In an era of high stakes testing and standards-based educational reform, the need for high quality professional development (PD) emerges as a critical factor that influences systemic change (Kubitskey and Fishman 2006). The reality, however, is that most traditional forms of PD are still one-shot workshops with outside experts that “threaten the teacher’s identities as professionals who bring a lifetime of experience to the professional development process” (Reilly and Literat 2012, 102). Tragically, PD is often “demeaning and mind numbing as folks passively sit and get the wisdom of so-called experts” (Sparks 2002, 2-3).

Dennis Sparks (2002), who is noted for his work with the National Staff Development Council, states that high-quality, meaningful PD must focus on deepening teachers’ content knowledge and pedagogical skills. It embeds opportunities for practice and reflection in the ongoing work of the classroom. Such PD creates a learning ecosystem that cultivates collegiality and collaboration in solving important problems related to teaching and learning (Reilly and Literat 2012). At the core of relevant PD is the need to frame it as a joint adventure in inquiry for both the developers and the participants.

Creating Project PEARL
Pathways to Excellence and Achievement in Research and Learning (PEARL) was a three-year project that targeted teams of teachers and librarians working with high school students on project-based learning. Funded by the Institute of Museum and Library Services, PEARL’s objectives were to collaboratively
- identify critical learning gaps in the research process for students
- create and implement interventions to address these learning gaps
- cultivate coteaching opportunities within school teams.

We worked with two cohorts in year-long PD programs during the school years 2010-2011 and 2011-2012. A total of 50 teachers and librarians representing 20 schools in Hawaii participated in PEARL. Both cohorts began with a one-week summer institute that was held at a high school library on Oahu. During the ensuing school year, the participants worked directly with their students on different aspects of research planning and implementation at their respective schools. Teams posted progress reports and reflections online from September through April of the school year and exchanged ideas and suggestions with one another. Each participant also submitted a culminating portfolio that included lessons and summaries of related activities (e.g., conferencing sessions), exemplars of student work, and reflection logs.

On one level, our goal was to design, deliver, and facilitate the training. On a second level, our purpose was to analyze and document the iterative design process we used to
create, implement, and continually evolve the PD and to study its impact on teaching practices. Our six-member team included secondary and university librarians and library educators. We began our work with the understanding that an inquiry approach in teaching was fundamental to effective learning for students and that we had to model this process in developing the PD. In this paper, we present highlights of the design process and our lessons learned.

**Approaching PD as Inquiry**
The design process for our team began with identifying the questions that would help us shape the PEARL experience, namely

- How do adults learn best?
- What learning truly matters?
- How do we structure PD for that learning to happen?
- How do we capture impact on teaching practices?

As we combed the research on adult learning in both formal and informal settings, we realized the importance of capitalizing on the learner’s rich background of experiences, knowledge, skills, interests, and competences. This meant inviting the learners to take an active role in their own learning. This also meant that we would have to relinquish some control in order to respect the expertise teachers brought to the PD (Abilock, Fontichiaro, and Harada 2012; Smylie, 1995). Peter Early and Sara Bubb (2004) highlight the following critical characteristics of adult learners:

- They are largely self-directed and require a climate of trust, openness, and respect to learn effectively.
- Their previous experiences are too significant to ignore and must be implicit in the process.
- They prefer learning that incorporates problem-solving strategies.
- Their commitment to learning depends on its practical relevance. (18)

We also conducted informal focus group sessions with local librarians to help us determine the questions that instructional teams might wrestle with in project-based learning. The following questions emerged through the conversations:

- How should projects be designed to encourage the use of cognitive and metacognitive skills to develop learning and reflective abilities?
- How can projects be designed to help students maintain mastery goals, take risks, and view errors as inherent in learning?
- What must be directly taught and what type of support or scaffolding might be necessary?
- What are the outcomes for students in terms of the process and the product and how can these be effectively assessed?

**Structuring PD as Inquiry**
We wanted to frame the PD with the above questions in mind. This motivated us to cull from the extensive body of research on designing effective professional development (e.g., Darling Hammond and Richardson 2009, Guskey 2000, Resnick and Hall 1998,
Loucks-Horsley and Matsumoto 1999). Figure 1 identifies features that became building blocks for PEARL.

