A Practice-Centered Approach to Professional Development: Teacher-Librarian Collaboration in Capstone Projects

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Abstract

This paper reports on a professional development initiative that targeted teams of teachers and librarians working with high school students on strengthening an inquiry approach to capstone projects. While much has been written about student-focused models for information search and use, little has been reported on how training for the instructional teams might be structured to embody a constructivist inquiry approach with the adults who are facilitating this type of learning for students. This article describes the design and implementation of a statewide training program "Pathways to Excellence and Achievement in Research and Learning" (PEARL) that was implemented in Hawaii. The author reports on the theoretical framework for the training, interventions used, data collected, and the influence of the training on teaching practices focusing on information literacy instruction.

Introduction

Paradigm Shift in Professional Development for Educators

School districts across the nation have expended considerable resources to deliver professional development (PD) opportunities to school staffs on a range of topics and themes (Flint, Zisook, and Fisher 2011). In an era of high-stakes testing and standards-based educational reform, administrators acknowledge that effectively implemented PD vitally influences systemic change (Kubitskey and Fishman 2006; Christiansen and Robey 2015). A critical feature of such programs is allowing teachers to learn about practice *in* practice through which teachers' records of actual work result in collective professional knowledge (Ball and Cohen 1999; Ball, Ben-Peretz, and Cohen 2014).

Schools are viewed not only as places for teachers to work but also as places for teachers to learn (Hawley and Valli 1999). Recent research on teacher professional development underscores the importance of the alignment of PD with standards, curriculum, and assessment (Allen and Penuel 2015). Effective pedagogical approaches require emphasis on instructors' working as co-facilitators and operating as school teams (Owen 2015). This emphasis requires that instructors

meet collectively to collaborate and learn in actual school settings for the purpose of bringing collective inquiry into best practice and developing a shared commitment to continuous improvement (Christiansen and Robey 2015). Such PD calls for collegial learning opportunities that focus on solving authentic problems defined by the gaps between goals for student achievement and actual student performance. The reality, however, is that most traditional forms of PD remain train-the-trainer models or one-session workshops. Tragically, PD is often "demeaning and mind numbing as folks passively sit and get the wisdom of so-called experts" (Sparks 2002, 2–3).

Library educators have recognized the importance of shifting the PD paradigm from an instructor-driven transmission focus to a learner-centered constructivist approach that more closely mirrors how students effectively acquire information literacy (IL) skills (Callison 2004; Kuhlthau, Caspari, and Maniotes 2007; Montiel-Overall and Hernandez 2012). While transmission learning often relies on prescribed textbooks and packaged materials, guiding the process of construction requires the expertise of professionals who can formulate the overall direction and underlying principles to be developed during the learning experience. These professionals must craft their instruction to provide for active engagement that builds on past knowledge and develops higher-order thinking, which capitalizes on the social construction of knowledge. In this context, school librarians can play critical roles as participants in school-level teams and professional learning communities, bringing to the table their knowledge and skills as information specialists, staff developers, and researchers (Hughes-Hassell, Brasfield, and Dupree 2012).

Students' Capstone Work

Project PEARL (Pathways to Excellence and Achievement in Research and Learning) was a three-year endeavor that focused on professional development for teams of teachers and school librarians working with high school students on capstone projects. These projects served as culminating academic experiences for students, who received special honors distinction at graduation. Students were asked to select a topic, profession, or social problem that interested them, conduct research on the subject, create a paper and a final product demonstrating their learning acquisition or conclusions, and give an oral presentation on the project to a panel of teachers, experts, and community members who collectively evaluated its quality.

At the onset of their work, students participated in informational orientation sessions where they received handbooks that detailed procedures and timelines, and the requirements and criteria for assessing the quality of the paper and the final product. These school-level handbooks were based on a template prepared by state department of education content specialists in collaboration with a committee of teachers from different high schools. This use of a template ensured a measure of consistency in expectations across the participating schools. At each school, students were also assigned mentors who were teachers and resource personnel, including school librarians, counselors, and resource teachers (specialists who coached students who needed to improve their reading and writing skills). Students were expected to meet regularly with the mentors and maintain learning logs and checklists on their progress.

Students and mentors used the rubrics included in the handbook to familiarize themselves with the criteria for the overall quality of papers and products. Final papers were evaluated by faculty members at each school. In some schools, most of the faculty were involved in the review process; in other schools, teachers volunteered to serve as reviewers. The reviewers received training to use a calibration procedure for scoring student papers using the school's rubric.

Appendix A includes an example of a rubric for the research paper; this rubric is from one of the high school handbooks (Henry J. Kaiser High School 2013).

The research products were intended as extensions of the paper and could take one of several forms, including community service with government agencies and nonprofit organizations, career-related activities based on job shadowing and internships, and self-enhancement projects that allowed students to delve more deeply into areas of personal interests (e.g., theater arts, music, creative writing).

Unlike the paper review, assessment of the project presentations involved a wider spectrum of adults, including professionals and experts from the community and the local colleges. Assessment panelists were invited by the school's capstone project committee and selected based on the individuals' expertise in areas related to the students' work. Many of these panel members had formerly served as community mentors to individual students. For example, panel members included college faculty in STEM fields and the fine arts, artisans and architects in industrial arts and engineering, and members of the business community and nonprofit organizations where students had done community service. Appendix B includes an example of a rubric for evaluating the product presentations; this rubric is from one of the high school handbooks (Henry J. Kaiser High School 2013).

Project PEARL

Project PEARL worked with school teams, focusing on the skills involved in preparing the paper portion of the capstone work. Writing this paper required students to demonstrate a complex set of information-literacy competencies, including initiating substantive questions, reading and thinking critically, and analyzing and synthesizing found information to create new knowledge. Importantly, this was the segment that centrally involved school librarians in team teaching and consultative support to the students.

Funded by the Institute of Museum and Library Services (IMLS), the objectives for Project PEARL were to work with instructional teams in identifying critical learning gaps in the information-seeking process for students, implementing instructional interventions to address these learning gaps, and cultivating coteaching opportunities. The training was conducted on the island of Oahu in Hawaii. IMLS funding covered transportation and housing for participants from the neighboring islands, in addition to tuition for continuing education credit for all participants through the University of Hawaii's Outreach College. To capture participants' perceptions of effective learning and their actual practices, data were collected through questionnaires, interviews, reflection logs, and final portfolios that included lesson plans and exemplars of student papers and products.

The development and training team for Project PEARL was made up of three secondary school and university librarians and two library educators. Each librarian on the team had more than fifteen years of field experience. One of the library educators was a professor in library and information science with twenty years of university teaching, and the other was a specialist in computer and information sciences with five years of mentoring undergraduate students.

Related Literature

Overview

A literature review was conducted to help the development and training team create an effective instructional framework for the professional development and to identify gaps in students' information-searching and use skills that are essential to writing capstone research papers.

PD Framework

The focus of the PD was applying a practice-centered approach with school librarians and teachers as they identified gaps in high school students' IL skills and collaborating on interventions that would help students to bridge those gaps. A critical first step was reaching consensus on the goal of information seeking. There had to be agreement that the objective was more than locating relevant information—that student-centered learning moves information seeking beyond locating information and toward constructing new understandings as a result of personal meaning-making (Kuhlthau 2003). James E. Herring and Anne Marie Tarter (2007) succinctly captured the following as major elements of IL:

- identifying the purpose of the information and major ideas and questions connected with it;

- selecting sources in various formats to satisfy the purpose and extracting relevant information from them;

- analyzing, synthesizing, and organizing the information into newly found knowledge;

- communicating this knowledge to others; and

- reflecting on achievements and ways to transfer to other settings what was learned about both process and content.

The current national standards for twenty-first century learners published by the American Association of School Librarians (2007) confirmed the importance of situating IL in an inquiry framework. The standards depicted the range of skills, dispositions, responsibilities, and self-assessment strategies that promoted the notion of learning how to learn. These standards broadened the concept of IL by incorporating the skills necessary for a constructivist view of learning in which students are empowered to ask meaningful questions and follow a path of discovery to construct their own understandings, draw conclusions, create new knowledge, and share their knowledge with others (Stripling 2008).

Project PEARL developers agreed that a constructivist approach in teaching was foundational to effective learning for students. Based on the premise that cognition is the result of the interaction between people's experiences and their existing mental schemata (frameworks of knowledge), constructivism focuses on connecting new information with existing knowledge (Bruner 1996; Bransford, Brown, and Cocking 2000). This learning paradigm supports a nonlinear path of exploration that recognizes the inherent messiness of authentic research projects and invites participants to investigate open-ended problems (Fosnot 2005; Clark, Kirschner, and Sweller 2012). Rather than directing instruction, teachers guide learners to construct their personal meaning of the content through a process that is active and social (Vygotsky 1978; Brooks 2002).

