A User-Centered and Evidence-Based Approach for Digital Library Projects

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Abstract

Purpose –Soft Systems Methodology (SSM) processes fortified by collaborative evidence-based librarianship (EBL) principles can guide end-user involvement in digital library project design and development. User-generated research examples reveal the efficacy of this inclusive human-focused approach for building systems.

Design/ Methodology/Approach – From 2003 to 2006, user-centered interaction design guided increasingly complex human-computer interaction (HCI) projects at California Polytechnic State University. Toward that end, project planners invited polytechnic students, supervised by computer science professors, to assess peers' information seeking needs. This student-generated evidence informed creation of paper prototypes and implementation of usability tests. Sustained relationships between planners and beneficiaries permitted iterative evaluation and continuous improvement of design concepts and product functionalities.

Findings – Purposeful conversations aimed at learning from user-generated evidence enriches the planning process for digital library projects. Reflective of the 'learn by doing' educational values of the organization, this approach advanced learning among both users and planners throughout user-centered (re)design experiences.

Practical Implications –Collaborative design assumes that enabling interfaces, systems, and environments are best designed and developed inclusively, with and for beneficiaries. Toward that

end, practical guidelines are offered to enable replication of this approach, which depends on user produced and interpreted evidence, in other organizational settings.

Originality/Value – A paucity of literature exists on the relevance of evidence-based librarianship in the digital age. Similarly, too little applied research has adopted a human-centered focus for design and development of information systems. Finally, too few digital library projects recognize the value of initiating positive user experiences at project inception.

Keywords – Evidence-Based Librarianship (EBL), Soft Systems Methodology (SSM), Human-Computer Interaction (HCI), interaction design

Paper Type – Case Study

Undergraduate students currently enrolled in North American universities represent the first generation to grow up with the digital technologies developed and disseminated in the last decades of the 20th 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 and act differently (Prensky, 2001b). As a consequence, in the United States today, students are enrolled in a higher education system that was not designed to teach people like them (Prensky, 2001a). Nor were academic libraries designed to serve the Net Generation (Lippincott, 2005). It is also the case that traditional design approaches for libraries' information retrieval systems are insufficient, given users' information management and knowledge creation challenges.

In response, librarians at California Polytechnic State University (Cal Poly) in San Luis Obispo, California, USA evolved an evidence-based collaborative design (co-design) approach which significantly involves users in the creation of digital library projects. As one of twenty-three campuses in the California State University (CSU) system, the institution is distinguished by an applied "learn by doing" educational approach. However, although this participatory research approach evolved within the particular circumstances of the Cal Poly environment, its process-based philosophy is easily transferable to other institutional settings where elements can be modified, appropriate to organizational circumstances.

This paper describes and illustrates a user-centered and evidence-based approach for needs assessment and systems design. From 2003 to 2006, student-generated results informed the design and development of several digital initiatives, including a federated search interface, a digital research portal, and a website persona prototype. Throughout, a wide array of research methodologies, including focus groups, usability studies, rapid prototyping, and user surveys, were employed within the framework of 'soft' systems thinking, which ensured consideration of the human element in systems analysis and design. In addition, an action research orientation encouraged real world benefits including, in this initiative, advancement of an evidence-based workplace learning culture.

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) recognized the need to reconsider library processes, procedures, and services. They understood that this would require changing how they thought and what they thought about, as they readied themselves for new roles in the academic enterprise (Somerville and Mirijamdotter, 2005b). These conclusions are corroborated by the recent literature on information interaction (e.g., Milne, 2007) and social learning (e.g., Brown, 2002) behaviors, preferences, and expectations of today's Net Generation students (e.g., Windham, 2005; Windham, 2006) and the related literature exploring the implications for academic libraries (e.g., Somerville and Collins, 2008; Lukasiewicz, 2008).

