

The Exploratorium Teacher Institute
The Leadership Training & Support Program

September, 2001

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This project is funded by the National Science Foundation
Noyce Foundation, Hewlett Foundation, Carnegie Foundation, Clarence Heller Foundation,
Pacific Bell Foundation, Crocker Foundation, and
The California Department of Education.

I. The Exploratorium's Beginning Teacher Program

Overview Of The Teacher Institute

The Exploratorium Teacher Institute has offered on-going professional development for middle and high school science teachers for over 17 years. The focus of our work is helping science teachers infuse their curriculum with inquiry. Exploratorium staff model inquiry-based pedagogies for the participants and show teachers how to reproduce classroom versions of Exploratorium exhibits cheap, and easy-to-find materials. The purpose of these classroom exhibits is to give teachers a tool that will demonstrate unusual and unexpected phenomena for their students. By interacting with these phenomena, students will become curious, they will formulate questions, and by motivated to explore and engage in meaningful learning.

The Teacher Institute (TI) is currently a professional home for over 2000 alumni teachers. These teachers work for various districts throughout the Bay Area. In any given year, about 800 TI alumni attend five-hour Saturday workshops, two-hour after school workshops, and two-week Advanced Summer Institutes. About a dozen of these alumni come from well outside the Bay Area (such as Los Angeles) and some travel from outside the state. Alumni teachers also check out materials from *the Exploratorium Teacher Resource Library*. These teachers also make use of web-based teaching resources: (1) A listserve (PINHOLE) where teachers ask questions related to science and pedagogy. (2) A web site (www.exploratorium.edu/ti) where about 150 hands-on activities developed by the Teacher Institute are posted. (3) Various live educational webcasts that can be used to augment classroom activities.

To become alumni of the Teacher Institute and eligible for this continuing training and support, science teachers must complete an intensive four-week Introductory Summer Institute. In the Introductory Summer Institute, teachers are exposed to strong science content and teaching strategies stressing inquiry and critical thinking. The foundation for our work is the Exploratorium exhibit collection. In workshops, exhibits are tools to (1) intellectually challenge teachers with unusual or counter-intuitive physical phenomena, (2) provide a launching point for classroom activities that allow teachers to deepen their own understanding and knowledge, and (3) furnish models for hands-on, inquiry-based teaching. In the Exploratorium machine shop, teachers work with staff to make classroom versions of exhibits. Quite literally, teachers bring the exhibits, philosophy, and pedagogy of the Exploratorium back to their students.

During the Summer Institute, teachers receive three hours training at exhibits and in the classrooms. Participants spend another two hours working on projects: developing curriculum,

building classroom exhibits, conducting research on the Internet, etc. The goal is to give teachers the rare opportunity to plan lessons and units with the guidance of scientists, science educators, and their colleagues.

History Of The Exploratorium Beginning Teacher Program

To qualify for the Introductory Summer Institute, a middle or high school science teacher had to have at least five years of teaching experience. This requirement stemmed from our observations that beginning teachers we had accepted into four-week summer institutes tended to frantically gather up every lesson, activity, and material we offered them without giving much thought to how they might develop a coherent curriculum that built conceptual understanding among their science students. Because beginning teachers had few successful strategies for dealing with classroom management and student discipline, they came to us interested in help with day-to-day survival rather than the development of their science content knowledge or pedagogical strategies. It was the more experienced science teacher (who had a repertoire of successful discipline and classroom management strategies and had experience constructing lessons and units) that was ready and eager to consider how inquiry-based pedagogical strategies could be infused into their curriculum.

In the mid 1990's, we noticed that the number of experienced science teachers applying for our Introductory Summer Institutes was dropping while the number of beginning science teachers making inquiries about our programs was rising. Alumni teachers contacted us frequently about beginning science teachers at their schools – begging us to make an exception to our admission policy and admit a novice into our institutes. At the same time, we observed another trend. Our most talented alumni, some having been with the Teacher Institute since 1984, were retiring from teaching. But these exemplary veteran teachers wanted to continue their association with the Exploratorium and the professional community they had helped to create.

It became obvious that we needed to develop a program to meet the needs of novice science teachers simply to maintain our pool of alumni and help our local districts retain their new science teachers. We also felt we could take advantage of our retired Teacher Institute alumni, who could serve as on-site coaches for our novices. Our most experienced and exemplary alumni could also serve as mentors – providing guidance and support to novices during after school hours. Both mentors and coaches would be responsible for inducting novices into the profession as well as the Exploratorium Teacher Institute.