The PD developers recognized that a constructivist approach to student learning meant that the teachers and school librarians guiding the process must also be immersed in a similar stream of learning. PD participants had to experience an active, ongoing process of learning by questioning and building on what they already knew. In a review of the research on effective PD for the adult learner, the PEARL team identified the following critical themes that embraced a constructivist frame of reference:

- Emphasis on active inquiry-oriented learning: Time is scheduled for instructional planning, discussion, and consideration of desired student learning outcomes (Ball and Cohen 1999; Singer et al. 2000; Penuel et al. 2007). Deeper learning is integrally linked to reflective practice (Bourner, 2003; Leung and Kember 2003).

- Focus on coherence: The training is aligned with teachers' personal goals for learning and their professional goals for student achievement and attainment of standards (Kubitskey and Fishman 2006; Darling-Hammond 2008).

- Provision for sustained learning and support: The training moves beyond the conventional one-shot workshops and formal course formats to a year-long learning and teaching experience that combines iterative cycles of planning, trial, reflection, and modification/change. Continuous mentoring and peer-critiquing opportunities are provided in both face-to-face and online formats (Resnick and Hall 1998; Guskey 2002). Ongoing reflection provides a dynamic way of thinking about practice and professional growth (Schön 1983; Fenwick and Tennant 2004; Booth 2011).

Gaps in Students' Information Seeking and Use

Concurrent with a review of the literature on constructivist applications to teaching and learning, the PEARL developers studied the literature on student behaviors in information seeking and use, particularly reports identifying students' weaknesses in IL skills. In a meta-analysis of studies dealing with high school students engaged in research, Jin Soo Chung and Delia Neuman (2007) concluded that students have difficulties in a range of critical skills, including accessing, evaluating, and using information contained in particular information sources. Shu-Hsien Chen (2003) and Joyce Valenza (2006) focused on the many difficulties that students have in formulating search problems, including the concept of keywords, the development of search strategies, and the use of browsing techniques.

While evaluating information sources remains a critical skill for college readiness, interpreting and communicating students' findings are additional facets that they must master in the learning process. Unfortunately, in his New Jersey study Ross Todd found these areas were among those least taught by school librarians: 80 percent or more of the librarians focused on awareness of sources and access strategies, and on the ethical use of information; 70 to 80 percent focused on the critical evaluation of sources; and only 50 to 60 percent taught the more challenging and highly individualized tasks such as forming one's own questions about a topic, in addition to sorting and organizing information and ideas (2012, 5).

In their research on the influence of motivation on student persistence and success in information seeking, Ruth V. Small and colleagues discovered that instruction often lacked relevance with little opportunity to encourage personal control or satisfaction in both K–12 schools (Small 2000) and in community colleges (Small, Zakaria, and El-Figuigui 2004). Although students appeared to value the learning of search strategies, overemphasis on searching, without situating

the search within a relevant problem-solving context and not providing students with adequate guided practice, resulted in lowered student motivation.

In addition to the literature review, the PEARL development team conducted a focus group session with a dozen librarians from Oahu high schools. The purpose of the focus group session was to identify specific challenges that instructional teams had uncovered in capstone work with their students. The problems that the school librarians identified were mirrored in published reports about students' inability to properly analyze and synthesize information (Herring 2006; Rowlands et al. 2008; Prensky 2009; Donham 2014; McNicol and Shields 2014). The local librarians confirmed the following gaps in conducting effective searches, gaps that had been noted in earlier studies (Branch 2003; Neely 2006; Donham 2007):

- Location of information and ideas: Students were frequently unfamiliar with discipline-specific resources. They had difficulty identifying key reference sources along with subject-related databases, and professional, state, and federal websites.

- Development of appropriate and efficient search strategies: Students were generally novices in developing search strategies, e.g., identifying keywords, synonyms, and related terms, and knowing when natural language searching was possible.

- Evaluation and assessment of findings: Students had difficulty identifying and understanding key concepts in retrieved information, restating those concepts and details accurately by paraphrasing, and identifying material that was appropriate for quoting. They struggled with the analysis of websites and with the critical evaluation of information found in various sources.

Importantly, the focus group agreed with earlier studies (Branch and Solowan 2003; Williams and Coles 2007), noting that teachers themselves frequently lacked key information skills such as where and how to search and how to evaluate sources. Although classroom teachers possessed disciplinary knowledge, librarians strongly felt that they, too, could assist students in constructing meaning from retrieved information. Participants in the focus group reinforced the notion of information literacy as the foundation for interpreting, evaluating, and applying information and knowledge to new contexts.

Project Design and Implementation

Recognizing that adult learners are largely self-directed, the PEARL developers capitalized on the participants' rich backgrounds of experiences, knowledge, skills, and interests by inviting the school teams to assume an active role in their own learning (Earley and Bubb 2004; Merriam and Bierema 2013). The PEARL developers incorporated problem-solving strategies applied to real-world needs and emphasized the use of authentic records and tools for teaching and learning. The developers' overarching goal was to create a common ground for individuals and teams to jointly plan, teach, and reflect. A critical component of the PD was posing the following types of questions that challenged participants to examine current practices and brainstorm alternatives:

- What makes students effective researchers?

- How might teachers and librarians help students build sufficient background knowledge to formulate researchable topics and issues?

- How might educators—both classroom teachers and school librarians—guide students to create more-rigorous and creative questions?

- How might students think more critically about their research journeys?

Participants

About six months prior to the PD, information about Project PEARL was mailed to all high school principals in Hawaii, encouraging them to ask members of their faculty to apply for the project. At the same time, e-mail messages were sent to the high school librarians in the state so that they would encourage teachers to join them in Project PEARL. Two criteria were used in selecting the participants: (1) the schools had to be implementing capstone work with students, and (2) participants had to apply as teacher and librarian teams. From 2010 to 2013, two cohorts were selected for a total of sixty teachers and librarians from twenty-four secondary schools. Two-thirds of the teams represented schools on the island of Oahu; the remaining third came from schools on the Big Island (Hawaii), Maui, and Molokai. The participants' years of teaching experience ranged from two to thirty years. These teams worked with a total of 811 students in grades 9 through 12.

Organization of the PD

The training experience for each cohort began in the summer with a one-week institute held in June at Kapolei High School on Oahu. The remainder of the PD program extended into the school year (August through May); teams developed and implemented their learning plans at their respective sites. Using Laulima, the University of Hawaii's course management system for online instruction, the teams posted monthly online reports and exchanged (with the developers and their PEARL colleagues) reflections about their progress. At the end of the school year, each participant also submitted a culminating electronic portfolio that included lessons and summaries of related activities (e.g., reports of conferencing sessions), exemplars of student work, and reflection logs.

The formal PD was conducted from 2010 to 2013; PEARL developers have continued through the present to keep in touch with PEARL participants. By means of phone calls and e-mail exchanges, the developers collect informal longitudinal information that includes representative samples of capstone work and reports on the evolution of the teams themselves as people have retired or moved to new schools.

In designing the PD, the developers addressed questions such as:

- How do adult learners learn best?

- How might the PD be organized and delivered to capitalize on the needs and interests of these learners?

Table 1 highlights the attributes of effective training gleaned from the professional literature and the attributes' integration in Project PEARL.

Table 1. Attributes of effective PD for educators and their implementation in Project PEARL.

Attributes of Effective PD	Implementation in Project PEARL
Coherence—Aligning the PD with instructors' personal goals for learning and their professional goals for student achievement and attainment of standards.	The PD provided opportunities for participants to articulate their personal goals via informal profiles shared with the group. The institute focused on purposeful problem solving rather than "recipe" exchanges. Each school team also collaborated on learning plans that connected project-based work with classroom and library standards.
Sustained learning and support—moving beyond the conventional one-shot workshops.	The PD blended face-to-face and online interaction for teachers and school librarians to learn from each other based on their own levels of development and preparedness rather than structuring everyone's progress into a fixed sequence. PEARL developers built in iterative cycles of planning, trial, reflection, and modification/change, and provided ongoing mentoring and peer-critiquing opportunities.

The PEARL developers incorporated elements of play and humor in a relaxed learning environment. During the summer institute, strategies such as the following were found to increase affiliation among participants, advance cognitive development, and invite exploration in a safe learning environment.