The 'gap' in college students' expectations and their library experiences was confirmed by the results of an Association of Research Libraries (ARL) LibQUAL survey implemented at Cal Poly in 2004. The instrument aimed to compare user expectations with user perceptions of library service quality. Three dimensions were measured: "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). Student respondents rated the library as low in the information control category. More specifically, seventy-five percent of the students reported regularly using non-library gateways such as Yahoo and Google for information, while only four percent reported accessing library resources virtually through the library website. Within the context of an evolving organizational culture of assessment, librarians were alarmed by the serious 'gap' between what library users expected and what library systems delivered. This evidence discovery fostered librarians' agreement to examine the underlying assumptions and beliefs that historically guided workplace decision making (Somerville and Brar, 2006; Somerville and Brar, 2007).

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 is equally important to consider the question of how – and with whom - to conduct research studies that inform digital library concept development and project design. In this case, the university's student-centric 'learn by doing' educational philosophy informed creation of a collaborative user-centered design approach. It drove librarians' agreement to invite student-generated research projects, 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 reported research results.

Evidence-Based and Systems Thinking Origins

The Cal Poly approach is grounded in evidence-based information practices fortified by systems thinking processes which guide inclusive and iterative participatory design and development processes. The term Evidence-Based Librarianship (EBL) was first introduced into the library and information science literature by Jonathan Eldredge in 1997. Subsequently, Andrew Booth (2004) adapted an existing definition of evidence based practice in proposing that EBL is an approach to information science that promotes the collection, interpretation, and integration of valid, important, and applicable user reported, librarian observed, and research derived evidence. He counseled that professional judgments on the application of best available evidence should be moderated by user needs and preferences (Booth, 2002). Over the years, several defining characteristics have emerged, including 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, Cal Poly librarians initiated evidence-based design processes for technology-enabled discovery tools.

Cal Poly librarians were prepared to work with user-centered evidence through practice with Soft Systems Methodology (SSM) processes and tools (Checkland and Holwell, 1998; Checkland and Poulter, 2006). Developed over thirty years ago by Dr. Peter Checkland at the Lancaster University Management School in the United Kingdom, this holistic systems thinking framework guided interpretation of student-generated evidence, providing a common language and shared

tools for discussion and analysis of complexities and interdependencies. More particularly, the constitutive elements of SSM – finding out, modeling, comparing, and taking action – informed the iterative process of identifying and evaluating meaningful data, comparing and contrasting multiple interpretations, and delineating and infusing thoughtful insights – and unsolved curiosities – into a continuous learning process. See Figure 1.
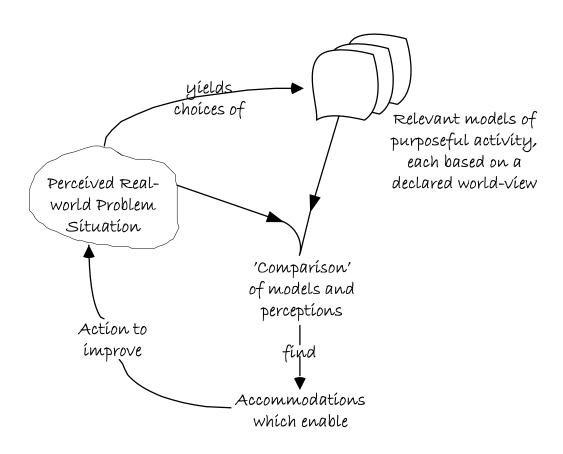
Figure 1. Soft Systems Methodology Processes

Early on, in January 2004, librarians exercised requisite critical thinking skills in considering research data generated from a little known qualitative research methodology - open-ended phenomenographic interviews - which explored the conceptions of information held by a representative set of the polytechnic undergraduate students (Maybee, 2006). Transcript analysis, enriched by SSM visualization techniques for modeling, provided rich opportunities to value the various ways that information interactions advance student learning. Such an appreciative framework proved important during subsequent consideration of diverse stakeholder and

beneficiary perspectives on interface, portal, and website design and development projects. In addition, librarians discovered that although they enjoyed information searching, students valued information finding, sharing, and using.

Given this 'gap', librarians decided to adopt a radically different approach in the concept and design phases of digital library projects. They invited computer science professors teaching Human-Computer Interaction (HCI) courses to invite their students to assume responsibility for problem definition, methodological implementation, and data analysis activities. Over a three year period, from 2003 to 2006, reliance on student-framed, student-conducted, and student-reported research results shifted project decision making from 'library centric' to 'user centric.' This occurred naturally as student-generated and student-interpreted evidence caused librarians to question existing ways of seeing and doing things and "opened up novel and elegant proposals for … advancing thinking and taking action" (Jackson, 2003).

