

# **Collaborative Co-Design: The Cal Poly Digital Teaching Library User Centric Approach**

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Undergraduate students currently enrolled in US universities represent the first generations to grow up with the digital technologies developed and disseminated in the last decades of the 20<sup>th</sup> century. Having spent their entire lives using computers, videogames, digital music players, video cams, cell phones, email, instant messaging, and all the other tools and toys of contemporary technology, they think differently (Prensky, December 2001). As a consequence, today's students are not the people that the US educational system was designed to teach (Prensky, October 2001). It is also the case that traditional design approaches are insufficient for developing enabling information management and knowledge creation tools in contemporary digital teaching library environments.

Therefore, drawing from human-information interaction (HII) principles and practices (Morville, 2005), librarians at California Polytechnic State University (Cal Poly) in San Luis Obispo, California created a collaborative design approach involving users in the production of digital library teaching and learning resources and technology-enabled infrastructure. In this paper, we report on a unique approach to user studies and system evaluation as exemplified by student framed, student conducted, and student interpreted research findings which inform disciplinary digital research portal design and development efforts. In addition, we describe research-in-progress which involves students in investigating and reporting results that, in this case, inform the construction and population of a physical and virtual learning commons within the Digital Teaching Library initiative.

Throughout, a wide array of research methodologies, including focus groups, usability studies, rapid prototyping, and survey instruments, have been employed in the spirit of "appreciative design" (Norum, 2001). In addition, an action research orientation ensures real world benefits, even as it promotes the organizational learning and relationship building necessary to allow the organization to respond to challenges and opportunities in an increasingly dynamic digital library environment.

## **Background**

In recent years, amidst rapid technological change, aggravating financial uncertainty, and escalating community expectations, librarians at California Polytechnic State University in San Luis Obispo, California (Cal Poly, SLO) have recognized that nimble responsiveness requires reinvention of library processes, procedures, and services. They understood that this would require changing how they think and what they think about, as they readied themselves for new roles in the academic enterprise (Somerville & Mirijamdotter, 2005, ACRL).

These insights evolved out of a literature-based discovery process exploring information interaction behaviours, preferences, and expectations of Net Generation students and the implications for academic libraries' roles (Lippincott, 2005). The Net Generation, referred to as Millennials, include students born in the 1980s and later, who are globally concerned, integrated, realistic, pragmatic, cyber-literate, media savvy, and environmentally conscious (Lancaster & Stillman, 2006). This is in contrast to traditionalists born before 1946, who are patriotic, loyal, fiscally conservative, and have faith in institutions; baby boomers born between 1946 and 1964, who are idealistic, competitive, question authority, and challenge institutions; and Generation X born between 1965 and 1981, who are eclectic, resourceful, self-reliant, distrust institutions, and highly adaptive to both change and technology (Lancaster & Stillman, 2006).

The Net generation students first involved in the 'discovery' process at Cal Poly were third year computer science students. They were asked to make recommendation for customizing an 'out of the box' federated search engine, ExLibris MetaLib, for searching

multiple databases, accessing full text documents, and designing ‘my space’ environments. Students unanimously recommended that the ‘meta’ search engine mirror google ‘look and feel’ and functionalities. In addition, they recommended that ‘my e-shelf’ should permit organizing citations by course and indicating availability including full-text status. A ‘my databases’ should permit saving lists by course and allow metasearching. They also wanted a ‘my e-journal’ list, search history capture, an alert profile, and direct linkage to the ‘my PolyCAT’ (university online catalogue) information organization space.

These perceptions mirrored the results of an Association of Research Libraries (ARL) LibQUAL survey measuring user perceptions and expectations of library service quality in three dimensions: Affect of Service (user interactions with library staff), Information Control (access to desired library resources), and Library as Place (user interaction with physical library environment). Millennial students rated the library high in Affect of Services and low in Information Control and Library as Place. 75% of respondents reported regularly using non-library gateways such as yahoo and google for information, while only 4% reported accessing library resources virtually through the library web site and 15% reported using library resources in the physical facility. Within the context of an evolving evidence-based information practice culture, these findings indicated a serious ‘gap’ in users’ expectations and library resources, systems, and services and provided the impetus for librarians’ agreement to examine the underlying assumptions and beliefs that historically guided library decision making.