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. Participants 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 additional sticky notes. The continuous stream of postings reflected how everyone was feeling about the activities and brought attention to possible areas for adjustment in the training.

Student profiles: The development team created six fictional profiles of students, each working through a capstone project. In the institute, 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 attention to recognizable student traits, and grounded and focused participants' discussions.

Swap meets: While the developers spent the mornings introducing a range of intervention strategies, the afternoons of the institute were devoted to teams' brainstorming 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 school teams to share their progress, seek feedback from one another, and

share successful interventions they had already been using. This form of public reflection and exchange allowed novices and experienced instructors alike to learn from others. The PD conversations focused on identifying the IL gaps and determining strategies that might help students to bridge these gaps (table 2).

Table 2. Student gaps in IL skills and sample interventions introduced.

Student gaps in IL skills	Instructional strategies to address gaps
Topic selection	Personal-interest inventories, assessments of experiences and skills, conferencing
Exploration or pre-search to gain background knowledge	Concept mapping, research logs, conferencing
Question generation	Protocols for question generation, Question Master (gaming technique), critical friends (peer interaction and critiquing), gallery walks to exchange feedback
Thesis formulation	Prompts, conferencing
Search techniques	Basic and advanced search techniques, templates to enter search strategies, conferencing
Analysis, synthesis, and organization of findings	Organizers (e.g., mind map, hierarchical tree, fishbone diagram, timeline, flowchart)
Self-reflection	Research logs, group reflection circles

At the end of the one-week summer institute, school teams and PEARL developers agreed on a timeline for the online postings that were critical for the remainder of the PD. These online reports and reflections were made public amongst the participants. As a result, teams could continue providing feedback to one another.

Research Questions

To assess the influence of the PEARL experience on school teams assisting students with their capstone papers, the developers focused on the following questions:

- RQ 1: How did the summer institute influence participants' levels of confidence in teaching the IL skills students need to write their capstone papers?

- RQ 2: How did the year-long PD influence IL instruction provided by the school teams?

- RQ 3: How were instructional relationships in the teacher and librarian teams influenced by interactions during the year-long PD?

Overview of Assessment of Project PEARL

A mixed method approach (Tashakkori and Teddlie 1998) was used to assess Project PEARL's impact on the instruction provided by the participating teams. The data were initially analyzed quantitatively and further supported with qualitative data. Quantitative data were collected using a retrospective pre-post questionnaire (Pratt, McGuigan, and Katzev 2000; Rockwell and Kohn 1989). Clara C. Pratt and colleagues (2000) stated that self-reported program evaluations using traditional pre-program and post-program questionnaires often lead to inaccurate results due to *response shift bias* that is influenced by limited knowledge prior to program participation. Pratt and her colleagues indicated that a retrospective pre-post questionnaire (administered after a program, but containing questions about respondents' pre- *and* post-program attitudes and actions) allows participants to focus on their experiences with the program and compare these experiences to their previous behaviors. As a result, responses to a retrospective pre-post questionnaire provide a more-accurate description of the participants' perceived gains. This information was supported with merged data from on-site interviews, online logs, and culminating electronic portfolios. To conduct this study, the development team received approval from the University of Hawaii's Office of Human Services and from the Systems Accountability Office in the Hawaii Department of Education.

Instrumentation and Analysis

Quantitative Data

Participants' perceptions of confidence and practice were collected using two retrospective pre-post questionnaires based on a five-point Likert scale from low (1) to high (5). The questionnaires were created by the PEARL developers and vetted by two state specialists in the School Library Services Division of the Hawaii Department of Education. At the end of the one-week summer institute, participants completed the first questionnaire in which they reflected back to the beginning of the institute and rated their confidence in teaching different IL skills at that time (the retrospective pre-PD self-assessment). They were also asked to rate their current level of confidence following the institute (the post-PD self-assessment). In a similar fashion, participants completed a second questionnaire at the end of the year-long PD, this time indicating their actual teaching of the IL skills previous to the PD and their teaching as a result of the PD. Quantitative data from the questionnaires were analyzed using t-tests to determine if the gains reported were statistically significant and substantial.

Qualitative Data

Several measures were used to collect both perceptions of confidence and evidence of actual teaching. One member of the PEARL development team served as the project evaluator. He and a graduate assistant employed an open and axial coding process (Strauss and Corbin 1998; Denzin and Lincoln 2005) to identify areas of teaching emphasis that emerged from the qualitative data. Axial coding allowed them to link various interventions and tools to the related areas of teaching emphasis. The open and axial coding process is further detailed in the findings

and discussion section of this paper. A member check was conducted during the on-site interviews at the end of the PD to determine the viability of the interpretation. Qualitative measures included the following:

- Open-ended questions were appended to the retrospective pre-post questionnaires. In the questionnaire administered at the end of the one-week summer institute, participants indicated which IL learning outcomes they felt were critical as a result of the institute and also any perceived changes in their instructional relationships as teams. In the questionnaire for the entire PD, participants were again asked to note any changes in what they felt were critical learning outcomes for students and any demonstrated changes in instructional relationships as teams.

- During the school year, logs were posted online by school teams from August through May. Participants used Laulima, the University of Hawaii's course management system, for these monthly progress checks in which participants described ongoing work with the students, interventions used, and insights gained.

- Culminating portfolios were submitted individually by all participants in May of years 1 (cohort 1) and 2 (cohort 2). Portfolios were evidences of actual practice that included lesson plans, summaries of performance assessments, student exemplars, and culminating reflection pieces.

- On-site interviews were conducted at the end of the school year. The project evaluator and graduate assistant visited each of the school sites and met with the teams in May and June of years 1 and 2. The interviewers used a semi-structured interview format for the sessions that averaged about an hour at each site. The school teams were able confirm their observations and elaborate on their teaching and student performances in these sessions.

Findings and Discussion

Overview

In this section we focus on the three research questions with a summary of quantitative data from the questionnaires and qualitative data excerpted from participants' logs and portfolios and from the interviews. PEARL developers' observations and insights were integrated with the findings and supported with references from educational research.

RQ 1: How did the summer institute influence participants' levels of confidence in teaching the IL skills that students need to write their capstone papers?

At the end of the one-week summer institute, the PEARL developers collected questionnaire data on the session's impact on perceived confidence in teaching the skills needed for capstone projects. Table 3 lists the IL skills targeted at the institute. Participants in both cohorts indicated gains in confidence levels across all skills addressed in the sessions (table 4). Implementation levels were measured with a five-point Likert scale. The strongest gains were for objective 2, developing pre-search opportunities for students to explore larger topics or themes before selecting more-specific areas for research (mean increase of 2.10), and for objective 7, helping

students develop and assess progress on their capstone work (mean increase of 1.80). Both of these areas were new to the teachers; therefore, the developers concentrated on strategies in both areas and facilitated discussions on how to incorporate the strategies into school projects. Objective 6, strategies to identify and evaluate useful sources of information, received the highest confidence rating (4.47) among teachers and school librarians for two reasons: the easy-to-use evaluation tools introduced at the institute and the support that the librarians could provide in coteaching this particular skill.

The degrees of freedom for objective 2 (strategies to conduct explorations in the pre-search phase) and objective 5 (strategies to identify key words and phrases) were lower than for the other objectives because the content was largely presented at the second iteration of the institute based on feedback from cohort 1 schools, suggesting that more institute time be spent in these areas. The minimal emphasis placed on strategies addressing objectives 2 and 5 in the first institute resulted in the lower degrees of freedom for those two objectives.

Table 3. Skills presented in the institute.

Objectives for Teachers and School Librarians

1. Strategies to motivate students in making project selections

2. Strategies to conduct explorations in the pre-search phase

3. Strategies to generate questions

4. Strategies to write thesis statements

5. Strategies to identify key words and phrases

6. Strategies to identify and evaluate useful sources for information

7. Strategies to develop and assess research progress

8. Strategies to analyze and synthesize information and construct personal meaning

Table 4. Confidence levels with skills and intervention strategies presented in the institute.