<table>
<thead>
<tr>
<th>Features of Effective PD</th>
<th>Implementation in PEARL</th>
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<tbody>
<tr>
<td>Active inquiry-oriented learning—providing time for instructional planning, discussion, and consideration of underlying principles of project-based design.</td>
<td>We framed the PD around essential questions and allowed time for facilitated conversations and focused planning. We also intentionally built in think and talk time. Over 70 percent of the institute was devoted to discussions between school teams and planning sessions within school teams.</td>
</tr>
<tr>
<td>Coherence—aligning the PD with instructors’ personal goals for learning and their goals for students, coherence with other reform activities and standards in the local school contexts.</td>
<td>We opened the PD with opportunities for participants to articulate their personal goals via informal profiles shared with the group. We focused on purposeful problem solving rather than recipe exchanges. Each school team also collaborated on school action plans that connected project based learning with classroom-library standards and the school’s priorities.</td>
</tr>
<tr>
<td>Sustained learning and support—moving beyond the conventional one-shot workshops and formal course formats to a year-long, interactive learning and teaching experience.</td>
<td>We blended face-to-face and online interaction for teachers to learn from each other based on their own level of development and preparedness rather than structuring everyone’s progress into a fixed sequence. We built in iterative cycles of planning, trial, reflection, and modification/change and provided ongoing mentoring and peer critiquing opportunities in both face-to-face and online formats.</td>
</tr>
<tr>
<td>Problem solving regarding local barriers and supports—addressing conflicting demands and school-specific initiatives as a real part of the challenge.</td>
<td>We integrated real-world issues into the implementation phase and encouraged teams to share challenges they encountered in carrying out their action plans.</td>
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</table>

**Figure 1. Essential Features of Effective PD**

**Engaging in Collaborative Learning**
The PEARL initiative focused on a practice-based foundation using authentic records and tools for teaching and learning with the aim of creating a common ground for individuals and teams to jointly plan, teach, and reflect. The tone for the PD was established with the following questions that developers and participants found essential in understanding and dealing with learning in schools:

- What makes students effective researchers?
- How can inquiry shape student research?
- How might students build sufficient background knowledge to identify researchable topics and issues?
- How might students be challenged to create more rigorous and creative questions?
- How might students chronicle and reflect on their research journey?

To address these questions in a collaborative environment, our team experimented with strategies that invited open exchanges, more questions, and collegial feedback during the institute. Examples of strategies included:

**Facewall:** In this “no tech” social networking approach participants used sticky notes to generate questions or ask for assistance with something being covered in the institute. They posted their notes on a bulletin board, which served as the Facewall. Throughout the day, participants browsed through the postings and responded to them with more sticky notes. The continuous stream of postings reflected how participants were feeling about the activities and flagged possible areas for adjustments in the training.

**Student profiles:** We created six profiles that described fictional students who were working through their projects. Teams read the profiles and “adopted” one of the students to assist in successfully completing his or her project. Participants appreciated this technique that brought out recognizable student traits and concretized their discussions. As one of them noted in a conversation with the authors:

> The student profiles made our conversations and recommendations real. Our team selected Logan (one of the fictional students) because he mirrored many of the traits we saw in our students such as lack of interest in academic work, limited extracurricular activities, and a desire for quick fixes to things. At the same time, he was curious about nanotechnology and we thought this might be a hook for a possible project for Logan.

**Swap meets:** While we spent the mornings introducing a range of intervention strategies to use with the participants, we devoted the afternoons to team planning sessions where members brainstormed how they might adapt techniques and tools to their own situations. The swap meet in the last hour of each day was time set aside for teams to share their progress and seek feedback from their PEARL colleagues. This form of public reflection allowed novices and experienced instructors alike to learn from others. As one teacher described it:

> The swap meets were critical. If we reported a roadblock in our thinking, someone from another team would suggest something that opened new options we had not considered. We also loved the opportunity to help other teams with their issues. These exchanges definitely energized all of us.
Other strategies that we incorporated into the PD included the following:

- Critical friends – allowing buddies to critique one another’s works in progress
- Gallery walk – displaying created artifacts (e.g., charted lists, visualizations of ideas) and having participants browse and comment on the artifacts
- Gamification – using gaming techniques to engage participants (e.g., team competitions and joint problem solving)
- Role-playing – enacting different roles and inviting participants to experience situations from different perspectives and points of view
- Peer teaching – having school teams teach others about the tools, strategies, and lessons they had successfully used.