Since organizational and individual change begins with the onset of research, librarians recognized that the question of what to study was critically important. As Cal Poly’s experiences illustrate, it has proven equally important to consider the question of how – and with whom - to conduct research studies that inform digital teaching library design development. In this case, the university’s long time student-centric ‘learn by doing’ educational philosophy informed selection of this collaborative user-centric design approach. It drove librarians’ agreement to invite student-generated research projects on library services and systems, with the aim of obtaining authentic perspectives on ‘user experience’ expectations, preferences, wants, and needs. This approach required relinquishing control of the research process: students, with faculty supervision, generated problem definitions, chose research methodologies, conducted data analysis, and produced results reports.

Following this, librarians engaged with student and faculty researchers to determine the implications of findings for library services and systems. Iterative dialogue fostered sustainable communication which altered relationships, processes, and practices for librarians and their campus beneficiaries through Cal Poly’s collaborative evidence based information practice (EBIP).

## **Evidence Based Information Practices**

Cal Poly’s distinctive approach is grounded in pragmatic evidence based information practice, which seeks to improve library practice by utilizing the best available evidence from working experiences in librarianship (Eldridge 1997). According to Booth and Brice (2004), EBIP has several defining characteristics. Of most relevance here, elements include:

- A pragmatic focus on the ‘best available evidence,’
- Incorporation of the user perspective, and
- Acceptance of a broad range of quantitative and qualitative designs.

With firm grounding in these principles and practices, a modified version of EBIP – named collaborative EBIP –has been implemented successfully at Cal Poly’s Kennedy Library. A defining characteristic of collaborative EBIP is that the evidence based processes are driven not by librarians but rather by stakeholders who assume responsibility for problem definition, methodological implementation, and data analysis activities (Somerville, Rogers, Mirijamdotter, & Partridge, 2006). Reliance on student-framed, student-conducted, and student-reported research results serves to shift the locus of decision making control from **‘library centric’** to **‘user centric.’**

This innovative evidence-generating approach was paired with an action research orientation that aims to bring about change in the project situation (the action) while learning from the process of deriving the change (the research) (Checkland & Holwell 1998; Wilson 2001). In this case, the emphasis on inquiry-based learning, as well as attention to participation and involvement, intended to intrinsically and simultaneously assist in practical problem-solving as it enriched the professional competencies of the participants. This enterprise-level thinking guided librarians’ reconsideration of fundamental notions about organizational purposes, concurrent with reinventing constituency relationships and workplace roles. Thinking tools also fostered ‘big picture’ appreciation of the larger academic enterprise (Somerville & Mirijamdotter, 2005, Syllabus; Somerville, Mirijamdotter, & Collins, 2006).

### ***Human-Information Interaction Elements***

In the technology industry, designers are discovering that their products are often much more successful when they take into account the needs, expectations and behaviours of their target audience (the “users” of the technology products) as opposed to relying exclusively on their own opinions and perceptions. The creation of effective “user interfaces” (the means by which end users communicate with technology or technology systems) require careful consideration of the context of usage – i.e., how do people work?, how do people solve problems?, how will the technology be incorporated into work practices?, how do people interpret the technology’s output?, and what are their strengths and weaknesses? There is a recognized need for mediation between the world(s) of the end users and the world of technology in order to bring the two together in an ultimately productive relationship.

In the world of contemporary digital librarianship, one could say that there is an analogous need for mediation between the worlds of the end users (in this case, faculty and students) and the technology-based world of digital information. From this perspective, the main interface issues are not between humans and software/hardware systems in order to do work (although these do affect the outcomes sometimes), but rather between humans and information systems in order to ‘make meaning.’ In this view, the new role of librarians can be seen as facilitating the input mechanisms (e.g., how to query the information space/system in the context of a problem) and the output mechanisms (i.e., how to make sense of what the information system is communicating back).

The study of human-information interaction (HII) is a relatively new arena that draws heavily on the methodologies and techniques developed in the study of human-computer interaction. More specifically, in 1995 Nahum Gershon coined the term Human Information Interaction (HII) to denote how human beings interact with, relate to, and process information regardless of the medium connecting the two. Since then, the term has been widely adopted by the traditional information science and information retrieval communities. This paradigm is characterized by highly interactive interfaces, user-centred methods, and sensitivity to the dynamic,

multi-channel nature of information seeking behaviour. Researchers in Human Information Interaction draw insight and inspiration from the field of Human Computer Interaction (HCI) while recognizing that they face unique challenges.