Objective	Pre-Institute	Pre-Institute SD*	Post-Institute	Post-Institute SD	Mean Increase	Mean Increase SD	DF**
1	2.92	0.91	4.18	0.60	1.26	0.84	59
2	2.03	0.86	4.13	0.55	2.10	0.86	31
3	2.50	0.95	4.07	0.52	1.57	0.86	59
4	2.64	0.92	3.92	0.75	1.28	0.90	58
5	2.90	1.04	4.05	0.62	1.15	0.98	31
6	2.88	0.89	4.47	0.63	1.59	0.91	58
7	2.15	0.82	3.95	0.62	1.80	0.97	59
8	2.68	0.91	3.93	0.61	1.25	0.75	59

| Overall | 2.59 | 0.91 | 4.09 | 0.61 | 1.50 | 0.88 |

* "SD" means standard deviation.
** "DF" means degrees of freedom.

All items were statistically significant at p<.05

RQ 2: How did the year-long PD influence IL instruction provided by the school teams?

Self-Assessment of Implementation Levels

The PD covered a range of IL skills deemed essential in capstone research papers (refer to table 3). Participants indicated gains in addressing all the skills presented in the institute. The following implementation levels were measured with a five-point Likert scale in a retrospective pre- and post-PD questionnaire: 1=did not teach the skill, 2=briefly mentioned the skill, 3=introduced the skill in some detail, 4=introduced the skill and modeled it, and 5=introduced, modeled, and provided guided practice.

Most of the participants indicated that prior to the PD, they either did not teach a particular skill (rating of 1) or that "instruction" involved distribution of research tips that they briefly explained to the students (rating of 2). Following the PD, most participants rated themselves at the 3 and 4 levels in terms of introducing and modeling the skills (see table 5). Based on a t-test for pre- and post-PD implementation levels, all increases were significant at p<. 05. Overall, the participants' levels of implementation increased 1.08 across all skills.

Table 5. Implementation of skills introduced in the year-long PD.

Objective	Pre-PD	Pre-PD SD*	Post-PD	Post-PD SD	Mean (Increase)	Mean Increase (SD)	DF**
1	2.95	1.31	4.05	1.29	1.10	1.10	42
2	1.96	0.94	3.92	1.12	1.96	1.06	24
3	2.51	1.20	3.79	1.21	1.28	1.19	42
4	2.91	1.27	3.88	1.33	0.97	1.34	42
5	2.68	1.18	3.64	1.29	0.96	1.34	24
6	3.23	1.15	3.95	1.09	0.72	0.98	42
7	2.07	1.17	3.12	1.40	1.05	1.36	40
8	2.61	0.98	3.76	1.22	1.15	1.03	41
Overall	2.62	1.15	3.76	1.24	1.15	1.18	

* "SD" means standard deviation.
** "DF" means degrees of freedom.

All items were statistically significant at p<.05

Identification of Instructional Practices Implemented

As mentioned earlier, the evaluator used an open and axial coding process to identify major instructional practices or categories culled from the qualitative data. During the open coding phase, he broadly identified (through feedback provided in the interviews and surveys) the IL skills being taught. He triangulated this data with additional information from the participants' logs and portfolios.

Using axial coding, the evaluator then identified the specific instructional strategies and tools mentioned as interventions used for each of the instructional practices. In addition, he linked the strategies and tools to the sources for the interventions. The major sources were interventions modeled at the summer institute, tools such as organizers and rubrics made available on the PEARL website, and teaching practices that were exchanged among the participants during the PD experience. Table 6 identifies the practices noted in the open coding phase. The table also connects the strategies and tools with each practice as determined through axial coding and further links the strategies and tools to one or more of the sources for the interventions.

Table 6. Connections between open and axial coding used in qualitative data analysis.

Open Coding: Identification of Skills Taught	Axial Coding: Interventions/Tools Employed	Axial Coding: Sources for Interventions/Tools Employed
Identification of potential topics or issues	Personal-interest inventory	Institute
	Freewrite activity	Institute
	KWL organizer	Institute
	Mind-mapping software to refine topic searches	Institute
Exploration of potential topics or issues to determine one most suitable for study	Rating checklist to analyze potential topics	Institute
	Organizer for assessing the topic of choice	Institute
Generation of questions for topic or issue selected	Checklist for essential questions	Institute
	Question Master Game	Institute
	Use of artifacts to initiate questions	Institute
	Comparison of open and closed questions	Institute
	Questions based on Bloom's revised taxonomy	Institute
	Question matrix	PEARL website/participant exchange

Creation of thesis statement	Generating thesis statement	Institute
	Perspectives approach	Institute
	Questions to guide developing a statement	Participant exchange
Location and retrieval of relevant information from a range of resources	Use of evaluation criteria from CRAAP test (Meriam Library 2010)	Institute
	Fact or fiction information sheet	PEARL website
	Making a judgment call information sheet	PEARL website
	Additional evaluation scoring sheets	Participant exchange
	Use of bogus websites	Institute/participant exchange
Synthesis of information in preparation for paper drafts	Use of various graphic organizers	Institute/participant exchange
Assessment of progress throughout the research process	"Facewall" profiles (self-profiles of research progress; peer feedback invited)	Institute
	Conference log	PEARL website
	Charting your research path	PEARL website
	Research journey map	PEARL website
	Two-column check-log with space for feedback	Participant exchange
	Addition of "learning stretch" questions to logs	Participant exchange

Prior to the PD, the teams had indicated that they were devoting little time to having the students brainstorm possible topics, engage in pre-searching activities, and generate rigorous questions. The results of the coding confirmed that these were also areas where the teams depended heavily on interventions introduced at the summer institute to bolster their instruction. In the remaining areas, the teams reported more familiarity and experience with different strategies and were willing to share with their colleagues examples from their own teaching experiences. They also indicated that they used some of the resources available on the PEARL website, which they felt they could appropriately adapt for their students.

Overview of Assessment of Student Work

School teams assessed student performances during the following phases of the capstone research process:

- pre-searching and selecting topics,

- generating questions,

- developing thesis statements,

- evaluating online resources that included identifying keywords, and

- analyzing and synthesizing information for the paper.

For these phases of the research process, teams used rubrics or checklists that were based on criteria discussed during the institute. PEARL developers and participants collaborated on the assessment instruments that could be used for both formative work with the students and for summative evaluations.

Scoring guidelines using these tools were also agreed upon at the summer training session. Examples of these instruments are provided in Appendices C through G. Importantly, at the beginning of the capstone project process the teams shared the assessment criteria and instruments with the students so that the pupils were aware of what was expected and could assess their own progress. According to the school teams, many students indicated they were better prepared for the consultation sessions because they had the criteria and instruments on hand. They also understood that the instructors would be using the same criteria in evaluating their completed tasks. In their culminating portfolios, team members reported on percentages of students who succeeded (meeting or exceeding) and percentages who failed (approaching or not meeting) to meet the criteria for IL skills that were taught.

Qualitative information culled from the participants' logs, portfolios, and interviews provided critical insights on instructional strategies that were effective, areas where students continued to have difficulties, and directions proposed for future modifications and changes. In the following sections, we elaborate on the intervention strategies used for the different phases of the research process and the criteria employed for determining quality of the students' work. We also examine the merits of peer mentoring and student self-assessment as strategies valued throughout the process.

Selecting a Topic/Pre-Searching For Background Knowledge

Teachers and school librarians acknowledged that pre-searching was a crucial exploratory stage for the students and the one most misunderstood by teachers. The instructors became increasingly aware that topic selection was related to how much the students knew about the problem or issue and that students were more successful if the choices were self-initiated (Gross 2006; Crow 2011). The teams introduced this phase by having students complete personal-interest inventories and engaging them in freewriting activities that centered on topics and questions the students wished to explore. The instructors encouraged students to jot down their thoughts in KWL-type organizers on which the students noted what they already knew about these topics and questions ("Know"), what they predicted, what they wondered about ("Want to Know"), and why they felt these items were personally or socially relevant to study ("What They Learned and Reflected On"). Mind-mapping software such as EBSCO Visual Search and VisuWords were also introduced to help students broaden or refine topic searches.

Based on the completed inventories and organizers, students selected possible areas to further explore. They conducted preliminary searches for information and self-rated their selections based on the following criteria: potential rigor of the topic, their personal interest in it, its possible connection to community/global issues, and the availability of relevant resources.

Students and instructors used a rating checklist to assess this phase of the work (Appendix C). Students received a rating of "exceeding" if both pupils and instructors agreed that students scored 3 on all criteria, a rating of "meeting" if scores were a mix of 2 and 3, and a rating of "not meeting" if they had mostly scores of 1.

The school 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 resources needed, and potential 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. The teachers attributed this increase to the use of tools introduced at the institute such as the personal inventory and a checklist to determine the suitability of the topics. By using these tools, students discovered "ideas they had not considered" and "connections with things they actually cared about." 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 [an exercise that was introduced in the institute] 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 them with specific feedback on their topics."