More importantly, we were in a strong position to develop and test a model of teacher induction that was content specific. By in large, existing beginning teacher programs are focusing on more general teacher needs such as classroom management and transition issues from college to school. Few focus on discipline-specific questions of content and discipline-specific pedagogy. The working hypothesis of our science teacher induction program is that *a discipline-specific beginning teacher program that links novices with more experienced, exemplary teachers who themselves are part of a professional community of learners will produce more effective science teaching practices earlier in the novice teacher's career.*

Description Of The Induction Program

The two-year induction program for novice middle and high school science teachers currently provides with a four-week summer institute, academic-year follow-up workshops, content workshops, support group meetings, and in class coaching. The various program components and the developmental goals each addresses are described in **Table 1**. **Table 2** describes what is required for novices to complete the program and join the ranks of Teacher Institute alumni. A schematic of the two-year induction program can be found in the appendix (**Appendix A**).

Our work focuses on supporting novices employed by our district partners—San Francisco Unified School District and the 23 districts represented by the San Mateo County Office of Education. Recently, we have also expanded our reach and are serving teachers in Oakland and Berkeley Unified School Districts. Currently, 27 novice teachers are in their second year of the two-year support program and another 89 are graduates of the program and are alumni of the Exploratorium Teacher Institute. A total of 32 novices (22%) have left the program since 1997, which includes beginning teachers who have left teaching, moved out of the area, or had personal challenges that made their continued participation too demanding. In the fall of 2001, we accepted another 30 novices into the two-year induction cycle, bringing the total to 178.

Another group of teachers served by our project is the *veteran middle and high school science teachers who are alumni of the Exploratorium Teacher Institute*. These are experienced teachers (some retired and some still employed by districts) serving as mentors and coaches for our novice participants, and their training and their work is the focus of this paper. Since the inception of the project, a total of 41 veteran TI alumni teachers have been trained and have served as either mentors (28) or in-class coaches (13). These veteran teachers are employed in a variety of school districts, including San Leandro, Oakland Unified, Santa Rosa, and Marin County. The majority however, comes from San Francisco and San Mateo Counties.

Table 1: Design of the Exploratorium Induction Program

Induction Program Elements	Developmental Need Addressed
Orientation Day	Build group identity and match coaches and mentors with novices
Mentor-Novice Support Groups	Classroom management, discipline, "tricks of the trade," reduce isolation, connect novices to appropriate Exploratorium resources, reflect on practice with others "in the same boat."
Novice Workshops	Generic teaching issues, designing lessons and curriculum units, sharing ideas for lessons and successful classroom activities, student assessment strategies
Classroom Coaching	Classroom management, discipline, reflect on practice with experienced observer, connect novices to appropriate Exploratorium resources, introduce novices to teachers in their schools
Saturday Content Workshops	Science content, inquiry, pedagogy, special topics (e.g. literacy, diversity, gender equity)
4-wk Summer Institutes	Science content, inquiry, discipline-specific pedagogy
2-wk Advanced Institutes	Curriculum and lesson design, science content, pedagogy

Table 2: Required & Optional Program Elements

Induction Program Components	Beginning Teachers (hours over 2 years)
<i>Orientation Day</i>	8 hrs (required)
<i>Mentor-Novice Support Groups</i>	16 hrs (required) up to 32 hrs (optional)
<i>Novice Workshops</i>	16 hrs (required) up to 40 hrs (optional)
<i>Classroom Coaching</i>	32 hrs (required) up to 128 hrs (optional)
<i>Saturday Workshops</i>	20 hrs (required)
<i>4-week Summer Institute</i>	100 hrs (required)
<i>2-week Advanced Institute</i>	up to 60 hrs (optional)
Total Hours	192 hrs (minimum) 408 hrs (maximum)

II. The Exploratorium Leadership Program

The Exploratorium Leadership Program is currently a two-year training and support program for alumni of the Teacher Institute who take on the responsibilities of mentoring and coaching novice science teachers in the Exploratorium Beginning Teacher Program.

A key goal of the Leadership Program is to train a cadre of veteran teachers to effectively apprentice the novice teachers and induct them into the strategies for teaching science using exploration and inquiry. However, another equally important objective of the program is to provide our alumni with opportunities to develop leadership skills. The skills they learn in our program not only help the beginning science teachers in their two-year induction program, but these skills are transferable to helping novice science teachers the schools and districts in which they work. Furthermore, because a number of our veteran alumni are active in science education reform efforts at the local, state and national levels, we expect that some participants in the Leadership Program will share their knowledge about science teacher induction in these arenas as well.