The approach known as “**user-centred design**” is both a philosophy and a process in which the needs, wants and limitations of end users play a central role at each stage of the design process. (Related methodologies include: cooperative design, the Scandinavian tradition that equitably involves designers and users; participatory design, a North American version of the above; and contextual design, a method that approaches product design out of an understanding of how customers work.) While quantitative methods are sometimes included in these approaches, a key feature of all of these design methodologies is the integral and extensive use of qualitative data collection and analysis methodologies – open ended interviews, focus groups, ethnographic studies, and participant observation. Another important characteristic is the emphasis on iterative design, often leading to rapid prototyping of solutions which can, in turn, be evaluated, modified, and, finally, implemented in a relatively short time frame, while incorporating user feedback throughout.

The Cal Poly action research orientation, which pairs individual and team learning with ‘real world’ situation improvements, qualitative user-centric human-computer interaction (HCI), and human-information interaction (HII) methodologies offers a number of important benefits. First, data collection and interpretation required sustained face-to-face communication between librarians and student researchers at the point of initiating studies and applying results. These dialogues offered librarians valuable experiential insights into user constituency perspectives through primary ‘voiced’ exchanges. These exchanges also offer opportunities for clarification and aid interpretation, unlike the ‘cut and dry’ style of reductive numeric data reports.

In addition, because relationships with supervising faculty oftentimes continue, it was possible to return to study of different aspects of a particularly perplexing problem in subsequent quarters. This user-generated approach to information practice enables gathering a rich array of authentic textured evidence that allows quick prototype problem solutions, service improvements, and organizational changes. Intrinsically iterative, collaborative evidence-based information practice naturally encourages continuous improvement. Continuing inquiry relationships also promote perpetual learning that fuel robust information exchange relationships within the library and with the campus community.

## **Digital Teaching Library Co-Design Projects**

### **Example 1 – Ex Libris MetaLib Customization**

When results from an Association of Research Libraries (ARL) LibQUAL study corroborated Millennium students’ propensity for google search functionalities, librarians recruited age-appropriate student researchers to assess a federated search engine, Ex Libris’ MetaLib, paired with a citation linker, SFX, in hopes of offering students a ‘google-like’ alternative. The students’ research question was: “How can we improve the ‘out of the box’ interface to an electronic meta-database retrieval system providing federated search engine access to the library’s expensive online databases of scholarly journals, newspapers, and other research resources?” (Rogers 2005).

Computer science professor Dr. Erika Rogers directed the work of students enrolled in a Human-Computer Interaction (HCI) course to propose an interface design that would be both usable and efficient for Cal Poly students and faculty. In addition, they aimed to

design overall branding for the site so users would be able to easily distinguish library owned or subscribed content, including colour scheme and graphics concepts.

The initial part of the project included four stages of data collection and review :1) analysis of earlier focus group results, 2) familiarization with the old and new library interfaces, 3) generation of features list and needed changes, and 4) creation and execution of a walkthrough paper prototype. Prior to HCI student involvement in this project, the library had already conducted usability tests and focus groups querying students on various MetaLib design and implementation issues. Analysis of this data corroborated the LibQUAL findings that users primarily wanted a simple, Google-like interface. In the second stage, the student team compared single database search engine functionality with the MetaLib multi-database search interface, which resulted in a list of customization recommendations. The students also developed four task scenarios for research subjects to complete using both the original release interface and the ‘paper prototype’ customized MetaLib product, revealing further problems to be addressed.