In their reflections, the teams discussed future pedagogical adaptations that included more peer critiquing of topics and additional conferencing sessions to assist students having difficulties in generating possible topics. A librarian observed:

> "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 topics. As a result of this PD, the teachers scheduled several days for pre-searching, and I felt it was very useful. This also gave us time to meet with each student to talk about his or her topic and possible avenues of research and how it could tie in with the culminating product. We could definitely have used even more time to help some of the students, who were struggling."

Generating Questions

In the past, the teachers admitted that they frequently created the questions for the students. Using protocols to actively engage students in the generation of more-critical questions was "eye-opening" for them. In the institute, participants brainstormed questions around an interesting artifact, categorized the questions as closed- or open-ended queries, and prioritized the questions perceived to be most important for further investigation. By adapting this intervention strategy and using it with the students, teachers and school librarians found that most of the pupils were better able to generate questions. Students' ability to generate their own questions moved them beyond the simple encyclopedic information characteristic of report writing (Dahlgren and Oberg 2001; Donham 2010). The teachers and librarians also challenged students to create questions that required both lower-level and higher-order thinking based on Bloom's revised taxonomy (Anderson and Krathwohl 2001).

In their logs teachers indicated that students' generating their own questions was "a first time experience" for many of the pupils. The teachers also commented that the youngsters often expected instructors to "give them the questions." To encourage students' generation of queries,

the teams also experimented with a friendly game (Question Master) that challenged youngsters to create questions from different perspectives.

The criteria used to assess the questions included their rigor and challenge (instructors urged students to create questions that "stretched" their thinking and imagination), the questions' relationship to disciplinary knowledge, their potential for open-ended study, and their relevance to social concerns. Appendix D includes a rubric used by students and instructors for this phase of the research process.

According to the teams, about 75 percent of the students were able to produce questions that were clearly stated, central to the issue or topic under study, and generative in nature (that is, questions for which the answers would result in new questions, leading students to deep understandings of issues and problems). The remaining students "were stuck at the who-what-where levels." In debriefing sessions, several teams felt they needed to incorporate more peer sharing of questions in the future, using strategies such as pair-share and gallery walks. To broaden questions, in addition to deepening them, the teams also considered the use of graphic organizers such as mind maps, hierarchical trees, and question matrices.

Formulating Thesis Statements

Thesis formulation was a critical part of the meaning-making process. At this stage, students had to possess sufficient background information to create more-specific and deeper focuses for their investigations. The teams acknowledged that this skill remained one of the most difficult for them to teach and for students to master. Although the teams used direct instruction involving checklists to identify key elements of effective thesis statements, many of the teachers and librarians realized that they had not provided sufficient time for students to explore and gain adequate background knowledge about their selected topics before expecting pupils to formulate researchable thesis statements.

One team, however, used a creative approach that proved effective. The school librarian on the team described it as follows:

> The students had to draw their own graphic to explain the parts of the thesis statement; they were creative [and] at the same time they were able to show their understanding. Later, we had the students verbally present their thesis statements to the class and have their peers provide "plus" and "minus" feedback to them. We then worked as a class to help our students craft stronger statements.

To assess the thesis statements, students and instructors used a rubric that focused on quality indicators: clarity, scope, and purpose (Appendix E).

Only 52 percent of the students initially drafted statements that clearly articulated a stand and that were potentially arguable. Reflecting on lessons learned from this experience, team members also realized that students needed "a wider range of sample statements to analyze" instead of a quick lesson on creating "good statements." In future sessions, teams considered having the students examine sample sets of statements and "calibrating" the quality of these statements based on the criteria presented in the rubric. As one teacher noted:

> Simply modeling good thesis statements is not very effective. Students have to examine both weak and strong statements—we need to use the established criteria and guide [students] through discussions about why certain statements are stronger than others and what can be done to improve weaker ones.

Evaluating Sources of Information

The school librarians in Project PEARL led website evaluation sessions for all teams. Most of this work focused on using EBSCO online databases. The librarians adopted the following evaluation criteria from the CRAAP Test (Meriam Library 2010): currency, relevance, authority, accuracy, and purpose. To pique student curiosity in this phase, librarians used such techniques as introducing bogus or hoax sites such as "Save the Tree Octopus" and "Dihydrogen Monoxide" and challenged student teams to find evidence as to whether these sites were real or fake. Using a rubric based on the CRAAP criteria, students then assessed how well they were able to evaluate resources for their own research area by gathering useful information about those resources (Appendix F).

Over 80 percent of the students were able to accomplish the tasks involved in evaluating sources. In conferencing with students, librarians found that most individuals needed additional help in comparing information from different online sources to determine the relative authority and relevance of different materials. Students who did not satisfactorily complete this phase of research had particular difficulty in identifying bias. In their reflection logs, librarians agreed with Frances J. Harris's (2008) observations that simply finding the creator of an article or a website is not sufficient to determine either authority or bias.

As school teams, PEARL participants discussed the importance of a closer reading of textual material by employing strategies proposed by Daniel Callison (2015), such as having students compare two articles describing the same event and analyzing the author's choice of words, in addition to the organization of the work and the possible omission of important facts.

Analyzing and Synthesizing Information

The PEARL teams concurred with studies that identified analyzing and synthesizing information as being an especially critical challenge for students as they conduct research (Gordon 2000; Stripling 2010; Callison 2013). Pupils had to synthesize large amounts of information, grapple with multiple ideas, and weave them into a meaningful whole of substantiated opinions, valid conclusions, and conceptual understanding. As a result of intervention strategies shared at the summer institute, school teams adopted the use of various graphic organizers (e.g., mind maps, hierarchical trees, timelines, flow charts, fishbone diagrams) as an intermediary intervention between taking notes and drafting the papers. The teams reported that the use of different organizers was a valuable technique to aid students as they read for understanding, analyzed and summarized the text, and uncovered implicit meanings. One librarian observed:

> 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.

A rubric used for this phase of the process highlighted the following criteria: content that was related to the thesis with evidence of substantiating details, organization that displayed a clear statement of purpose and a logical flow of thinking, and integration of information from a range of relevant sources (Appendix G).

In Project PEARL, about 75 percent of the students produced final works that exhibited clearly stated thesis statements supported by cited evidence in a coherent presentation. The remainder of

the students floundered in organizing their information and selecting the most compelling evidence to support their major points.

Reflecting on this phase of the work, the teams concurred that more conferencing time with individual students was necessary. However, increasing the number of one-to-one conferences remained an enormous challenge because students' and educators' schedules during the school day are already full. Therefore, classroom teachers, school librarians, and students have limited opportunities to devote more time to face-to-face conferences during the school day.

However, several teams reported having promising success with "online critiquing" via Google Docs and said that they planned to expand use of Google Drive to create and edit web-based documents. One team experimented with online peer critiquing by pairing students to read and respond to each other's drafts. A member of this team indicated that they were "pleased to note how students used the rubric to provide critical comments to one another." The team noted that students engaged in this activity also mentioned that "helping my buddy made me see where I needed to do more work on my own draft."

Encouraging Peer Mentoring and Support

This last observation on peer critiquing lends support to Carol C. Kuhlthau's belief that a valuable strategy in meaning-making involves students working with their peers through the more difficult stages of the research process (1993). PEARL participants, who experimented with peer response groups, in which students served as listeners and responders, discovered that interest and motivation increased when students determined their own line of inquiry and owned their questions. One team described using peer critiquing in generating questions as follows:

> Having students work in small groups made managing the large class much easier. [Note: This was an academy with over a hundred students working simultaneously on Capstone Projects.] 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 reflecting higher orders of thinking. When the students seemed to stray off their targets, teachers had an opportunity to correct misunderstandings and to refine the questions.

In another situation, senior students mentored their junior colleagues:

> It was very successful having the seniors in the Health Services Academy work as mentors to the juniors. Together they brainstormed possible topics and the seniors provided the juniors with tips on planning and implementing their projects. The younger students served as assistants during the seniors' capstone presentations before the judging panels. The older students also shared the different components of their portfolios and their research papers. This type of peer exchange was as powerful as the support provided by the teachers.

Focusing on Self-Reflection

To be self-regulated learners, students must step away from their work and ask critical questions such as:

- What do I already know?

- What do I want to find out?

- How do I find out?

- What did I learn?

- What new questions do I have?