At the end of the summer institute, participants and developers agreed on a timeline for the online postings during the school year that would include regular reflection reports. The reports were public to all PEARL team members thereby allowing teams to provide feedback to one another. While we assigned each team to a buddy team for this purpose, we also encouraged exchanges among all teams. A critical component of the online work was providing timely and relevant feedback as PEARL developers. Wiggins’ (2012) observations about the characteristics of effective feedback held true for our adult learners.

- Ensure that the learner has a goal, acts on it, and receives goal-targeted feedback.
- Provide actionable feedback that is specific, concrete, and useful.
- Fashion exchanges that are learner-friendly--avoid overloading or being too technical.
- Provide timely responses so the learner has opportunities to revise and improve on performance.

Figure 2 provides a sampling of characteristics and feedback offered in our online conversations.

<table>
<thead>
<tr>
<th>Characteristics of Effective Feedback</th>
<th>Examples from PEARL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offer specific suggestions for improvement</td>
<td>“Your students had trouble developing questions from a list of different perspectives. I wonder if the list needs to be shortened and whether students want more examples of questions from the selected perspectives?”</td>
</tr>
<tr>
<td>Pose questions to clarify and expand on points made</td>
<td>“You had a great approach to having students explore problems in the real world. How did you introduce current events to motivate their interest? What activities did you implement?”</td>
</tr>
<tr>
<td>Encourage cross-team dialogue</td>
<td>“It must be ESP because several of your colleagues brought up the same issue of involving community participation.”</td>
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</table>
mentors in the research projects! Check out the suggestions that Amy and June made in their reflections this month.”

Link to your personal experiences

“As a former English teacher, I can relate to your concerns that students don’t do enough critical reading so they have limited models of good writing.”

Figure 2. Characteristics and Examples of Effective Feedback

**Impacting Teaching and Learning**

As developers, our critical question was how did the PEARL experience influence teaching practices in project-based learning? To study the overall impact of the year-long PEARL training, we collected data from surveys and post-interviews as well as participants’ logs, reports, and final portfolios. We employed an open and axial coding process to identify themes that emerged from the qualitative data. Quantitative data from surveys were analyzed using t-tests to determine if the gains reported were statistically significant and substantial.

The PEARL training had covered a range of skills deemed essential in inquiry-framed projects. They included: identifying researchable topics, conducting preliminary searches for background information, generating higher-order questions, writing thesis statements, refining search strategies, evaluating resources, synthesizing information, and reflecting throughout the process. While all participants indicated that they incorporated many of these skills in direct instruction, the following areas emerged as especially critical in a majority of the logs written and in statements made during the interviews. We capture representative comments below.

**Allowing time for pre-searching to explore topics and gain background knowledge.** A librarian made the following observation of her team:

> I think in the past, my teachers did not realize the importance of giving students time to explore and build some background knowledge before selecting their final topic. As a result of PEARL, the teachers I collaborated with scheduled several days for pre-search and I felt it was very useful. This also gave us time to meet with each student to talk about their topic and possible avenues of research and how it could tie into their actual project.

**Guiding students in topic selection.** In previous years, teachers admitted that they expected students to “find topics” on their own. One teacher acknowledged that guiding the students to select topics of relevance and interest was the first major hurdle in the process. She noted:

> The Assessing the Topic of Choice [introduced in the training] was a good tool to use when conferencing with the students. It made them evaluate their topics based on the criteria provided. During our conferences with the students, these criteria helped us provide the students with specific feedback on their topics.
Participants also experimented with interactive instructional techniques that allowed students to assume greater responsibility for collaborative learning. The following excerpts from teachers’ logs describe the uses of peer critiquing and mentoring.