From the results of these efforts, the student team evolved a series of prototypes, ranging from chalkboard mock-ups to high-fidelity final products. These prototypes addressed all facets of the MetaLib product interface including screen designs, navigation tabs, icons, logos and buttons. This evidence was submitted to librarians throughout the quarter, in an iterative fashion which encouraged student learning. One proposed interface is shown in Figure 1:



Figure 1

Playfully named ‘PolyDog’ to complement the name of the library’s ‘PolyCat’ online public access catalogue (OPAC), this interface design template was submitted to the librarians at the end of the quarter in the form of a final project report. Librarians considered the results so useful that, after the digital services staff had implemented the students’ recommendations in a local release, they forwarded the students’ report to the product vendor, ExLibris. Many of the students’ recommendations were reflected in the new version 3 release of MetaLib. This collaborative EBIP experience also served to introduce librarians to interface design, moving them from their traditional passive stance as consumers of commercial database products, to producers of evidence-based interfaces which enable information interaction and knowledge creation.

## **Example 2 – Disciplinary Digital Research Portal**

A second project begun in January 2004 involved students in a senior-level Human-Computer Interaction (HCI) course on user-centred content architecture design (Preece & Sharp 2002). Students started by asking: “What do Cal Poly faculty and students know about library resources? What do they want to know? And how do they want to learn it?” Results revealed that the overwhelming majority of both faculty and students studied did not know what a librarian did or how to find one.

When students were asked where they went to do research, seventy-two percent replied that they used the Internet while only four percent said they went to the library. The study found that most students use the library website as a tool to find books and journals, but they knew nothing about library personnel such as librarians, who offer assistance in finding books, journals and other relevant resources. This is in keeping with other findings that students often do not see libraries and library personnel as part of their information-support network, relying instead upon the Internet and their friends for assistance (Seamans 2002). Given the students’ Web orientation, student researchers recommended that librarians produce digital research products, to be refined by usability study results and interaction design techniques. This suggestion initiated the librarians’ new roles as content providers for web based learning environments. Concurrently, students continued to explore form and content questions as they evolved a digital research portal template.

Two students continued the work in the spring quarter as their senior project, taking the work to the next level by focusing on the creation of a content architecture, including mapping of information elements to web page components. Students combined locally generated evidence with ‘good practices’ identified in an international review of library web pages. Then, during fall quarter 2004, a usability study was designed and conducted with a intention to obtain student feedback on the most recently produced disciplinary web pages. The original intention was merely to gain basic usability data to assist the library staff in finalizing the pages and perhaps making some minor improvements in navigation and layout. However, the study began with a questionnaire that probed student research habits, student research skills, and student learning styles. Following this, subjects were to complete a usability study of the current web pages.

The evidence resulting from the questionnaire prompted students’ interest in a new line of inquiry: the potential effects of learning styles and, more specifically, whether the concept of ‘scaffolding’ could be effectively incorporated into the website re-design. From here, interest developed in the usage of ‘personas’ as an interaction design technique to model archetypal end-users (Cooper & Reimann 2002). A two-dimensional meta-architecture emerged for a disciplinary research portal (Rogers, Somerville, & Randles 2005; Somerville & Vuotto 2005) which continues to evolve based on ongoing student-generated evidence. In addition to providing ‘real world’ human information interaction benefits, this project offers ‘proof of concept’ validation for the efficacy of employing a research-in-practice co-design approach in a physical and virtual Learning Commons.

## **Example 3 – Digital Learning Environment Co-Design**

As libraries evolve virtual and physical learning commons environments (Beagle 2004), Cal Poly students in senior level computer science classes have developed user-information interaction design prototypes during winter quarters 2005 and 2006 and spring quarter 2006. During winter quarter 2005, they benefited from international, interdisciplinary experimentation on virtual collaborative work with graduate students in San José State University School’s Library and Information Science (SJSU SLIS) and Cal

Poly knowledge management program (Mirijamdotter, Somerville, & Holst 2005). Once again, the ‘problem situation’ was framed by students, who (in consultation with faculty supervisor Dr. Franz Kurfess) determined the data collection strategies most suited to generating peer-to-peer advisement on co-creation of a technology enabled, pedagogically sound, and information resourced user centric environment.

A Senior Project Centre was amongst the proposed digital teaching library initiatives. Students’ persistent interest in this initiative, quarter after quarter, reflects the critical importance of this culminating project – i.e., completion is a requirement for graduation. Current access strategies disallow students’ recommendations that 1) students can access information about past projects through digital repositories providing both abstracts and full text; 2) students can communicate with potential student collaborators, prospective faculty sponsors, and potential industry partners; and 3) students can make senior projects available to industry in support of prospective graduate hires and faculty can identify their expertise to industrial advisory boards. Because of the highly political nature of the senior projects proposal, which might be construed as infringing on what is considered to be ‘academic freedom’ in the United States, implementation of this proposal is still under discussion.