In past years, a majority of the teachers in Project PEARL admitted that assessing students' progress had been a "hit or miss" practice. One teacher confessed, "I did it very informally and only if I had the time." In these situations, students frequently did not have a voice in the process. They turned in their products and received grades on them but had no opportunity to discuss their work with the instructors. In short, assessment was sporadic and teacher-focused.

As a result of exchanges during the institute, teams experimented with variant forms of conference logs to check for students' progress throughout the research process. The logs included columns for key tasks, dates started and completed, and spaces for student and mentor comments and for next steps planned. Students were responsible for maintaining the logs and having them available during face-to-face and virtual conferences. A librarian reported:

> It was a good idea to incorporate assessment checklists and rubrics into the process. This helped students to be aware of the criteria for the quality of 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.

Equally important was what students themselves had to say about the value of their capstone experiences. The following excerpts from the Project PEARL developers' longitudinal data collection captured the students' thoughts as budding researchers.

Kevin on the importance of persistence:

> I was constantly plagued with technical issues each step of the way. This occasionally took a toll on my motivation to complete my program. Enduring the challenges taught me about perseverance, and I also realized that delaying the need for instant gratification reaped a greater reward at the end.

Jennifer on vulnerability as part of the process:

> It was all right to be vulnerable and naive. I was exposed to so many new fields and experiences. I truly felt like I was five years old again in a foreign world. However, with resilience and a desire to learn, I witnessed my personal growth.

Heather on self-empowerment:

> The project gave me the unique opportunity to take charge of my own education. That freedom made it fun to explore. At the same time, the freedom was the most challenging part of the process. At first, I was almost paralyzed with indecision because I wanted to

pick the "right path" for my project. Once I realized that there was no "right" way, I was able to enjoy trying different things and learning from both successes and failures. In short, the most rewarding part was the freedom to learn in a real-world setting.

RQ 3: How were instructional relationships between the teacher and librarian influenced by interactions during the year-long PD?

The instructional power of collaborative teaching lies in designing the learning experience together, coteaching the components, and jointly assessing the teaching process in addition to the results of student learning (Moreillon 2012). At Rutgers University, research on the impact of school libraries on student learning (Todd, Kuhlthau, and Heinstrom 2005; Todd 2006) reported that where teams of school librarians and teachers guided students through the stages of the inquiry process, students went beyond merely fact finding to personal understanding.

In Project PEARL participants completed open-ended questions regarding their instructional relationships prior to and after the PD program. 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 the PD, and the opportunities to intensively plan and exchange ideas seeded new working relationships. The remaining 20 percent indicated that their instructional relationships had been positive even before the training and that the PD 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. In particular, classroom teachers appreciated the emotional support librarians brought to the team. A teacher, who worked with her librarian for the first time, reflected:

> Hands down, the BEST part of this project has been the collaboration with our 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 training 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.

School librarians were heavily involved in the pre-searching phase, and they assisted with conference sessions at various points in the research process. Many of them also critiqued students' final work as members of review panels. 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.

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, the librarian and teacher made necessary adjustments in their team-taught instruction.

> The students 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 about their questions so 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. The "big a-ha" was giving ourselves 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.

Although the PEARL PD ended in 2013, the developers have maintained contact with the school teams. Through phone and e-mail conversations with the PEARL librarians, the developers discovered that eighteen of the twenty-four librarians have continued to work with partners, although the team compositions have changed because of retirements, transfers, and changes in teaching assignments. Of the other six librarians, three have retired, and the other three have transferred to new schools where they are forming instructional partnerships.

An important positive 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 school-wide task force for project-based learning

- Coordinating the campus senior project initiative

- Collaborating with the school curriculum coordinator to design and deliver professional development for teachers

- Facilitating the mentoring program for new teachers

- Initiating a series of "tech tools for learning" sessions that are open to students, faculty, and staff

- 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

Limitations and Recommendations

This case study was an initiative restricted to sixty participants from twenty-four schools in one state. Therefore, the findings are context-bound and cannot be generalized. Importantly, however, the study has highlighted the need for expanded research, not only in relation to the structure and delivery of PD but also the instructional guidance that supports students in becoming more proficient in mastering and applying IL skills. The findings and discussion provided insights into what school librarians do well, and where opportunities for continuous improvement might be possible. The areas for future examination described below point to the wider range of topics that awaits deeper investigation.

Although the Project PEARL teams gained competence in implementing a range of strategies to address student gaps in IL skills, there were instances where the focus remained heavily on accessing and locating information. More study is needed regarding the knowledge-construction dimensions of information literacy that relate to the convergence of prior learning, new information, and learning readiness, and to how school librarians and teachers can facilitate this process through a guided form of inquiry.

Student self-assessment remained one of the weaker components in Project PEARL. While teachers and librarians acknowledged that promoting reflective practice and self-monitoring were foundational to self-directed learning, they also admitted that they were novices in promoting this behavior. A clearer identification of specific student behaviors that can be tangible measures of quality performance is another area that merits further investigation.

Conclusion

Dennis Sparks, who is noted for his work with the National Staff Development Council, stated that high-quality, meaningful PD must focus on deepening teachers' content knowledge and pedagogical skills (2002). Initial findings from Project PEARL indicated that one way to provide effective PD is to embrace a job-embedded approach that promotes shared responsibility among teaching partners. This project focused on the creation of a model for PD that incorporated practice and reflection in the ongoing work of the classroom and school library. The Project PEARL developers sought to nurture a learning environment that cultivated collaborative solving of important problems in helping students succeed in capstone projects.

The Project PEARL developers recognized that to foster students' growth as complex problem solvers and reflective thinkers, the instructional teams must also experience the same process (Harada 2010). By focusing on critical questions about teaching and learning, participants challenged themselves to design instruction as teams. They discovered the power of learning as partners who accepted a collective responsibility for student learning.

Simplistic as it may sound, participants discovered that students needed instructional guidance to successfully manage to progress through the stages of information searching and meaning-making. Much as adult learners required instruction and reflection to occur over time, students also needed a series of learning experiences spread over a period of time to become increasingly engaged, interested, and reflective. Learning in this manner became a joint adventure in inquiry for both the instructor and the student. In such an environment, librarians and teachers are fostering dispositions for learning that will last a lifetime.

Acknowledgments

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Appendix A: Capstone Work: Rubric to Assess the Research Paper

	EXEMPLARY	PROFICIENT	APPROACHES	DEVELOPING	SCORE
Form (MLA)					
MANUSCRIPT FORM (Typing/spacing, Page number/order, Heading/title)	No errors 4	Two or fewer errors 3	Four or fewer errors 2	Five or more errors 1	
DOCUMENTATION	All parenthetical documentation and works cited page are MLA correct, all researched info documented 4	A few minor errors in documentation and works cited page, all researched info documented 3	Some errors in documentation and works cited page, more citations of researched items are needed 2	Many errors in documentation, works cited page, inadequate amount of citations to support position 1	
BIBLIOGRAPHY (Annotated for at least five entries)	No errors 4	Two or fewer errors 3	Four or fewer errors 2	Five or more errors 1	
Mechanics, Usage, Grammar					
SENTENCE FLUENCY (fused sentence/run-on error, comma splice/comma fault error, mixed construction, garbled sentence, stringy sentences, parallelism)	Sentences well built, strong and varied structure make it easy to read aloud 4	Text flows, sentences somewhat varied, relatively easy to read aloud 3	Sentence structure awkward rather than fluid, reader must slow down 2	Writing difficult to follow or read aloud, sentences are incomplete, run-on, and/or awkward 1	
CAPITALIZATION UTILIZATION PUNCTUATION SPELLING (CUPS)	Strong control of standard writing conventions, few errors 4	Reasonable control of standard writing conventions, some editing necessary 3	Limited control of standard writing conventions, errors starting to impede readability 2	Little or no control of standard writing conventions, extensive errors make it difficult to get message 1	