History Of The Leadership Program

During the first three pilot years of the Beginning Teacher Program, we had relatively few requirements for alumni interested in mentoring or in-class coaching. All we asked was that alumni interested in being a mentor or a coach (1) be willing to travel to work with novices either in San Francisco or San Mateo, (2) describe a commitment to inquiry-based teaching and learning, and (3) complete the four-week Leadership Institute in the summer. Also, we had little in the way of a formal training and support program. Alumni interested in mentoring or coaching our novices were required to complete a three-week summer Leadership Institute designed to give our veterans strategies for supporting beginning science teachers.

In the first three pilot years of the Beginning Teacher Program, we actively recruited the mentors and coaches. We contacted veteran teachers that the Exploratorium staff identified as the most experienced and talented. Alumni contacted were regular participants in our on-going workshops and had the closest and longest relationships with the Teacher Institute (some for 15+ years). We contacted veterans who were engaged and eager workshop participants and had taken on leadership roles in their schools and districts. Alumni who had prior experience mentoring novice science teachers were also recruited. Those we selected were chosen based on our own personal knowledge of their leadership abilities, our impressions of their potential as successful mentors, and our observations of their abilities to share expertise with others.

We developed various responsibilities for mentors and coaches, such as leading novice support group meetings, visiting novices in their classrooms and providing on-site support, and leading novice workshops. However, in the pilot years of the Beginning Teacher Program, we provided little guidance or support to the alumni as they carried out their jobs. We relied on mentors and coaches to make independent decisions about what their novices needed and take the initiative to provide novices with support, materials, and advice. It was not our intention to leave our veteran teachers to “sink or swim” – but at that stage in the development of the fledgling Beginning Teacher Program, we were defining the goals of the induction program and refining the program elements to best support the novices. Developing the Leadership Program would have to wait until the Beginning Teacher Program was more mature and clear roles for mentors and coaches could be defined.

Most of the mentors and coaches were patient with the lack of clarity about their roles and responsibilities. They were aware that they were part of a brand new program and that they were pioneers. In fact, the mentors and coaches were given numerous formal and informal opportunities to share their impressions of both the induction program and their leadership experience – and we relied heavily on their insights and suggestions to improve the Beginning Teacher Program and develop the Leadership Program.

By the end of pilot phase, we had fully developed the program elements of the Beginning Teacher Program. We had clearly identified the objectives of the induction program, we had mapped program elements to these goals, and we had developed a number of strategies and tools. We were then ready to do the same for the Leadership Program. We needed to clearly define the objectives of this program, develop a specific set of recruitment and selection strategies, and define specific roles and responsibilities that mentors and coaches needed to assume in the induction project.

This past year, Inverness Research Associates were responsible for formatively evaluating the Leadership Program. They interviewed participants in the program, they shadowed both coaches and mentors as they performed their jobs, and they monitored the impact of the program on both the professional development of novices and experienced teachers. IRA met regularly with Exploratorium staff, reporting preliminary findings and helping us to develop the Leadership Program as completely and thoughtfully as we had done for the Beginning Teacher Program. The description of the Leadership Program that follows is the result of their

insights and suggestions. A schematic of the two-year Leadership Program can be found in the appendix (**Appendix B**)

Leadership Roles In The Exploratorium Beginning Teacher Program

We intend for our novices to regard the Teacher Institute as their professional home for the rest of their careers as secondary science teachers. *Mentors* induct novices into the Teacher Institute, directing them to Exploratorium science teaching resources that will best meet their needs. Mentors also lead special workshops for novices on the generic challenges of teaching (e.g. classroom management, discipline, and parental involvement), but in the context of inquiry-based science teaching. For example, a workshop on “Parental Involvement” might include an introduction to science activities that involve families; a workshop on “Classroom Management” might include specific strategies for distributing hands-on science materials in ways that retain the attention of the students. Mentors are currently employed science teachers who are available after school and on weekends.

Coaches induct novices into the larger guild of the science teaching profession. They help novices develop specific strategies and techniques of effective inquiry-based teaching and learning. The primary role of the coach is to model lessons for the novices, provide one-on-one support as novices try inquiry-based activities and lessons, and help novices reflect on their practice with the goal of improving their pedagogical content knowledge. Coaches also help novices become less isolated at their schools. They introduce novices to other science teachers at the school, they help build relationships between novices and their principals, and they help orient novices to the educational resources available within the district and at other science institutions. Coaches are either retired from teaching or are currently on-leave from their regular assignments.