Other proposals, however, have been implemented more easily. For instance, a Multimedia Café was proposed which would provide workspace that allows team work amidst coffee and snacks. Computers recessed in tables encourage simultaneous project work and social activities. The Brainstorming Room concept similarly acknowledged Net-gen student’s preferences for collaborative space with moveable whiteboard, media centre, idea box (with gadgets and ‘thingies’ to promote creativity), a digital media projection system, and – concurrently – easy access to food and drink.

The most fully developed Learning Commons initiative is the Lumiere new media collaborative of faculty, students and staff, which aims to create a new form of interactive, fully-immersive, Internet-enabled three-dimensional (3-D)cinema. The project aims to integrate the technology invention process with a pedagogy enabling of discovery about the perspective-rich history and theory related to modern media interconnection, distribution, and usage. The primary production goal is creation of the Lumiere Ghosting Device - an interactive 3D cinema theatre connected to other Lumiere Ghosting Devices (theatres) through a high-speed connection to the next generation of the Internet (Internet2) which can be repurposed for open collaboration, artistic expression, gaming, training, and interactive storytelling. By making use of recent developments in higher processing speeds, larger bandwidth capacities, and smaller computing and projection systems, the Lumiere Ghosting Device is portable so the entire device can be assembled, calibrated, connected to the Internet, and be completely operational in an afternoon using a small technical crew of three or four people.

The location of the Lumiere Ghosting Project in the Learning Commons has effectively blending and strengthened the user centric stance of collaborating Learning Commons Partners. Within this Learning Commons ‘innovation zone’, students have assumed responsibilities for multimedia knowledge creation, under the supervision of Dr. David Gillette, director of the campus New Media program. In the process, constructivist learning processes have evolved that strengthen the intellectual, social, personal, and practical knowledge required for effective, sustainable learning (Somerville & Gillette 2006). Concurrently, librarians’ collaboration with student and faculty stakeholders has served to close the gap between librarians and students identified by the LibQUAL survey.



# Digital Teaching Library Learning Outcomes

Mindful that changing circumstances required redefinition of roles, goals, and methods, Cal Poly librarians committed to learn how to transform their work purposes, processes, and relationships. In keeping with the campus ‘learn by doing’ educational philosophy, they evolved a unique collaborative evidence-based information practice approach. Invited student research projects supervised by faculty ensured investigations of critical importance to user constituency groups. This novel evidence-producing process enabled new ways of seeing, enabling heightened engagement with campus stakeholders.