GRAMMAR (subject/verb agreement, tense agreement, adjective adverb usage, misplaced and dangling modifiers, double negatives, etc.	Strong control of grammar conventions, few errors 4	Reasonable control of grammar conventions, some editing necessary 3	Limited control of grammar conventions, errors starting to impede readability 2	Little or no control of grammar conventions, extensive errors make it difficult to get message 1
VOICE	Clear sense of "writing to be read," brings topic to life, strong audience awareness 4	Writer's voice is formal and engaging with some sense of "writing to be read" 3	Writer's voice may emerge at times, little sense of reader /writer interaction 2	No audience awareness, voice is flat, lifeless, and impersonal 1
WORD CHOICE (incorrect word usage, contractions, slang, abbreviations, $1^{st}/2^{nd}$ person pronouns, shift in tense	Language is natural, interesting, figurative, and precise 4	Language is functional and occasionally goes beyond ordinary 3	Language is predictable, ordinary, and/or repetitious 2	Language is limited, monotonous, and/or misused 1
Content				
INTRODUCTION (clearly stated, introduces the topic of the paper and the main points to be discussed)	Clearly stated, introduces the topic of the paper and the main points to be discussed. 4	Clearly stated, introduces the topic of the paper. 3	In the introduction, the explanation of topic is confusing. 2	Don't know the exact topic. 1
THESIS	Arguable thesis, compellingly supported with opposition clearly refuted 4	Arguable thesis with clear supporting detail 3	Thesis unclear, simple, with minimal development or support 2	Lacking central thesis, consistency and/or purpose 1
CONCEPT DEVELOPMENT	Demonstrates complete understanding of the subject. Shows higher critical thinking skills with a well-developed, detailed, relevant, and accurate treatment of the subject 4	Shows understanding of the subject matter. Develops an easily followed train of thought with documented support that is carried throughout. 3	Some of the concepts discussed are covered in a confusing manner. There is in adequate documentation of the thought process. 2	Thinking scattered, little concept development. No evidence of original thought. 1

ORGANIZATION	Sequence and structure strong, precise introduction and conclusion 4	Generally clear and logical organization, structure a bit predictable 3	Structure inconsistent, undeveloped or obvious text, intro or conclusion 2	Lacks organization structure, no apparent intro and/or conclusion 1	
ACCURACY AND CITATION	Selection of supporting resource material is authoritative, current, and pertinent. All supporting documentation is properly cited. 4	Some of the selection of supporting resource material is authoritative, current, and pertinent. All supporting documentation is properly cited. 3	Little of the selection of supporting resource material is authoritative, current, and pertinent. Some supporting documentation is properly cited. 2	None of the selection of supporting resource material is authoritative, current, and pertinent. No supporting documentation is properly cited. 1	
OVERALL RATING	**(PASS) (FAIL) Total Points Earned/Possible Points (40)**				

Source: *Kaiser High School Senior Project Student Handbook* 2013.

Appendix B: Capstone Work: Rubric to Assess the Product

Student's Name: _____

Presentation Title: _____ Date: _____

Please circle a rating for each criterion. The criteria are based on Hawaii DOE General Learner Outcomes (GLO).

GLO #1: Self-Directed Learner	Excellent	Proficient	Partially Proficient	Not Proficient
Criterion	4	3	2	1
Understands content and challenge	Student provides clear and convincing evidence of time commitment and effort, independence and self-direction, and the ability to solve problems that arose during the learning process. Student provides clear evidence of a learning stretch and self-discovery.	Student provides adequate evidence of time commitment and effort, independence and self-direction, and the ability to solve problems that arose during the learning process. Student provides adequate evidence of a learning stretch and self-discovery.	Student provides limited evidence of time commitment and effort, independence and self-direction, and/or the ability to solve problems that arose during the learning process. Student provides limited evidence of a learning stretch and self-discovery.	Student provides little to no evidence of time commitment and effort, independence and self-direction, and/or the ability to solve problems that arose during the learning process. Student provides little to no evidence of a learning stretch and self-discovery.
GLO #2: Community Contributor	Excellent	Proficient	Partially Proficient	Not Proficient
Criterion	4	3	2	1
Interacts with people outside of the classroom	Student provides clear and convincing evidence that he/she established a professional working relationship with community members.	Student provides adequate evidence that he/she established a professional working relationship with community members.	Student provides limited evidence that he/she established a professional working relationship with community members.	Student provides little to no evidence that he/she established a professional working relationship with community members.
GLO #3: Complex Thinker	Excellent	Proficient	Partially Proficient	Not Proficient
Criterion	4	3	2	1

Synthesizes information from research and experience	Student provides clear and convincing evidence he/she understands the Essential Question and can explain how it connects to the research paper and the project. Student clearly explains the learning process and how he/she solved any problems. Effective use of technology evident in the project as a whole.	Student provides adequate evidence he/she understands the Essential Question and can explain how it connects to the research paper and the project. Student explains the learning process and how he/she solved any problems. Adequate use of technology evident in the project as a whole.	Provides limited evidence he/she understands the Essential Question and can explain how it developed. Has some difficulty connecting EQ to the research paper and the project. Struggles to explain the learning process and how he/she solved any problems. Use of technology in the project attempted but insubstantial.	Provides little to no evidence he/she understands the Essential Question and can explain how it developed. Has difficulty connecting EQ to the research paper and the project. Cannot explain the learning process and how he/she solved any problems. Use of technology in the project poor.
GLO #4: Quality Producer	**Excellent**	**Proficient**	**Partially Proficient**	**Not Proficient**
Criterion	4	3	2	1
Creates a rigorous and relevant project	Student provides clear and convincing evidence that the research and the project match the speaker's area of interest. The depth and complexity of the project's <u>scope</u> is especially strong.	Student provides adequate evidence that the research and the project match the speaker's area of interest. The depth and complexity of the project's <u>scope</u> is evident.	Student provides limited evidence that the research and the project match the speaker's area of interest. The depth and complexity of the project's <u>scope</u> is marginal.	Student provides little to no evidence that the research and the project match the speaker's area of interest. The depth and complexity of the project's <u>scope</u> is inadequate.
GLO #5: Effective Communicator	**Excellent**	**Proficient**	**Partially Proficient**	**Not Proficient**
Criteria	4	3	2	1
General Presentation ** Essential Question, learning stretch, personal relevance, self-discovery, research and independent fieldwork*	Attention-getting introduction is followed by a logical, well-organized presentation that clearly and comprehensively connects all the components* of the Senior Project.	An adequate introduction is followed by a generally logical, organized presentation that generally connects all the components* of the Senior Project.	A simplistic introduction is followed by a loosely logical, organized presentation that marginally connects all the components* of the Senior Project. Audience understanding is affected.	A weak or irrelevant introduction is followed by a haphazardly organized presentation that unsuccessfully attempts to connect all the components* of the Senior Project. Audience understanding is affected.

Presentation Aids	Aids are relevant, error free, well-organized, and neat and clearly guide the audience through the presentation.	Aids are relevant, generally error free, well-organized, and neat and adequately guide the audience through the presentation.	Aids are of limited relevance and contain errors that begin to interfere with meaning. They present a barrier to the audience more than serving as a guide.	Aids are of little to no relevance and contain errors that severely interfere with meaning. They present a barrier to the audience more than serving as a guide.
Delivery	Student is exceptional in the following areas: articulation, use of standard English, posture, eye contact, professional dress, volume, speaking rate, word choice, and poise.	Student is adequate in the following areas: articulation, use of standard English, posture, eye contact, professional dress, volume, speaking rate, word choice, and poise.	Student is marginal in fewer than half of the following areas: articulation, use of standard English, posture, eye contact, professional dress, volume, speaking rate, word choice, and poise.	Student is marginal in more than half of the following areas: articulation, use of standard English, posture, eye contact, professional dress, volume, speaking rate, word choice, and poise.
Question and Answer	Student responds directly and accurately; answers with exceptional fluency and confidence, and shows enthusiasm.	Student responds adequately; answers with adequate fluency, confidence, and enthusiasm.	Student responds inadequately; answers with limited fluency, confidence, and enthusiasm.	Student responds inadequately; answers with little fluency, confidence, and enthusiasm.

Source: *Kaiser High School Senior Project Student Handbook* 2013.

Appendix C: Rating Checklist to Assess the Selection of Topics

To students: Selecting a topic or theme for your research project is the first step in your research journey so take the time to make sure it will work for you. A topic that is right for you will keep you motivated and inspired throughout the research process. Carefully study the rating checklist below and assess the strength of your proposed topic.