SSM's action research orientation urged librarians to become both reflective (re)learners and also responsive action-takers (Checkland and Poulter, 2006). In addition, it ensured that practical problem-solving occurred simultaneous with professional enrichment (Somerville *et al*., 2005c; Somerville *et a*l, 2005d) as librarians reconsidered organizational purposes, reinvented constituency relationships, and re-imagined workplace roles within the context of a 'big picture' appreciation for the larger academic enterprise (Somerville and Mirjamdotter, 2005a; Somerville *et al.,* 2006; Davis and Somerville, 2006).

User-Centered Design

Cal Poly's collaborative evidence-based design tenets mirror trends in n the technology industry where designers are discovering that their products are more commercially 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. As industry has learned, the creation of effective "user interfaces" (the means by which end users communicate with technology or technology systems) requires careful consideration of the context of usage. This requires asking – 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? As the corporate community has discovered, understanding how to gather, interpret, and apply insights to better mediate between the world(s) of the end users and the world of technology requires considerable effort to bring the two together in an ultimately productive relationship.

Similarly, in the world of contemporary digital librarianship, one could say that there is an analogous need for mediation between the world(s) of the end user (e.g., university students) and the world of digital information. In order to negotiate the 'gap' between humans and information (Kuhlthau, 2000) and improve users' 'meaning making' during information encounters (Kuhlthau, 1999), highly interactive interfaces must be designed through employing user-centered methods to study information seeking behaviors. From this point of 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).

Reflective of industry trends, Cal Poly's user-centered design approach 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. While quantitative methods are sometimes included in these approaches, a key feature of all 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. In addition, the emphasis on iterative design leading to rapid prototyping of solutions which can, in turn, be evaluated, modified, and implemented in a relatively short time frame, ensures users' immediate 'instant gratification'.

Because data collection and evidence interpretation requires frequent face-to-face communication between university librarians and student researchers throughout the design and redesign processes, librarians also obtain valuable 'voiced' insights into user constituency perspectives. Continuing relationships with supervising faculty offer, as well, the possibility to return to study of different aspects of a particularly perplexing problem in subsequent academic

quarters. Finally, the action orientation encourages quick prototype problem solutions, service improvements, and organizational changes that enable continuous improvement and promote inquiring relationships within the library and with the campus community.

<div align="center">**Digital Library Projects**</div>

Example 1 – Information Retrieval System Interface

When results from an Association of Research Libraries (ARL) LibQUAL study corroborated Cal Poly students' appreciation of Google search capabilities, librarians recruited peer researchers to assess a federated search engine, Ex Libris' MetaLib, paired with a citation linker, SFX, in hopes of offering users an acceptable means of searching multiple databases simultaneously. 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?" .

With supervision from their professor, students in a Human-Computer Interaction (HCI) course employed usability testing and research to propose an interface design that would be both usable and efficient for Cal Poly students. The design project involved a series of stages, mirroring the iterative SSM design cycle for data collection and review, followed by 'action taking'. First, faculty and student users conducted usability tests of the vendor's 'out of the box' interface, employing screen shot capture and 'talking out loud' protocols, supplemented by study of the 'native interface' functionalities available for single database searches. Next, focus group discussions were conducted to explore students' research needs and search experiences, followed by transcription of the recorded remarks and 'fact pattern' identification.

With an improved understanding of their peers' information seeking purposes, student researchers proposed modifications to the vendor's 'off the shelf' product. Using information visualization and user navigation principles, they created a 'walkthrough' paper prototype. Students also developed four task scenarios for research subjects to complete using both the

vendor's original release and the paper prototype product, revealing further problems to be addressed. These results, in turn, informed a series of prototypes, ranging from chalkboard mock-ups to high-fidelity final products, which addressed all facets of the MetaLib product interface including screen designs, navigation tabs, icons, logos and buttons. Students regularly reported on their progress, in an iterative fashion which encouraged two-way student and librarian learning.