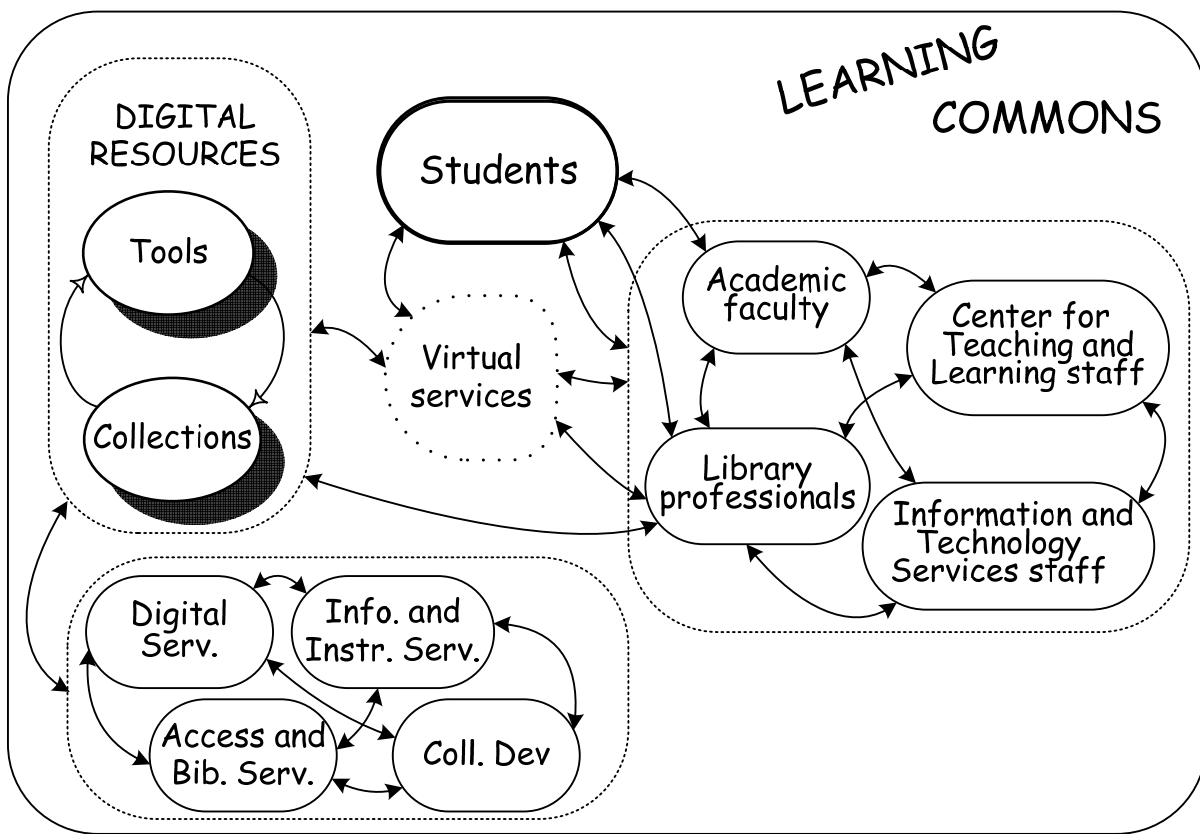
Librarians depended on student-produced evidence to guide the iterative process of evaluating meaningful data, comparing and contrasting multiple interpretations, and infusing reflective insights – and unsolved curiosities – into a continuous learning process “that challenges existing ways of seeing and doing things, and can lead to some surprising shifts in Weltanschauungen, opening up novel and elegant proposals for ... advancing thinking and taking action” (Jackson, 2003). Library wide, professionals and paraprofessionals now continue to ‘learn their way to change’ (Davis & Somerville 2006; Somerville, Schader, & Huston 2005).

The dialogue-based interaction necessary to this collaborative design and development process has offered librarians important practice valuing diverse perspectives and contexts. The relationship building processes involved in implementing original studies and then, interactively, interpreting results has produced two-way empathy and insight. In the case of Learning Commons design efforts, such an approach places students at the centre of their educational process. Unlike traditional methods of distributing knowledge from a top-down, instructor-centred process, the Cal Poly Learning Commons is designed to help students discover and then refine their own methods for acquiring and applying knowledge. In that spirit, librarians, instructional designers, pedagogy experts, and technologists working together in the Learning Commons and adjacent facility spaces support creative approaches to teaching and learning that seamlessly integrate technology with the construction of individual and shared knowledge (Somerville & Gillette 2006).

Evidence-based information exchanges between librarians and their faculty and student constituencies continue to fuel collaborative partnerships within an ever increasing circle of participants striving to transition to digital age competences and perspectives. In addition, growing conversance with a variety of research-in-practice strategies promises to aid librarians in remaining current and relevant in a rapidly changing digital library environment.

## Conclusions

Current collaborative evidence-based information practice focuses on populating a physical and virtual Learning Commons. This partnership involves campus information technology, instructional design, and pedagogy experts who – with librarians – support faculty experimentation with technology-enabled, information resourced teaching innovations (Gillette & Somerville 2006). Librarians have reflected their understanding of this collaboration opportunity in Figure 2, which reflects their newly expanded boundaries of concern and influence.



**Figure 2**

The dynamic interactions reflected in this figure suggest the power of collaborative ‘evidence making’ information practice fortified by systems thinking practices which intrinsically cultivate relationships between builders and beneficiaries of information management and knowledge creation tools and resources. More specifically, librarians now assume new roles as collaborative architects of digital information and knowledge enabling spaces. They approach their new responsibilities with confidence, grounded in collaborative evidence-based practices that inform day to day decision making well aligned with long range user-centric planning in partnership with Millennium beneficiaries.

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