While these roles are somewhat distinct, there is crossover between the roles of coaches and mentors. For this reason, they often work together on a number of tasks. Coaches and mentors co-lead the novice support group meeting, co-teach some of the novice workshops, and work together to help novices develop lessons and units. **Table 3** lists the specific responsibilities of the mentors and coaches in the Leadership Program and describes how these tasks map onto the primary goals of the Beginning Teacher Program.

**Table 3: Key Responsibilities Of Mentors And Coaches
Mapped Against Goals Of The Beginning Teacher Program**

Key Goals Of The Beginning Teacher Program	Mentor Responsibility		Coach Responsibility	
	Lead Novice Support Groups	Lead Novice Workshops	Lead Novice Support Groups	In-Class Coaching
<i>Build strong science content appropriate for middle and high school science teaching and consistent with the California State Science Standards.</i>		X		X
<i>Develop inquiry-based, student-centered teaching strategies as described in the National Science Standards</i>		X		X
<i>Develop generic teaching skills, such as strategies for materials management, discipline, lesson planning, assessment, etc.</i>	X	X	X	X
<i>Reduce isolation of novice teachers by helping them form relationships with other novices, Teacher Institute staff and alumni, and colleagues at their schools.</i>	X	X	X	X
<i>Induct novices into the Exploratorium Teacher Institute, which provides novices with access to a community of exemplary science teachers, staff scientists and educators, and a variety of materials and other science education resources.</i>		X		X

Selection Process

While we sometimes still recruit talented veteran teachers from the alumni pool to apply as mentors and coaches, no one is selected for the Leadership Program without going through a formal selection process. The process consists of four parts: (1) an announcement mailed to all alumni that describes the Leadership Program and asks interested veterans to phone the Teacher Institute Mentor Program Coordinator for more information. (2) A telephone screening where the goals and responsibilities of mentoring and coaching are described, alumni describe their interests, and qualified applicants are directed to apply as either a coach or a mentor. (3) A formal application process where alumni are asked to describe their prior leadership experiences, philosophies of teaching and learning, and pedagogy. (4) A formal interview and in-class observation where inquiry-based teaching abilities are assessed and the applicant's ability to reflect on their practice is determined (teaching observations are not done for retired alumni). **Table 4** summarizes this selection process.

The application, interviews, and classroom observations are critical in determining whether or not an applicant meets the selection criteria for being either a mentor or a coach. **Table 5** describes the minimum requirements for mentor and coaches. Some selection criteria are practical – such as a willingness to travel and a commitment to work with novices in our induction program for 2-years. Other criteria were developed in order to ensure that our mentors and coaches have the potential to help novices develop the content and pedagogical skills necessary to be effective science teachers. These criteria include the ability to make their pedagogical knowledge explicit, experience in curriculum design and unit planning, strong science content knowledge, leadership experience or potential, and a demonstrated commitment to inquiry-based teaching and learning.

Table 4: The Selection Process For The Leadership Program

<p>Announcement: Mailed to all Teacher Institute Alumni announcing opportunity to serve as a mentor or a coach in the Induction Program. Interested alumni are asked to call the Mentor Program Coordinator.</p> <p>Telephone screening: Key roles in the project described, time commitment described, identification of whether the alumni should apply as a mentor or a coach.</p> <p>Application review: Veteran teacher is asked to fill out a questionnaire. Asks about teaching approach, experience as a mentor, use of Exploratorium materials in their teaching, etc. Teacher Institute staff reviews applications and makes selection of candidates who meet minimum requirements.</p> <p>Interview/Classroom Visit: Candidate is interviewed and observed in their classrooms; teaching strategies are assessed; candidate is encouraged to ask questions about the job.</p>
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Table 5: Selection Criteria For The 2-Year Leadership Program