One proposed interface was playfully named 'PolyDog' to complement the name of the library's 'PolyCat' (POLYtechnic online public access CATalog). Although this suggestion was not accepted – when focus group findings revealed that it did not communicate the product purpose well, librarians considered the other MetaLib customization recommendations so useful that, after implementing them in a local release, they forwarded the students' report to the product vendor, where it informed the vendor's subsequent release (version 3). The success of this initial collaborative evidence-based design experience served to introduce librarians to systems design and usability testing, moving them from their traditional passive roles as consumers of commercial database products to producers of information interaction and knowledge creation tools.

Example 2 – Research Guide Web Pages

Librarians next worked with another group of students studying Human-Computer Interaction (HCI). These students wished to apply interaction design, which aims to improve usability and experience by researching and understanding users' needs and then designing to meet and exceed those needs. Encouraged to select a project of importance to their peers, students choose to study librarians' Web-based academic research guides. Although frequently used within the profession to guide students to appropriate research tools and information sources, this popular 'pathfinder' (list) approach has not benefited from significant user-centered research (Staley, 2007). Consequently, the presentation typically does not match students' information search processes, creating a "gap between the system's traditional patterns of information provision and the users' natural process of information use" (Kuhlthau, 1991, 361).

Students' initial research explored: "What do Cal Poly students know about library resources? What do they want to know? And how do they want to learn it?" Results revealed that

seventy-two percent of student respondents used the Internet for research while only four percent reported using the library; these results corroborated the library's earlier LibQUAL findings. The study also discovered that although some students used the library website to find books and journals, few knew that librarians could assist in finding relevant resources. This is in keeping with other studies which found that students often do not see libraries and library personnel as part of their information-support network, relying instead on the Internet and their friends for assistance (Seamans, 2002).

Given the Net Generation's Web usage patterns, student researchers advised librarians to improve this digital discovery tool. Students offered to explore form and content issues in support of librarians' new roles as content providers for Web-based learning environments. Drawing insights from their peers' focus group and usability study findings, researchers launched a usability study designed to obtain feedback on the recently revised (1-D) content template. See Figure 2.
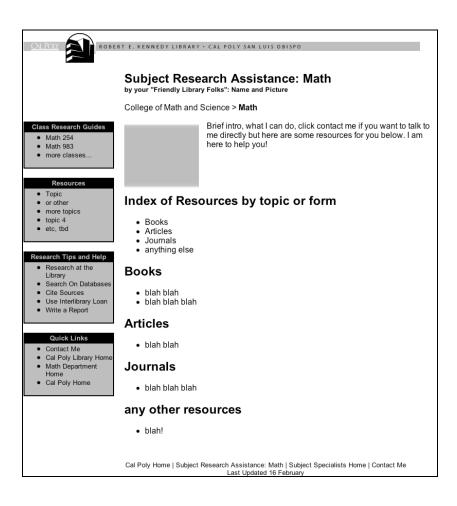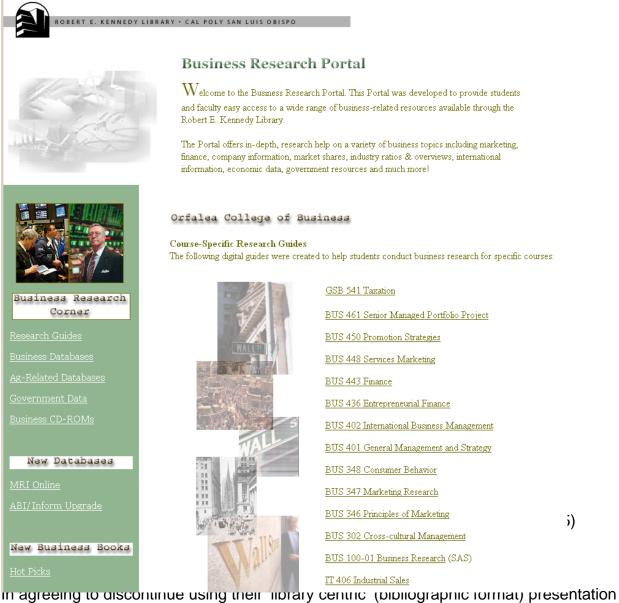

Figure 2. Bibliographic-Format Organized Content Presentation Template (Rogers *et al.*, 2005)

The study intended to obtain basic usability data to assist librarians in making some minor improvements in Web page navigation and layout. However, after analyzing research results, students recommended significant changes, which they incorporated into a new template that recognizes students' desire to access content for course-specific purposes. See Figure 3.

