local university. We submitted several grant proposals - three successful so far. I attribute at least some of that success to our awareness of the latest research in our field, and the network of practitioners and researchers made accessible to us by being involved in CILS.

Impacts on the Field

Based on our study of the ILC, we also saw evidence that it began to have beneficial impacts on the broader field of informal science education. The ILC helped begin building capacity of the field to improve itself, it contributed towards leadership development within the field, and it created a community of practice that appears poised to have an even greater impact on the field in the future. Participants noted,

I have grown professionally and personally because of my experiences in CILS-ILC. With time it will prove to have an impact on practice on a national level.

There is no substitute for confidence. Working, conversing and associating with enthusiastic, talented, amazing professionals in education makes you a better leader. Leadership is about vision. You can't see past the forest unless you have the information and inspiration to "climb some trees". CILS provided that.

As part of the Centers for Learning and Teaching initiative, the CILS ILC was a leadership development strand that is consonant with the intention and theory of the Centers initiative. It has many potential payoffs in terms of the next generation of leaders. Because of the ILC, there are now more people in the field with the interest, improved capacity, and propensity to deepen and strengthen informal education's connections with schools. With this hybrid leadership – people grounded in informal AND school realities, policies and politics – this network of people is in a better position to navigate those two worlds because of their knowledge, understanding and experience. As ILC participants articulated,

This sort of work across cultures – research and practice – and across institutional boundaries is CRITICAL to improving science teaching and learning both in schools and in informal institutions. The work CILS has done so far is phenomenal and incredibly valuable to the formal and informal education fields, to the professionals in the fields... and to the students who glean the results of our "conversations".

Coming to understand the commonality of excellent science education across institutional contexts has helped me help our Center [science museum] become recognized for leadership in science education and then to build on that leadership and that understanding to help schools and teachers see what they might do to bring science alive in their classrooms.

Survey data illustrated ways in which the ILC program contributed significantly to participants' leadership abilities and confidence, which we believe in turn will impact the field. For example, 76% of ILC graduates said that CILS contributed greatly to their ability to take on leadership roles in collaborations and partnerships with other museums, 60% to take on leadership in professional organizations of informal science education, and 45% to take on leadership in the policy arena (local, state or national). The following participants' comments illustrate examples of concrete ways in which ILC participants are putting their greater leadership capacity to use.

Since my involvement with CILS, I have presented at three national conferences. Being a better educated museum educator gives me the confidence to disseminate my findings to the greater community.

My experiences at CILS and the readings that we discussed have helped me better grasp the informal education field and thus helped me more confidently express my opinions and ideas to the museum administration and as part of national working groups and boards. For me, my increased knowledge and thus confidence in my own understanding of the field have helped me take on greater leadership roles.

I have chaired panels at conferences, and have taken lead authorship roles – important for my position – which I would not have had the courage to do prior to my involvement with CILS.

It is important to note that the ILC participants have created a group of leading educators that is evolving into a professional network reaching beyond the bounds of the ILC program. Survey data suggest that ILC participants believe strongly in the potential of the group to improve their own work and the ways they connect with schools. The program proved to have a deep and powerful impact on the individual participants such that we believe it has the potential, given sufficient support, to become a powerful and sustainable network. Participants remarked,

ILC has convened the community of practice like no other organization has.

CILS played a most central role in the development of museum education leadership and in a community of museum education leaders. It has been a privilege to be associated with this wonderful project and I hope to be associated with the community that CILS has fostered for many years to come.

III. Challenges, Lessons-Learned, Opportunities Going Forward

As with any major endeavor, the CILS ILC experiment was not without its challenges. Through feedback and reflection, lessons were learned, and the opportunities going forward appear ripe and plentiful.

Challenges and Lessons-Learned

CILS learned a great deal from evolving the ILC program over its five years. There were several key design features that proved especially important and beneficial. One of these areas involved recruitment and selection of participants, included the following aspects:

- Having participants come in pairs, or having multiple people from the same institution participate in the ILC is important. These “teams” could then go back to their institution better prepared to support one another in implementing what they learned and keeping up their morale when faced with daunting institutional realities.
- Careful recruitment and selection is critical for the overall cohesion and effectiveness of the cohorts. For example, it became apparent early on that the ILC should focus more on people who actually do professional development work with teachers and less on other museum professionals such as exhibit developers and those who work primarily with field trips.
- The nature of participants’ institutional roles was important. The ideal ILC candidates were from higher-level institutional roles of responsibility and/or were the type of energetic practitioners that would benefit the most by following through and applying what they learned.
- Having a few representatives from other countries added to the mix and brought a fresh international perspective that proved beneficial.
- Creating a cohort that included both “veterans” and “novices” was advantageous.