Mentors	Coaches
<ul style="list-style-type: none"> • Exploratorium Teacher Institute Alumni • Must be able to make a 2-year commitment including participation in Leadership Institute. • Demonstrated commitment to hands-on, inquiry-based, student centered learning; uses Exploratorium materials. • Ability to articulate the rationale behind their own strategies for science teaching; the ability to reflect on their practice • Experience with curriculum planning and lesson design. • Evidence of professional leadership abilities or the potential for leadership. • Science content expertise appropriate for middle or high school teaching. • Flexible and adaptable; good with people. • In geographical area of Teacher Institute novices served or willing to travel. 	<ul style="list-style-type: none"> • (same) • (same) • (same) • (same) • (same) • Well established history of working with other teachers, especially mentoring novices. • (same) • (same) • (same) • minimum 10 years teaching experience • released from teaching or retired • willing to work 1 day / week

Summer Leadership Institute

The 4-week Summer Leadership Institute introduces mentors and coaches to the goals of the Exploratorium Beginning Teacher program, provides an orientation to their roles and responsibilities in the induction program, and prepares them for their roles as support group leaders, novice workshop leaders, and classroom coaches. The Summer Leadership Institute is held at the same time as novices are taking their 4-week Introductory Summer Institute. Participants in the leadership program are required to work with novices for 6-hours each week – helping beginning teachers develop a science teaching unit that incorporates Exploratorium activities, inquiry-based learning, and authentic assessment (see *What Are Teaching Boxes* below). The specific objectives of the Summer Leadership Institute for mentors and coaches are described in **Table 6**.

During the Leadership Institute, participants engage in moderated group discussions and activities that develop and refine their abilities to (1) Reflect, critique, model, and coach. (2) Plan workshops on topics helpful to beginning teachers, such as science materials management, student discipline, and organizational survival skills. (3) Develop “starting points” to initiate relationships and meaningful conversations with beginning teachers. (4) Identify and locate science lessons, curriculum materials, resource agencies, science organizations, and other key resources that might be helpful to novices. (5) Work with beginning teachers on their “Teaching Boxes” (see *What Are Teaching Boxes* below) – a tool that both helps novices create science units and helps the mentors/coaches share their pedagogical knowledge and “tricks of the trade”.

The Leadership Institute is organized and led by our *Mentor Program Coordinator* (Modesto Tamez) and *Master Teacher-In-Residence* (Tory Brady) – both have had extensive experience supporting both novice teachers and preparing veteran science teachers for leadership roles.

The “Practice Workshop”

A new training program for the mentors and coaches, *The Practice Workshop*, was introduced in the summer of 2001. While originally conceived as a content-based workshop for beginning science teachers in SFUSD participating in a BTSA orientation workshop, this experience proved to be extremely valuable for our mentors and coaches who help lead the Exploratorium sessions.

Table 6: Objectives Of The Summer Leadership Institute

To Prepare Mentors To ...	To Prepare Coaches To...
<ul style="list-style-type: none"> • Lead a successful, engaging workshop for novice teachers that helps novices bring Exploratorium activities into their classrooms. • Help novices with the more generic issues of teaching, but in the context of Exploratorium activities and approaches. • Help novices construct a “Teaching Box.” • Help novices form relationships with Exploratorium Teacher Institute Resources and Staff. 	<ul style="list-style-type: none"> • Lead a successful support group that helps novices form relationship between other novices and veteran teachers. • Help novices with specific classroom challenges, both generic and discipline-specific, in the context of the novice’s classroom. • Help novices construct and use “Teaching Boxes” in their classrooms. • Help novices form relationships with other novices and with colleagues at their school.

What Are Teaching Boxes?

A challenge we faced in the first two years of the project was a conflict between the need for novices to have “stuff” and the desire mentors had to share their ideas about teaching and learning. Because novices were focused on day-to-day survival in classrooms with few supplies or other resources, they wanted mentors to supply them with materials and lessons that they could use immediately. Mentors, who had just spent the 4-week *Leadership Seminar* sharing their classroom experiences and pedagogical philosophies with their peers, felt a need to pass their knowledge and their “tricks-of-the-trade” to the next generation of science teachers.

While sympathetic to the novices, we also wanted to foster more meaningful dialogues between novices and veterans, preferably in the context of the actual content the novices were teaching. To accomplish this, the Exploratorium Teacher Institute developed a “product” that novices and mentors work on together called the *Teaching Box*.

The concept was born from the realization that most science teachers committed to hands-on, inquiry-based teaching have storage areas filled with file boxes that contain materials needed to teach a science unit. Not only does a file box contain the “stuff” that the novices hunger for (like lesson plans, descriptions of activities, supplies, and worksheets); it also externalizes a teacher’s internalized views about pedagogy, learning, and assessment.