One team described using peer critiquing as students their generated questions:

*Having students work in small groups made managing the large class much easier. [Note: this was an academy with over a hundred students.] We also had five adults on the floor to help as necessary. Having students share out in a round-robin style worked well. It provided more immediate feedback than if questions were just turned in to the teachers. As students shared and got the “thumbs up” there was a sense of validation and pride. There were a few “oohs” as students tried to outdo each other in asking questions at a higher order of thinking. When they were off their targets, it gave the teachers an opportunity to correct misunderstandings and to refine the questioning. Occasionally as students read a question aloud, they would catch themselves asking an inappropriate (for the perspective) question. We encouraged them to challenge the thinking without attacking the thinker.*

In another situation, senior students mentored their junior colleagues:

*Having the 2010-2011 Health Services Capstone students mentor the 2011-2012 Capstone students in the fourth quarter of their junior year was very successful. The seniors helped the juniors brainstorm possible topics and also gave them advice about how to plan and implement their projects. The juniors became the seniors’ assistants during their presentations at the oral boards and also practiced with them during the fourth quarter. This activity took place during recess, lunch, and after school. The seniors also shared the different components of their portfolios and their research papers. This type of advice offered by peers was much more powerful than any advice we could have provided.*

**Recognizing that Inquiry Teaching and Learning Is Bumpy and Messy**

As teams planned and implemented their ideas, they constantly had to rethink what they were doing. A librarian described the following exchange with one of her teachers. As they closely observed what students were doing, they made necessary adjustments in their team taught instruction.

*The students kind of took a step back at one point because they realized their questions weren’t that good. We had continued on but then we realized that we should get them to think a little more. We also took a step back to the question generation phase…we wanted to get them thinking about what they had done and how improvements could be made.*

Another librarian said the “big a-ha” for her team was giving themselves “the permission to make changes without feeling like we had failed…that we were engaged in a spiral of trying things, observing the results with students, getting student feedback, and returning to the design table again.”
Reflecting as Part of the Learning Process

Prior to PEARL, teachers acknowledged that they had given “little time” to students reflecting on their ongoing work. As a result of the summer exchanges, the teams modified the assessment and conferencing handouts provided during the institute to incorporate reflection as an integral part of the projects. A librarian reported:

*It was a good idea to incorporate assessment checklists into the worksheets. This helped students to be aware of the criteria for their work. Also, the PEARL Conferencing Check-Log for Research was a great forum for students to reflect on the research process and for mentors to provide specific feedback on the students’ reflections.*

By having her students assess their own progress, a teacher discovered the power of self-reflection:

*I was surprised that students were able to articulate their feelings, understand their learning targets, and provide wonderful feedback on their learning process. The rubric I used as a reflection piece was invaluable and I will continue to use this template in the future. The main reason it worked was students were able to identify their needs and what they felt they could improve upon. As a teacher, I couldn’t ask for better feedback than having students be able to tell me themselves.*

Growing Instructional Partnerships

A crucial target of the PEARL training was to strengthen the instructional partnerships of librarians and teachers. Individuals completed open-ended survey questions regarding their instructional relationships as teams prior to and after the PD. Almost 80 percent of the participants indicated that their relationships were markedly strengthened as a result of the collaborative planning and problem solving during the training. In some cases, partnerships had not existed before PEARL and the intensive opportunities to plan and exchange ideas seeded the new working relationships. The remaining 20 percent indicated that their instructional relationships had been positive even before the training and that PEARL helped them sustain their existing levels of cooperative and collaborative work. Teachers discovered that their librarians contributed deep understanding of how information might be interpreted, evaluated, and applied to new contexts. At the same time, they appreciated the emotional support librarians brought to the team. A teacher, who worked with her librarian for the first time, wrote:

*Hands down, the BEST part of this project has been the collaboration with T [librarian]. She was a tremendous support and resource. She was always willing to check out another source or pursue another angle or clarify a difficult idea. Working with her bumped up the quality of the thesis statement tremendously. There is no doubt that taking the PEARL institute as a team made the research process much more palatable. We had a clearer sequence of the process and definitely had a better handle on how to get to the thesis statement. The academic and personal support that I received from my librarian created a vehicle for my own growth as a writer and as a teacher.*

Reflecting on Student Outcomes
Teaching teams used a range of rubrics and checklists to assess student performance on the major phases of research. We had introduced assessment tools at the institute and teams were invited to adapt them or design their own instruments. We asked the teams to report percentages of students succeeding and percentages failing to meet the criteria for research skills that were taught. The following notes capture the teams’ reflections about strategies that worked; areas where students continued to have difficulties; and plans for future modifications and changes.