One of the challenging aspects of this work resided in the institutional realities ILC graduates faced when they got back home. By participating in the CILS community, participants generated a great deal of enthusiasm and ideas that they wanted to implement. Yet they often faced inertia or even opposition when they returned home. While recruiting higher-level ISI staff, such as Education Directors, would not guarantee smooth-sailing for participants post-graduation, in the words of the ILC director, "it might secure more buy-in to the important issues that participants are grappling with and it might pave the way for more dialogue and institutional strategizing that can build on the ideas and leadership of ILC participants."

Several other programmatic and institutional challenges were highlighted by ILC graduates during focus group interviews:

- ILC participants varied greatly in their own need for ongoing learning and development related to inquiry. A future ILC-type program could perhaps help address this varied need.
- ILC participants were keenly aware that they needed to develop their own institution's staff (again, vis a vis inquiry as a core professional development experience) before good work can happen with teachers.
- ISI institutional pressures are extremely strenuous and they are not the same as those of schools (except linked to money, but with very different manifestations). These stresses exacerbate the already large gap between ISIs and schools. Examples at ISIs include the pressure to do whatever will garner turnstile fees rather than offering rich coherent teacher professional development, and seeking grants with attached strings that inhibit rather than help their work.
- As mentioned above, participants varied in their institutional clout, thus they varied in feelings of efficacy with CILS work. Regardless of their institutional role, ILC participants need strategies and tools for gaining authority and acting as change agents in their home institutions. They also need "shots in the arm", occasional infusions of inspiration and stimulating professional development, to stay strong.
- Participants would have liked more chances to strategize about funding – how it affects their work and how they can deal with problems it (the lack of funds) creates.

All of these issues strike us as reflective of conditions within the ISIs that must be addressed *on the way to* museum educators being able to serve teachers and schools well. That is, there are many intermediate steps these practitioners and their institutions seem to have to take along the way to do more and better work with schools.

In Summary, Opportunities Going Forward

CILS focused its work at the intersection between informal learning and schools. The ILC helped create and professionalize a network of informal science institutions connecting with schools. The basic theory of action or logic model behind the ILC was that investing in the leadership of ISI educators that work with teachers, building their knowledge, capacity and connections, will lead to better professional development for teachers, smarter teachers, and thus smarter students. We see this as an important link in the improvement infrastructure chain. As a result of the CILS ILC, there is broader awareness of the greater enterprise of science education improvement and the important role of ISIs within that enterprise. We hope that this vital work will continue.

IV. Appendix – Participant Vignettes

As illustrations of the types of impacts that the ILC has had on participants, we include the following two vignettes or snap-shots of case studies that we conducted in 2004. The first is of Rita Bell, Education Program Manager at the Monterey Bay Aquarium. The second is of Preeti Gupta, Vice President of Education at the New York Hall of Science.

Since our formal interviews with them back in 2004, we have met and talked with them at various conferences and meetings. Rita continues to take on more and more leadership at the Aquarium and in professional organizations internationally. Preeti has also taken on greater leadership roles at the New York Hall of Science, is currently pursuing her Ph.D. in Education, and is increasingly active in national efforts to improve science education. For example, she is currently serving on the steering committee of the newly funded Center for the Advancement of Informal Science Education (CAISE), and is chairing their Leadership and Diversity Task Force.

Both Rita and Preeti represent cases of the significant impacts that a long-term professional development program and network such as the ILC can have on participants. Here are their stories.

CILS Informal Learning Certificate (ILC) Participant Vignette – Rita Bell

As part of CILS evaluation work, Inverness Research Associates' researchers have had the opportunity to interact with Rita for the past three years. In June 2004, we conducted an in-depth interview with her, and she completed a detailed online survey of ILC participants in December 2004. The following is a summary of the impact ILC has had on Rita and her work as an informal science educator.

Background

Rita is Education Programs Manager at the Monterey Bay Aquarium (MBA) in California. She has been in that position for seven and a half years, and at the Aquarium for 11 years. Rita oversees their Teacher Programs which include the following: teacher institutes, workshops and conferences; partnerships with districts and schools, school programs, field trips (over 80,000 students annually), and interactions with local teachers and district personnel; teen programs (school year and summer programs for middle and high school students); and a new project called Community Partnerships which is designed to integrate their programs for specific communities.