ROBERT E. KENNEDY LIBRARY • CAL POLY SAN LUIS OBISPO

Business Research Portal

Welcome to the Business Research Portal. This Portal was developed to provide students and faculty easy access to a wide range of business-related resources available through the Robert E. Kennedy Library.

The Portal offers in-depth, research help on a variety of business topics including marketing, finance, company information, market shares, industry ratios & overviews, international information, economic data, government resources and much more!

Orfalea College of Business

Course-Specific Research Guides
The following digital guides were created to help students conduct business research for specific courses:

GSB 541 Taxation

BUS 461 Senior Managed Portfolio Project

BUS 450 Promotion Strategies

BUS 448 Services Marketing

BUS 443 Finance

BUS 436 Entrepreneurial Finance

BUS 402 International Business Management

BUS 401 General Management and Strategy

BUS 348 Consumer Behavior

BUS 347 Marketing Research

BUS 346 Principles of Marketing

BUS 302 Cross-cultural Management

BUS 100-01 Business Research (SAS)

IT 406 Industrial Sales

Business Research Corner

Research Guides
Business Databases
Ag-Related Databases
Government Data
Business CD-ROMs

New Databases

MRI Online
ABI/Inform Upgrade

New Business Books

Hot Picks

In agreeing to discontinue using their 'library centric' (bibliographic format) presentation approach as the sole means of presenting content, librarians took an important step toward adopting a more 'student centric' system building perspective. In addition, as they were coached by students in user-centered content architecture and taxonomy principles, they came to appreciate their opportunity to advance students' 'relational' information literacy' (Bruce, 1997), whereby information proficiencies explicitly develop in tandem with disciplinary content mastery.

The most mature expression of this approach is found in Cal Poly's business research portal (http://www.lib.calpoly.edu/staff/fvuotto/), which reflects extensive user research, fortified by conversance with faculty-determined student learning outcomes (Somerville and Vuotto, 2005).

Example 3 – Discipline-Based Research Portal

Participation in the previous usability study required that student subjects complete a questionnaire on their research habits, research skills, and learning styles. When analyzed, these results inspired student researchers' interest in two new lines of inquiry - effects of learning styles and implications of class level (years toward graduation). In response, student researchers decided to use preliminary findings to create a two-dimensional (2-D) model for content architecture. The emphasis on learning styles emerged out of the recognition that the Web honors multiple forms of intelligence - abstract, textual, visual, musical, social, and kinesthetic, etc. Therefore, digital technologies offer opportunities for higher educators to construct tools, systems, and environments that enable all young people to experience information in their preferred learning mode and thereby successfully advance their 21st Century literacies – e.g., visual, historic, cultural, information, scientific, mathematical, and language. "The Web affords the match we need between a medium and how a particular person learns" (Brown, 2002). In addition, student researchers reasoned, peers early in their college career needed to receive foundational information for fulfilling required liberal arts and general studies coursework. Then, beginning in the third year of a four year undergraduate degree program (when most students declare their academic degree/major), students needed discipline-specific resources and research navigation assistance appropriate to the knowledge building traditions of the field (e.g., Elrod and Somerville, 2007).

Based on this evidence, student researchers hypothesized that implementation of a 'scaffolded' approach would assist students to move from one level of learning to the next as their academic career evolved. This is in line with the social development theory underpinning scaffolding – i.e., there is a 'gap' between the learner's actual knowledge and potential development and by appropriately bridging the gap through presentation of appropriately difficult

challenges (and accompanying support), individuals can grow to their full potential (Rogers *et al.,* 2005b). In response, students developed a two-dimensional (2-D) content architecture for a disciplinary research portal. See Figure 4.