Rating scale: 3=high to 1=low

Criteria	3	2	1	Supporting Comments
Rigor • Requires mastery of knowledge and skills related to a program of study • Demands in-depth research • Leads to the building of deeper knowledge and application of higher-order thinking • Challenges me academically and personally				
Level of interest/passion • Links to my personal interests/passion • Motivates me to discover and gain new knowledge • Relates to possible career/post high school plans				
Connection to community • Relates to a real-world issue/concern • Impacts the community • Provides an opportunity for communication/connection with community				
Resources • Requires use of a variety of media,				

methods and sources				
• Ensures that these resources are available and accessible				

Appendix D: Rubric to Assess the Questions Generated

Criteria	Exceeding	Meeting	Approaching	Not meeting
Rigor and challenge	• My questions require deep thinking and responses that cannot be answered with a simple yes or no. • My questions require the use of various information sources, including scholarly publications. • They inspire original thinking and ideas.	• My questions require deep thinking and responses that cannot be answered with a simple yes or no. • My questions require the use of various information sources.	• Most of my questions can be answered with simple yes or no responses. • Most of my questions can be answered by consulting an encyclopedia or other general reference work.	• All of my questions can be answered with simple yes or no responses. • All of my questions can be answered by consulting an encyclopedia.
Relation to disciplines	• My essential question requires deeper understanding of one or more disciplines. • My related questions reflect understanding of multiple viewpoints on the issue under study.	• My essential question requires deeper understanding of one or more disciplines.	• My essential question is superficial and can be handled by a shallow review of a discipline.	• My essential question is superficial and not clearly related to any discipline.
Clarity and focus	• All of my questions are clearly worded. • All of my questions relate to my essential question.	• Most of my questions are clearly worded. • Most of my questions relate to my essential question.	• Many of my questions are not clearly worded. • Many of my questions are not clearly	• All of my questions are poorly worded.

			related to my essential question.	
Open ended and generative in nature	• My questions go beyond factual information and require decisions and conclusions based on evidence. • My questions allow for multiple ways to respond to them. • My questions inspire me to ask more questions.	• My questions go beyond factual information and require decisions and conclusions based on evidence. • My questions allow for multiple ways to respond to them.	• Many of my questions are limited to factual information. • My questions do not encourage multiple ways to respond to them.	• All of my questions focus on simple factual information.
Relevance to society	• I clearly connect my essential question to a community or global issue. • My related questions emphasize seeking solutions to the issue.	• I clearly connect my essential question to a community or global issue.	• The connection of my essential question to a community or global issue is weak.	• There is no connection between my essential question and a larger community or global issue.

Rubric Scoring Guide

Exceeding – minimally has ratings of "exceeding" on 3 criteria with "meeting" on 2 criteria

Meeting – minimally has ratings of "meeting" on all 5 criteria

Approaching – minimally has ratings of "approaching" on all 5 criteria

Not meeting – has ratings of "approaching" and/or "not meeting" on all 5 criteria

Appendix E: Rubric to Assess a Thesis Statement

Criteria	Exceeding	Meeting	Approaching	Not meeting
Clarity	• My statement concisely states my focus. • My statement is clearly connected to my essential question.	• My statement concisely states my focus. • My statement is not clearly connected to my essential question.	• My statement does not clearly state my focus. • I did not connect my statement to the essential question.	• My statement does not clearly state my focus. • I have no essential question.
Scope	• My scope is appropriate, not too narrow or too broad. • My statement clearly presents my position in relation to the topic.	• My scope is appropriate, not too narrow or too broad. • My statement needs minor refinement regarding my position in relation to the topic.	• My scope is either too narrow or too broad. • My statement needs major refinement regarding my position in relation to the topic.	• My scope is either too narrow or too broad. • My statement does not include my position in relation to the topic.
Purpose	• My statement clearly identifies the purpose of my paper (e.g., analytical, expository, argumentative). • My statement proposes an idea that is supportable and arguable.	• My statement needs minor refinement regarding the purpose. • My statement proposes an idea that is supportable but has a weakly arguable stance.	• My statement needs major refinement regarding the purpose. • My statement is not supportable or arguable.	• My statement does not identify the purpose of the paper.

Rubric Scoring Guide

Exceeding – minimally has ratings of "exceeding" on 2 criteria with "meeting" on 1 criterion

Meeting – minimally has ratings of "meeting" on all 3 criteria

Approaching – minimally has ratings of "approaching" on all 3 criteria

Not meeting – has ratings of "approaching" and/or "not meeting" on all 3 criteria

Appendix F: Rubric to Assess the Evaluation of Online Resources

Criteria	Exceeding	Meeting	Approaching	Not meeting
Currency	• I noted when the information was posted. • I noted if the information had been revised or updated. • I tested the links to ensure they were functional. • I indicated if currency was essential for my paper.	• I did not complete one of the items under "exceeding."	• I did not complete two of the items under "exceeding."	• I did not complete three or all of the items under "exceeding."
Relevance	• I indicated the relation of the information to my research area or questions. • I used appropriate keywords and phrases to locate my information. • I determined if the reading level and content were appropriate for my purpose. • I compared information across sources to decide which was better or best for my needs.	• I did not complete one of the items under "exceeding."	• I did not complete two of the items under "exceeding."	• I did not complete three or all of the items under "exceeding."
Authority	• I identified the source of the information. • I described the source's credentials or affiliation with organizations.	• I did not complete one of the items under "exceeding."	• I did not complete two of the items under "exceeding."	• I did not complete three or all of the items under "exceeding."

	• I noted if the URL revealed anything about the source (.com .edu .gov .org .net). • I determined if the source was qualified to write on this topic.			
Accuracy	• I checked the references used in the source. • I noted if the information was supported by evidence. • I verified some of the information by using another source. • I checked for spelling, grammar, and typographical mistakes.	• I did not complete one of the items under "exceeding."	• I did not complete two of the items under "exceeding."	• I did not complete three or all of the items under "exceeding."
Purpose	• I identified the purpose of the information (inform, teach, sell, entertain). • I noted if the source made its intentions clear. • I noted if the language or tone seemed unbiased and free of emotion. • I identified if the information was factual, largely opinion, or propaganda.	• I did not complete one of the items under "exceeding."	• I did not complete two of the items under "exceeding."	• I did not complete three or all of the items under "exceeding."

Rubric Scoring Guide

Exceeding – minimally has ratings of "exceeding" on 3 criteria with "meeting" on 2 criteria

Meeting – minimally has ratings of "meeting" on all 5 criteria

Approaching – minimally has ratings of "approaching" on all 5 criteria

Not meeting – has ratings of "approaching" and/or "not meeting" on all 5 criteria

Appendix G: Rubric to Assess the Synthesis and Analysis of Information

Criteria	Exceeding	Meeting	Approaching	Not meeting
Content	• All of my information clearly relates to my thesis. • All of my examples and details are well developed. • I synthesized my main points to construct new concepts.	• Most of my information clearly relates to my thesis. • Most of my examples and details are well developed. • I clearly summarized my main points.	• Much of my information is not clearly related to my thesis. • Many of my examples and details are not sufficiently developed. • I did not adequately summarize my main points.	• I did not connect my information to my thesis. • I failed to provide examples and details. • I did not summarize my main points.
Organization	• All my major points are clearly stated. • My purpose is clearly stated, and there is detailed evidence of my attention to audience. • There is a logical flow throughout my paper.	• Most of my major points are clearly stated. • My purpose is clearly stated, but I need to relate it more closely to my audience. • There is a logical flow to most of my paper.	• My major points are not clearly stated. • My purpose is vaguely stated and not related to my audience. • Much of my information detracts rather than adds to the flow of the paper.	• It's difficult to identify my major points. • My purpose is not stated. • My sentences are awkward, and my thinking is scattered so it's difficult to read the paper.
Coverage	• My information comes from a range of relevant sources, including scholarly publications.	• My information comes from a range of relevant sources. • Most of my sources are well integrated	• My information comes from a limited number of sources. • Most of my sources are	• My information comes from a single source. • My information does not support any of my major points.

	• All of my sources are well integrated and effectively support my major points.	and effectively support my major points.	not well integrated to support my major points.	
Conventions	• All sentences are well constructed. • There are no grammatical or spelling errors. • All of my references are correctly cited.	• There are few grammatical or spelling errors. • Most of my references are correctly cited.	• There are many grammatical or spelling errors. • Many of my references are not correctly cited.	• There are many grammatical or spelling errors. • I failed to cite my references.

Rubric Scoring Guide

Exceeding – minimally has ratings of "exceeding" on 3 criteria with "meeting" on 1 criterion

Meeting – minimally has ratings of "meeting" on all 4 criteria

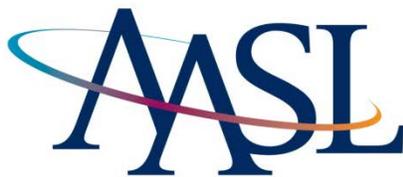**Approaching – minimally has ratings of "approaching" on all 4 criteria**

Not meeting – has ratings of "approaching" and/or "not meeting" on all 4 criteria

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