By engineering opportunities for novices and mentors to work together to create these *Teaching Boxes*, beginning teachers got the “stuff” they desired and were able to reflect on deep issues of teaching and learning with veteran science teachers eager to share their knowledge.

In the spring of 2001, the Exploratorium Teacher Institute was asked to organize and lead a special content-based workshop for beginning science teachers in San Francisco Unified's BTSA program. These new teachers would be taking a weeklong BTSA orientation workshop in the summer at a school near the museum. The BTSA coordinator (Christine Parker) asked the Exploratorium to lead a series of science workshops for these novices as a part of their BTSA training. We agreed and invited San Mateo County (through the science curriculum coordinator, Gary Nakagiri) to encourage some of their newly hired science teachers to come to the Exploratorium for the workshop as well.

A total of 18 beginning science teachers from San Francisco and San Mateo County attended the 5-day workshop at the Exploratorium. This special novice teacher workshop was organized and led by Teacher Institute staff scientists and educators. In the mornings, these novices participated in hands-on science activities that stressed the development of science inquiry skills. The content of the morning science activities focused on the concepts generally covered in the first few weeks of school: measurement, the metric system, the use of instruments and tools, and "what is science?"

In the afternoon, novices were given an opportunity to plan out their first week of school in detail and create a rough plan for the school year. *The mentors and coaches, who had just completed the Leadership Institute a month earlier, led these afternoon sessions.* Each mentor and coach was assigned a small group of novices to work with one-on-one. Their job was to provide advice and support to the novices as they developed a set of introductory lessons for their first week of school. The mentors and coaches also suggested strategies for introducing students to "rules of conduct" on the first day so that discipline problems and classroom management would not overwhelm the novices immediately. *While the primary purpose of using our Leadership Program participants was to provide novices with experienced science teachers to work with, it also gave our mentors an immediate opportunity to practice their newly developed coaching skills.*

The novices rated the Exploratorium experience highly. In written evaluations of the workshop, the novices reported that they had learned a great deal of content and pedagogy from the staff and from the mentors. They especially appreciated being able to reflect upon the inquiry-based activities they had learned in the mornings with veteran science teachers who helped them adapt the lessons to support their curriculum objectives. Moreover, they highly valued the time available to network, exchange ideas, discuss concerns, develop lessons, and select materials with more experienced colleagues. In fact, the workshop was so successful and

nearly all the novices immediately submitted applications for the two-year Exploratorium Beginning Teacher Program.

This “practice workshop” was particularly helpful to the mentors and coaches. All had completed the Leadership Institute eager to try out the mentoring and coaching strategies they had developed. But while they were anxious to get started with the novices in our induction program, they also felt some apprehension. Would they be successful? Did they have the kinds of expertise the novices needed and would they be able to make their knowledge explicit? In formal discussions with the mentors and coaches, they reported that the practice workshop was extremely valuable in building their confidence. The experience also helped them refine some of their mentoring and coaching strategies.

This workshop was so successful and well received by all the participants, that we plan to continue to work with the districts to make it an ongoing program element.

Leadership Support Group Meetings

Twice a semester, mentors and coaches meet to share their successes, challenges, and frustrations. These meetings take place over dinner at a restaurant, giving participants an opportunity to reflect on their work in an informal setting that encourages open discussion and esprit de corps. Conversations generally center on the working conditions of the novice teachers, their pedagogical abilities and science content knowledge, what the mentors and coaches have done to support their novices since the last dinner meeting, and where additional science resources for the novices might be located. Mentors and coaches are strongly encouraged to provide Teacher Institute staff with suggestions for strengthening both the Induction and Leadership Programs. The staff takes thorough notes at these support group meetings, summarize the key points in a written report, and use the observations and suggestions of the leaders to improve the program.

The mentors and coaches have recently requested that we increase the number of support group meetings and that we include additional professional development in these sessions. For example, they have requested special workshops on student assessment, gender equity in the science classroom, and strategies for eliciting student prior knowledge. The mentors and coaches are also interested in having special guests from local science education organizations share their expertise— for example, speakers from curriculum development projects at the Lawrence Hall of Science, educators from the UCSF Science Education Partnership, staff from the UCSC Beginning Teacher Center, etc. In the coming year, we will hold Leadership Support

Group Meetings at least six times; three meetings will include a guest speaker or some other formal training.