Once a psychology major, Rita earned a B.A. from UC Santa Cruz and an M.A. in education administration from University of San Francisco. Prior to entering the museum field, she was a middle school math and science teacher, was a member of a school board, and served as a school vice-principal. She also currently serves as president of the National Marine Educators Association.

Rita was a participant in the first ILC cohort, and has attended many CILS events: the September 2002 ILC Institute at the Exploratorium; the Winter 2003 School Sense workshop in Philadelphia; the August 2003 Bay Area Institute at UCSC in Santa Cruz; the February 2004 Learning Theory Workshop at the Exploratorium; and the most recent Summer 2004 Bay Area Institute in San Francisco. In addition, she participated as a guest panelist in the ILC second cohorts' Fall 2003 Institute.

Outside of the CILS-sponsored events, she also has been in contact with CILS staff, faculty, post docs, doctoral students, advisors, and other ILC participants. Rita is currently involved with CILS faculty and doctoral students in a joint research project with MBA and UCSC.

Benefits of Participation

Although Rita came to the ILC with a wealth of experience working within both formal and informal education, she feels that the ILC program and her subsequent involvement with CILS has benefited her tremendously. She reports personal, professional and institutional impacts which have led to her own increased leadership capacity as well as to her institution's increased educational effectiveness and collaboration with schools.

Personal Impacts

Rita's experiences with CILS stimulated her intellectual interests in inquiry, learning theory and research. In large part due to CILS, she is now considering pursuing a Ph.D. The CILS ILC program also contributed to Rita's ability to become a more active and effective leader in the field of informal science education. She reported feeling more empowered and confident to take on leadership roles in her department, institution, in collaborations/partnerships with other informal institutions and schools, as well as with CILS and research communities.

Being in contact with people through CILS – with a lot of other folks in informal science institutions and researchers, sharing some of our experiences and talking back and forth – has given me more confidence to speak up and share ideas.

I am currently serving as president of the National Marine Educators Association (a conglomeration of classroom teachers, aquarium folks, grant and university people). While my nomination and election probably didn't necessarily have to do with my involvement in CILS, I've been able to speak with more authority about quality educational experiences and the design of quality teacher professional development programs because of my experiences with CILS and the ILC. As a result, I'm in a position to reach many professional developers at aquaria and marine science centers, nationally and internationally.

Professional Boost

While Rita was quick to point out the value to her of the professional network that she now has access to through CILS, we also note what a valuable resource she has become to other CILS participants.

Since I started working at MBA, I've been interested in networking with other people who serve their institutions in the same or a similar role. It had been my hope that CILS would enable me to meet more people working in the field. It has.

I have touched base with a few of the other ILC participants . . . we email and have talked on a number of different occasions. Some of them are neophytes in this field, so there were things they'd undertaken that they wanted advice on. We ended up helping one museum with a workshop, we did a collaborative workshop together.

Through CILS, Rita was exposed to new professional groups and conferences.

I was invited to participate in a conference back in Annapolis, called "In Principle, In Practice" [in November 2004], which is through Institute for Learning Innovation. It's all new to me, but it sounds fascinating.

Institutional Benefits

Through the ILC institute and workshops, Rita picked up activities and approaches to teacher professional development that she implemented back at the Monterrey Bay Aquarium. She and her colleagues took some of the inquiry activities and adapted them to their needs. For example,

The Schoolyard Explorations is an inquiry project that has become the cornerstone of our Splash Zone Teacher Institute.

They [CILS faculty at the ILC] took us through the inquiry process and shared a number of different activities and did things out on the floor with us. That has been really helpful in terms of our development of curriculum ideas and program development here at the aquarium. We have taken a lot from that experience, modified it and morphed it so that it makes sense for our institution and our teaching audience, the teachers that we work with. It is not an exact duplication of what goes on at the Exploratorium, but it is our own spin on it, and it's been really good.

Not only has inquiry become more prominent in their programs, Rita reports that they are also expanding their connections with teachers and schools.

We have fully embraced the inquiry process as a significant part of our teacher institutes and workshops. We are expanding our teacher institute programs and looking for opportunities to remain connected with teachers who participate in our programs. We are making more efforts to connect the institute programs with the classroom, and we are working to make better connections between the classroom and field trip experiences.

Rita's CILS-ILC experience made an impact on MBA's program development.