Selecting a topic/pre-searching for background knowledge. Teams reported that almost 85 percent of the students were able to select topics that met criteria for intellectual rigor, personal interest, feasibility in terms of time and resources needed, and possible relevance to the community. The teachers indicated that the number of students completing this task was “much higher” than in previous years although no statistical data had been collected in earlier semesters. They attributed this increase to the use of PEARL tools such as the personal inventory and a checklist to determine the quality of the topics. Using these tools provided students with “ideas they had not considered” and “connections with things the students actually cared about.” The teams indicated that a majority of the students, who dropped out of the project assignment, were those with chronic absentee rates and those who transferred to other schools. In their reflections, teams discussed future adaptations that included peer sharing and critiquing of topics as well as more individual and group conferencing sessions to brainstorm possible topics and provide timely feedback.

Generating questions. Students admitted that generating their own questions was “a first time experience” for most of them. Teachers also commented that many students expected instructors to “give us the questions.” To initiate this activity, the teams experimented with the Question Master game approach, which was a friendly competition to generate questions from different perspectives. According to the teams, about 75 percent of the students were able to produce questions for their own projects that were clearly stated, central to the issue or topic under study, and generative in nature. The remaining students could only generate questions at “basic (who, what, where, when) levels.” Since most of the feedback had been solely between the instructor and the individual student, several teams reflected that they would incorporate more peer sharing of questions using different strategies such as pair-share and gallery walks in the future. They also discussed ways to introduce, model, and guide students to use graphic organizers that focused on broadening as well as deepening questions such as mind mapping, hierarchical trees, and question matrices.

Creating thesis statements. Teams acknowledged this skill remained the most difficult for them to teach and for students to master. Only 52 percent of the students met expectations for statements that clearly articulated a stand and that were potentially arguable. Although the instructors used checklists to identify key elements of effective thesis statements, in retrospect, many of the teams realized they had not provided sufficient time for students to explore and gain adequate background knowledge about their selected topics to formulate researchable thesis statements. They also noted that students needed “a range of sample statements to analyze” instead of a quick lesson on
creating “good statements.” In their reflections, teams considered future sessions where students could examine sample sets of statements and “calibrate” their quality using the criteria provided. As one teacher noted: “Just modeling good thesis statements is not very effective. Students have to examine both weak and strong statements—we need to guide them through discussions about why certain statements are stronger than others and what can be done to improve weak ones.”

Locating and evaluating information sources. Librarians led these sessions for all teams and reported that over 80 percent of the students were successful in accomplishing the tasks involved. Most of this work focused on using online databases, i.e., EBSCO. Students who did not satisfactorily complete this phase of research had particular difficulty with identifying bias. Librarians stated, “Simply identifying who produced the article or the site was not enough to determine bias.” They discussed the importance of closer reading, e.g., having students compare two articles describing the same event and analyzing their choices of words as well as the organization and possible omission of facts.

Organizing and synthesizing information. About 75 percent of the students produced drafts of formal writing that included a clearly stated thesis supported by cited evidence in a coherent presentation. In reporting the results, teams that incorporated the use of graphic organizers as a step between note taking and drafting final papers noted that students had greater success in the final phases of their projects. The organizers ranged from idea webs to hierarchical tree structures and fishbone organizers. One librarian noted, “It’s a misconception we have as instructors that our students can move seamlessly from taking notes, which is data collection, to shaping personal knowledge from the data. An organizer helps many of them visually represent how they are making sense of what they have collected. I think it’s a necessary bridge to understanding.”