	Lower Years (first two of four year program)	Intermediate Year (third)	Advanced Year (fourth)
Visual and Kinesthetic	More research content breadth but less depth and basic research strategies needed, paired with visual and kinesthetic presentation elements – e.g., use graphics and demonstrations and replace textual information with visual representations (graphs or diagrams)	Discipline-based coursework and higher order thinking experiences require more in depth information resources and research strategies, with continued application of visual and kinesthetic design elements	More depth topical content, presented within disciplinary framework, to enable more ambitious research purposes, with consistent application of visual and kinesthetic design elements
Auditory and Read/Write	More research content breadth but less depth and basic research strategies needed, paired with audio and read-write presentation elements – e.g., re-organize diagram or graph content into statements and offer both textual narrative and audio recordings, such as podcasts	Discipline-based coursework and higher order thinking experiences require more in depth information resources and research strategies, with continued application of audio and read-write elements	More depth topical content, presented within disciplinary framework, to enable more ambitious research purposes, with consistent application of audio and read-write elements

Figure 4. 2-D Content Architecture Model Excerpt (adapted from Rogers *et al.*, 2005)

The design concept acknowledged the 'dimensionality' of the target audience, including academic level considerations and other user attributes which produce different needs at various stages in students' careers. Students also recommended that viewing experiences accommodate learning style differences.

Example 4 – Website Content Architecture

From here, students developed interest in the usage of 'personas' as an interaction design technique to model archetypal end-users (Cooper and Reimann, 2003). These composite 'characters' reflected insights gleaned from various earlier student-generated studies and permitted researchers to extend their 2-D content architecture modelling with scenarios that moved the personas through tasks in order to achieve goals. For instance, by the third year of undergraduate study, students were enrolled primarily in courses within their major field. In order to successfully progress toward graduation, students needed to become familiar with the knowledge of the field. This required knowing how to access and interpret scholarly peer-reviewed articles. At the same time, in preparation for conducting original research in the final year of

undergraduate study, students needed to know the distinctive research conventions of their chosen field (Lant, 2001). Finally, since knowledge increases exponentially, students in their third year began to anticipate that they needed life long learning proficiencies adequate to support their continued learning in the workplace. As graduation approached, their interest in industry and company research increased as well. The students' scaffolding schema provided the presentation structure for contextualizing information that informed hypothesized goals (the "what") and tasks (the "how") for typical user types. See Figure 5.

Group	Content	Justification
Lower Years	More breadth (a wider variety of subjects) but less depth Foundational literature searching skills and critical thinking abilities	Students are enrolled in introductory general education and liberal arts courses. They need to develop basic information literacy proficiencies (recognizing an information need, framing a research question, planning an information seeking strategy, selecting and evaluating authoritative sources, organizing and interpreting information, managing and communicating insights.
Intermediate Years	Introduction to discipline-based finding tools and core authoritative information sources Discipline-appropriate strategies for identifying and evaluating information	When students declare their academic degree/major, they begin coursework which cultivates their discipline-based understanding of the kinds of knowledge, research, questions, studies, and activities which are appropriate to their fields of study. Working together, professors (domain content experts) and librarians (bibliographic information experts) can further student understanding about how knowledge comes to be created, discovered, analyzed, and evaluated, particularly as it applies to creation, exchange, and management of knowledge in contemporary digital environments.
Advanced Years	In depth exploration of a topic within chosen specialty in academic field, including comprehensive literature review in preparation for conducting original research project	In the final year of study, students must complete a culminating senior project. This requires completion of a comprehensive literature review – to properly place the study within existing research in the area – as well as demonstration of higher thinking abilities expressed throughout problem formulation and data collection, interpretation, and dissemination.

Figure 5. Personas Dimension I (adapted from Rogers *et al.*, 2005)

The completed personas presented student researchers' insights into the implications for progress toward graduation, including initiation of academic degree coursework in the chosen field of study. These factors, they reasoned, had depth, breadth, and scope implications for information needs and accompanying research strategy and critical thinking consequences. In addition, students delineated learning style characteristics relevant to content presentation decisions. See Figure 6 for highlights of two of the six distinctive persona composites.