Summer Leadership Institute II

All mentors and coaches are required to complete the Summer Leadership Institute (I) prior to beginning their two-year commitment to work with our novices. At the end of their first year, those we identify as particularly successful are strongly encouraged to repeat the Summer Leadership Institute (II). We have found that the insights of these experienced mentors and coaches are extremely valuable to the alumni who are just beginning the Leadership Program. They share the successful coaching and mentoring strategies they developed, they provide critical insights into challenges faced by the novices, and they help reassure an apprehensive new cohort of leaders. These experienced leaders are also critical in helping novices assemble their *Teaching Boxes* while concurrently modeling mentoring strategies for the new leaders in the program.

III. Summary: What We've Learned

Our *Beginning Teacher Program* (which now consists of a two-year *induction program* for novices and a two-year *leadership program* for veteran science teachers) is being evaluated by Inverness Research Associates (IRA). Their evaluation efforts are formative, providing us with a critical assessment of the work and making suggestions for improvement. Their evaluation is also helping us to identify the critical features of our work that can be exported to other organizations (museums, universities, etc.) interested in developing similar beginning science teacher programs. With IRA's observations and insight, we learned the following about the successful training and support of mentors and classroom coaches:

1. *Goals of induction must be clearly defined*

Clearly articulating what novices are being inducted into is critical for the development of a successful leadership program because *a lack of clarity about induction translates into ambiguity about the responsibilities of mentors and coaches*. For example, in a content-specific beginning teacher program such as ours, we determined that the primary objective was to help novices develop science content knowledge, pedagogical skills, and best practices consistent with inquiry-based learning. Moreover, another goal was to induct novices into a professional community of exemplary science teachers outside of their districts. It was only after we became explicit about what "induction" meant for novices in our program that we were able to articulate the roles of the mentors and coaches and then develop specific selection criteria for the leadership program.

2. *Roles and responsibilities need to be made explicit for the mentors and coaches from the beginning.*

Leadership programs that fail to clearly articulate the duties of mentoring and coaching runs the risk of inadvertently demoralizing veteran teachers. Inverness Research Associates observed that alumni were entering our Leadership Program with preconceived ideas about the responsibilities that they would have as mentors and coaches. The vast majority of our alumni, *having never been mentors and having never been mentored*, typically held idealist notions about the mentor-novice relationship and unrealistic expectations about what could be achieved. Lacking a clear understanding of their own role in the induction process, they attempted to help novices in every domain (content, pedagogy, school politics, administrative issues, student discipline, materials management, etc.) and as a result, spread themselves far too thin to be effective. Moreover, when their own unrealistic expectations of success were not met, alumni felt demoralized *much in the same way that a novice science teacher is often devastated by the stark differences between their expectations and the realities of their new careers.*

3. *Selection criteria for mentors and coaches need to be developed.*

We initially believed that virtually any of our experienced Teacher Institute Alumni who had been active in Exploratorium workshop programs could be trained and supported as an effective mentor or coach. However, not every veteran science teacher makes a successful mentor. Specific attitudes and skills are required that are not necessarily developed during one's teaching career.

In carrying out a successful induction program that links novice teachers with mentors, one must develop selection criteria for leaders that are consistent with the goals of induction for the novices. In our own work with beginning science teachers, there were some logistical considerations for mentors and coaches – could they attend the summer Leadership Institute, make a two-year commitment to our program and travel long distances to work with novices? There were also certain unique skills a mentor or coach needed to have from the start– were they reflective about their own practice, did they actually employ inquiry strategies in their science teaching, did they possess strong science content knowledge, and could they communicate well with colleagues.

4. *Mentors and coaches need exemplars, opportunities to practice skills, and time to reflect.*

The analogy between supporting mentor teachers and training new teachers can not be understated. Novice science teachers start their careers with little or no direct experience

with student-centered, inquiry-based teaching and learning. Similarly, master teachers start their new roles having never experienced being mentored or witnessed successful mentoring. Novice science teachers try out new pedagogical strategies in isolation, without the benefit of having an experienced master teacher providing them with guidance. Likewise, most mentors begin their work with novices without the benefits of formal practice sessions, coaching, or reflection. Allowing mentors to “sink or swim” in their new roles is as demoralizing and damaging as it is for novice science teachers.

We have found that the training of mentor and coaches must include the following: (1) Veteran teachers need to observe and experience models of exemplary mentoring and in-class coaching. (2) During these observations, the critical features of successful mentoring and coaching must be made explicit. (3) Veteran teachers need opportunities to practice their new mentoring and coaching skills, preferably in a safe environment where the risks of failure are minimized. (4) Veteran teachers need opportunities to reflect on the development of their new skills, preferably with the input of master teachers who are highly skilled at working with beginning teachers.