I think it has influenced the direction that we are going with our program development. We are looking for ways to provide richer opportunities for kids and families out on the exhibit floor. Before, that was just a minor focus of ours. For example, 70,000 kids came to the aquarium on self-guided field trips, and their teachers got a book, and that was it. But in the last couple of years, we have really been looking at their experience and have been trying to figure out how we can make that a richer experience for kids and teachers, how their experiences can be choreographed or linked so they get more out of it. It got us thinking in a kind of holistic way, instead of thinking about it as a lot of individual experiences that they could have; rather, here's a theme . . . We realized there were things we could suggest they do with kids before they come, to start getting kids to ask questions, and then have them investigate their own questions while they are here... That is a major change in our whole program development, and I don't know that it wouldn't have happened anyway, but it certainly was a good kick in the pants to get us going.

Rita has utilized contacts she made through CILS and the ILC to benefit the Aquarium. They conducted staff trainings and collaborative workshops with other ILC participants in the region, as well as called upon CILS participants to help with their strategic planning.

We have capitalized on our relationship with the Tech Museum and with the Children's Discovery Museum in San Jose... Some of their staff come down and we do a mini-version of the Tech Challenge, and some of my staff have gone up there to take a look at their programs.

Individuals I met through CILS were invited to participate in an Education Charrette at the aquarium. Their input provided the institution with ideas for our strategic plan and provided outside support for our department and division goals.

Understanding more about learning theory is helping Rita take a look at their own institution's theories and assumptions about how people learn.

The learning theory workshop we went to was very helpful, in terms of getting things that I can apply directly... I have gleaned things from all of these CILS' experiences, but the learning model was really good in terms of helping us to think through what our own models and assumptions are about how people learn. It is on my list of things to do with the staff. I think it will also give me a forum with which to communicate with our exhibits department and some of our other departments, because I don't know if we have the same assumptions about how people learn or what people do once they come.

Through CILS, Rita has a new-found appreciation for the importance and possible applicability of research. She recognizes challenges, but sees potential benefits of working more with research.

By helping the "practitioners" learn and use the language of the researchers, CILS is providing us with an opportunity to demonstrate our expertise, express our ideas and define our needs.

My experience with the ILC and CILS has been fun, and the research part has been frustrating at times, but I think it has really helped me in terms of growing and getting a sense of what research is out there in this field, what it deals with, and what some of the psychologists and theories say. I was a psych major way back when, and a lot of this is new to me... I realize I've really been out of it.

Much of the research still seems quite removed from the focus of our daily operations and programs. Even though I'm working closely with CILS faculty to define a research project, I wonder how much of what they're interested in researching will help me answer my question about if and how the experiences of our Young Women in Science participants get translated to their families at home.

I think finally we are at a stage now [at MBA] where we are beginning to look out more, rather than just looking inward... We are shifting our perspective and looking for opportunities and potential partners. We turned 20 this year and so it is time... we are over our really awkward adolescence and we are looking at the horizon a little, looking at what's out there that could make us better.

Summary

Rita is a good example of a practitioner who came to CILS with quite a bit of experience, both in the formal and informal worlds of education, but who gained a great deal by participating in the ILC program. She is a "practitioner" in a very real sense of the word, trying to put into practice all that she has learned about inquiry, about professional development design, about learning theory and research, about schools, and about what others in the field are doing. There is no doubt that by participating in the ILC and CILS, Rita and her home institution have benefited greatly – they expanded their contacts and reach, deepened their approaches, refined their programs, and are better positioned to be key players in this maturing field at the nexus of informal and formal science education.

CILS Informal Learning Certificate (ILC) Participant Vignette – Preeti Gupta

As part of CILS evaluation work, Inverness Research Associates' researchers have interacted with Preeti for the past three years and interviewed her in-depth in May 2004. The following is a summary of the impact ILC has had on her work and future plans.

Background

Preeti Gupta is Senior Vice President of Education at the New York Hall of Science. Responsible for education programs for schools, teachers and families at the museum, Preeti oversees three departments: science programs, interpretation and demonstration, and the multi-media science resource center. She started at the Hall as an explainer in 1989, and has a B.S. in Bioengineering and an M.A. in Educational Technology.

As a participant in the first ILC cohort, Preeti attended the September 2002 ILC Institute at the Exploratorium, the August 2003 Bay Area Institute at UCSC in Santa Cruz, and the February 2004 Learning Theory Workshop at the Exploratorium. She participated in a special CILS-sponsored, two-day meeting of science center and school leaders at the New York Hall of Science. Outside of the CILS-sponsored activities, she has also been in contact with some of the CILS doctoral students, other ILC participants, CILS staff and advisors.