Persona Description	Persona Goal	Persona Rationale
Student 1. Victor, second year computer science student, has a strong visual and kinaesthetic learning preference.	Complete assignments to fulfil general education course requirements. To do so, he must critically evaluate information sources to construct and defend best possible argument. He wants research guide web pages that satisfy his learning style.	Victor is taking general education courses so he wants just enough general information to complete the assignments – not too much detail, not too much depth. He also wants to find the best information as quickly as possible without having to read through extraneous material.
Student 2. Elizabeth, a third year business student, has a strong visual and kinesthetic learning preference.	Focus on major field of study, including discovery of particularly interesting topics within the field. Unfamiliar with disciplinary finding tools, reference books, core journals, etc., she needs a broad introduction to the literature. Also, as she contemplates her career options in 1 + years, she wants to investigate industry leaders and their corporations. She wants research guide web pages that satisfy her learning style.	Now that she is taking courses in her major field of study, she is particularly eager to excel. She needs good grades/marks and positive reference letters (based on stellar performance in class) to compete successfully for a good job after graduation. In addition, she finds the subject matter very interesting. So she is willing to spend more time on research projects, as well as browsing in the current literature.

Figure 6. Sample Persona Composites (adapted from Rogers *et al.*, 2005)

This culminating activity applied insights from three years of student-generated and faculty-supervised study of student information needs applied to the design of digital discovery tools. The personas demonstrated project participants' deep learning about archetypal goals, behaviors, and attitudes that, when situated, guide digital product development decisions. Besides corroborating the efficacy of inclusive, user-centered design processes, construction of the personas produced the shared vision, mutual empathy, and committed focus to sustain continuous dialogue-based relationships with system beneficiaries and other campus stakeholders.

The collaborative design activities also produced other unforeseen outcomes: working with students and faculty expanded boundaries of influence and concern for libraries and librarians. Cal Poly students moved librarians from managing information resources as artifact archivists and retrieval experts to enabling knowledge creation as knowledge mediators and learning enablers. Libraries were also recast – initially framed as passive resource centers and artifact repositories - to become active centers of instruction, exploration, and learning (Rogers *et al.*, 2005).

Conclusions and Implications

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 librarianship 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.

Systems thinking processes ensured careful consideration of 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. Growing conversance with a variety of user-centered (re)design strategies also aided librarians in fulfilling their expanded responsibilities as collaborative architects of digital information and knowledge enabling spaces. They learned to approach their new responsibilities with confidence, grounded in collaborative evidence-based practices for decision making and action taking.

Some transferable tenets emerged, which now guide implementation of an evidence-based collaborative design approach at a sister campus, San José State University in California's Silicon Valley (Somerville and Nino, 2007; Somerville and Collins, 2008). First, arguments for adoption recognize that library workplace decisions must increasing depend on user-produced evidence to guide the identification of library priorities, the evaluation of library services, and the design of library systems. This rethinking can be enabled by system's thinking which places these questions within the context of the institution's core research, teaching, and learning activities. And, finally, because collaborative evidence-based practice supports organizational learning, it informs the co-creation of necessary new roles, responsibilities, and relationships for libraries and librarians.

Secondly, collaborative evidence-based librarianship is inherently user-centric. Collaborative research and consultative dialogue depends on vigilantly ensuring that stakeholder and beneficiary viewpoints are pro-actively invited and thoughtfully considered. This includes depending on present and potential user communities to define 'success' outcomes, rather than depending on the 'busy-ness' statistics all too often used to measure organizational performance.

Finally, actively listening with the intention of understanding others' points of view enables integration of those insights into repurposing and redesigning decisions.

Thirdly, habits of reflective, interactive dialogue must be built into the cultural practices of the workplace. The active pursuit of learning through thoughtful consideration of user-centric evidence, paired with the intention to develop sustainable communications with present and potential users, aids in acquiring and exercising an ever expanding set of politically viable and culturally feasible research methodologies. Within a thoughtful, reflective culture, the resulting relationships will ensure nimble organizational responsiveness as co-designers "learn their way" (Checkland and Winter, 2006) to agreed upon actions that improve users' experiences.

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