Coreflecting on progress. In past years, the majority of the teachers acknowledged that assessing students’ progress had been a “hit or miss” practice. A teacher admitted, “I did it very informally and only if I had the time.” In addition, students frequently did not have a voice in the process, e.g., they turned in their notes and received grades on them but had no real opportunity to discuss their work with the instructors. In short, assessment was sporadic and teacher-focused. As a result of exchanges during the PEARL institute, teams experimented with variant forms of conference logs. The forms included columns for key tasks, dates started and completed, and spaces for student and mentor comments as well as next steps to take. Students were responsible for maintaining the logs and having them available during conferences. Several schools used Google Drive for this activity and reported success in editing and exchanging comments in this online environment.

**Tackling Problems and Adjusting Practice**

All the teams experienced hurdles that were challenging to surmount. Some of the obstacles were linked to students’ lack of motivation to complete research projects. This resulted in school-initiated future plans to focus on more individual conferencing and peer interaction and to integrate additional technology tools for learning. Both teachers
and librarians admitted that lack of time exacerbated by restrictive testing schedules made it difficult to teach all aspects of the research process. Therefore, many teams currently have plans in motion to initiate work on research skills earlier than the senior year. All the high schools participating in the PEARL training reported that they were able to gain administrative and faculty support to begin research activities with juniors, and in some cases, even earlier with freshmen and sophomores.

Other teachers planned to start with smaller writing projects within a school year and build skills in a scaffolded fashion. As one participant reported:

*I plan to have smaller writing projects during the school year to supplement the activities done in class. This way a student can build upon acquired skills and knowledge and apply this information in new ways. For example, I would like to include a mini-position paper into the curriculum so students can have practice writing thesis statements and conducting research.*

**Sustaining and Expanding Partnerships**

A critical focus for PEARL has been the participation of librarians as key teaching partners. In all instances, teachers discovered that librarians could “do substantially more than help with finding resources.” Librarians played major roles in the pre-searching phase of the projects and they assisted with conference sessions. Many of them also critiqued students’ final work as members of judging panels. In a recent email message, one of the librarians summed up the partnership experience as follows:

*My team came to realize that involving me in many facets of the work not only made their tasks easier, but that I contributed things they admittedly weren’t adequately addressing. They knew their subject areas; I contributed the process knowledge. The combination made everything so much better for our students.*

The question, of course, is whether school teams have been able to sustain their collaborative work. In phone and email contacts with the PEARL librarians, all but three indicated that they have continued to work with partners albeit the team compositions have changed because of retirements, transfers, and changes in teaching assignments. One of the three librarians reported that her original partners both retired and she is searching for new team members. The other two librarians transferred to new high schools where they are “still getting to know the faculty.”

A critical development has been the expanded leadership roles reported by seven of the librarians. They stated that working with their PEARL teams contributed to their “willingness and confidence” in assuming the following tasks:

- Leading a newly established schoolwide task force for project-based learning
- Codesigning and coteaching a special summer program for middle school students in core areas including research skills to prepare them for high school
- Participating in a work group with community college librarians to bridge the research gaps in the transition from high school to college
- Coordinating the campus senior project initiative
- Collaborating with the school curriculum coordinator to design and deliver professional development for teachers
- Coordinating the mentoring program for new teachers
- Initiating a series of “tech tools for learning” sessions that are open to students, faculty, and staff.

**Conclusion**

Quality PD acknowledges that the processes of teaching and learning are ambiguous, complicated, and nonlinear. The PD centers on the tasks, questions, and problems situated in practice. Instead of definitive answers and preordained solutions, participants focus on possibilities, methods of reasoning, and alternative conjectures. Importantly, this inquiry-oriented stance is a collective endeavor where professionals learn from one another.

As a development team, we realized that to create K-12 learners who are complex problem solvers and reflective researchers, the teams guiding them must also live the same process. By focusing on critical questions about teaching and learning, participants challenged themselves to design instruction as teams and foster learning as teams. They discovered the power of colearning and self-discovery where members accepted a collective responsibility for student learning. The gestalt effect of the interaction has truly been a phenomenon that results in a “whole that is other than the sum of its parts” (Tuck 2010).

**Note**

The PEARL Web site includes a training guide as well as handouts and news vignettes. We invite you to visit the site at http://www.hawaii.edu/lis/pearl/

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