5. *Tools must be developed that help make pedagogical content knowledge explicit*

The *Teaching Box* is a tool we initially developed to satisfy the beginning teacher’s immediate needs for classroom activities, lesson plans, and materials. More importantly, the *Teaching Box* provided mentors with a tool to help make their implicit knowledge about teaching and learning explicit for the novices. As one mentor teacher said, “The box is a metaphor, a focal point for me to share my stories with the novices and convey ideas.”

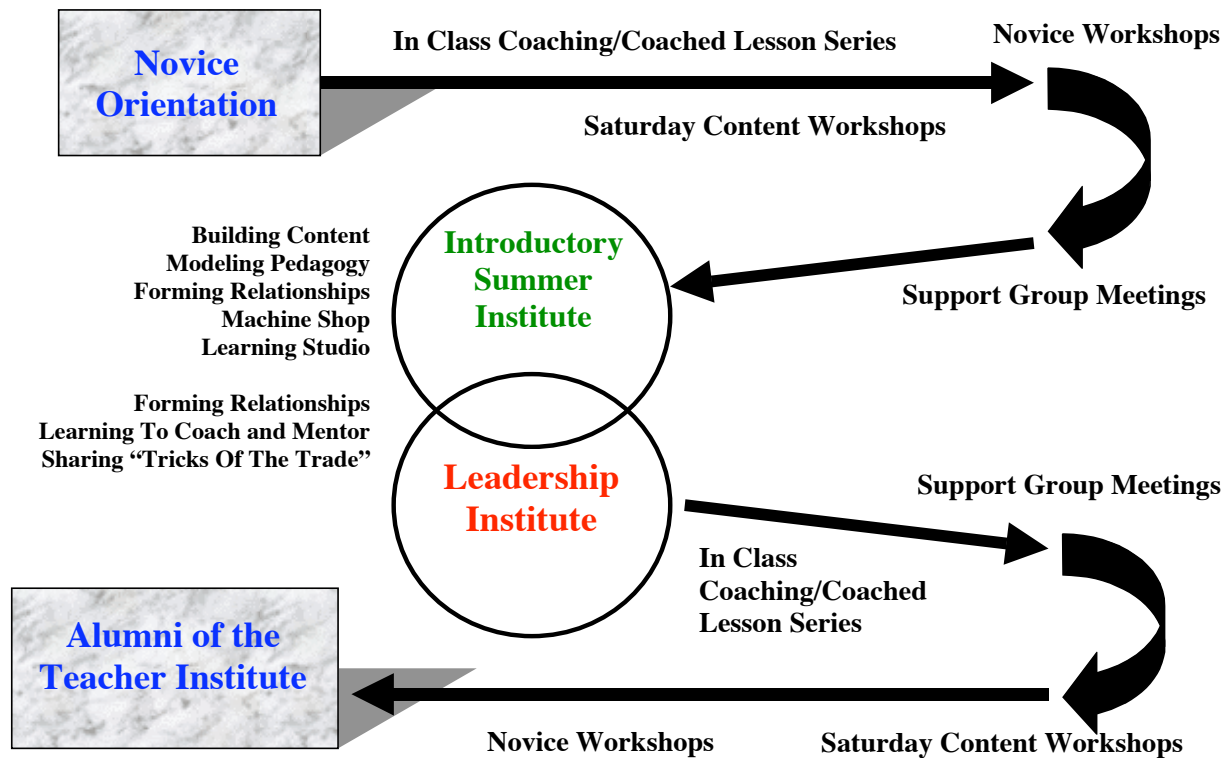
Tools and techniques that help facilitate the transfer of pedagogical content knowledge and expertise need to be invented by induction programs. Mentors have rarely been given formal opportunities to describe their education philosophies or articulate their rationale for the teaching strategies they employ – yet this articulation is critical to the professional development of the novices. For our work, the development of the *Teaching Boxes* represented a critical breakthrough because it promoted deep and rich discussions between novices and mentors. We believe that *Teaching Boxes* will be useful for other content-specific induction program and we plan to disseminate this tool.

IV. Appendices

Appendix A: *The Two-Year Exploratorium Induction Program*

Appendix B: *The Two-Year Exploratorium Leadership Program*

The Two Year Exploratorium Induction Program



The Two Year Exploratorium Leadership Program