Benefits of Participation

Preeti found the ILC program extremely beneficial, both personally and professionally. She not only found multiple ways to apply what she learned directly to her work, but her experiences with the ILC and CILS have influenced her career trajectory. She is thinking much more broadly in terms of how to be an active leader in the field, and is considering applying to a Ph.D. program. CILS is providing her with a new-found opportunity for thinking about her field and for tapping into an intellectual depth not always available in the very pragmatic world of working within museums.

Professional Boost

One of the highlights of the program for Preeti was getting to know other museum educators, university faculty, CILS staff, and researchers. Spending

time with other informal as well as formal education leaders was very energizing for her. As she put it,

With CILS what is helpful is being in the company of all of these people... the movers and shakers of the science museum and formal education industries. To be in that company and have discussion and dialogue is really important for me personally, to learn, but also to contribute. Being part of this community is really important to me.⁶

The ILC program expanded Preeti's thinking about informal learning, learning theories, and research. It helped her think more critically about informal science institutions.

I'm looking at museums, and also zoos, botanical gardens and natural history museums, in a different light... I'm thinking about what it is we are really trying to do, how valuable is it, and why is it valuable... which I wasn't really doing before.

I think a lot more about the learning that goes on in museums. I don't think I was thinking about that much before... I'm wanting to read more of the literature.

It [the ILC] showed me how to think more critically, how to do more professional development for my own staff, and made me think more about research as well as my own plans.

The importance and applicability of research was highlighted for her through CILS.

One of the most valuable parts of this program is the idea of research – learning about the research that's out there, creating research, or following through on research that is so needed in our field... I want to see more of that and I want to see more results from applying the research.

We know that there are certain problems we are not going to solve. So the question is, how do we make ourselves strong enough so that our voices can be heard... We need to have strong, sound research and data that says this is why such and such. I think CILS can do that, and it might be a tough thing to get our hands around, because it is such a big task, but I think we can do that.

I think the ILC is all part of professionalizing the field and bringing it up.

Personal Impact

⁶ Quotes are taken directly from interview transcripts and were slightly edited for clarity.

Preeti reported that CILS and the ILC program gave her the courage to pursue further studies and made her more interested in and confident to develop herself as a leader in the field.

This gave me some momentum and made me feel comfortable because I saw other young people, researchers, and Ph.D. students, working on this... It also has impacted me to very seriously consider my Ph.D. plans.

It is helping me move in a career direction of being a voice in this field and placing me on a map to think critically about the field... Most museum instructors fall into a trap where they are doing their day-to-day work and forget about the big picture, so this [ILC] forces us to think beyond the day-to-day.

Institutional Benefits

Preeti applied many of the things she learned through the ILC.

I have done a lot of implementation at the Hall of Science, taking what I learned and adapted it to use here... changing how I present an activity, or changing my outlook, or changing training styles... I shared a lot of what I learned with my staff, my instructors and my explainers, and I did a lot of turnkey training and brought up a lot of discussion points. I've instituted new types of professional development programs.

Another thing that I did with my instructors was not so much about pedagogy but about science content. I feel like our instructors get so caught up in their every-day teaching, that they don't keep up on current science as much, and so we are doing a science breakfast series... I gave them two articles to read that would bring about some thought or maybe questions about what the science is and we sat and we discussed the article. The hope was to bring about a level of comfort to say 'I don't quite understand why, for example, DNA does the thing that it does'... it gives us a forum for science discussion.

Going through the CILS ILC also gave Preeti and her institution an added advantage in fundraising.

What has been interesting, when I have talked about this [CILS-ILC] with other companies or people who want to write grants, they do find it very valuable that I've participated. When I write a support letter for them, they make sure I include something about [my ILC certificate], because it is meaty and they can then get their own grants... So it has made me more valuable to others; the Hall is more valuable to other agencies in New York because the Hall is part of this national program.

People I work with wrote an NSF grant, and when they found out that I had done this program in inquiry, they changed me from being “involved” to being co-PI because they thought it would help them get the grant. They did get the grant – and whether they got the grant because of our CILS connection, who knows. But it certainly is giving us a foothold to step up on.

Summary

In summary, Preeti’s involvement with CILS’ ILC has provided her with personal, professional, and institutional benefits that she believes has made a major impact on her current work as well as her future career trajectory. She is inspired by the work of the Center to want to learn more and become an active and effective leader in the field.