Practices, Aggregation, Infrastructure, and Retrieval Service (PAIRS) for Broadening Participation in Computing

Project Description

PAIRS will enable educators at all levels, in both formal and informal settings, to identify, select, and use educational resources that have been shown by research to be effective or promising for increasing the participation of members of under-represented groups in computing. Under the Broadening Participation in Computing program, we have developed the BPC Collection of the Engineering Pathway Digital Library, a National STEM Digital Library (NSDL) collection housed at UC-Berkeley. An initial collection of 65 resources has been catalogued on the site. An additional 279 evaluated resources have been identified and will be catalogued in the upcoming weeks. Resources include research articles, teaching methods, assignments, BPC projects, interventions, members of the BPC community, and other sites. As with other NSDL libraries, Engineering Pathway does not actually serve the resources, but describes and points to them. It routinely scours its URLs to ensure it is only pointing to live sites, is interoperable with other digital libraries, and is both browsable and searchable.

Year One Activities

PAIRS Branding: BPC Collection

The project title describes our activities and the functionality of the collection. However, we have named the collection the Broadening Participation in Computing Collection in Engineering Pathway so that a user knows instantly the purpose of the collection. Our project web site is here http://www.colorado.edu/atlas/research/arc/pairs/ and the Engineering Pathway can be found here http://www.engineeringpathway.com/ep/browse/host_collection/

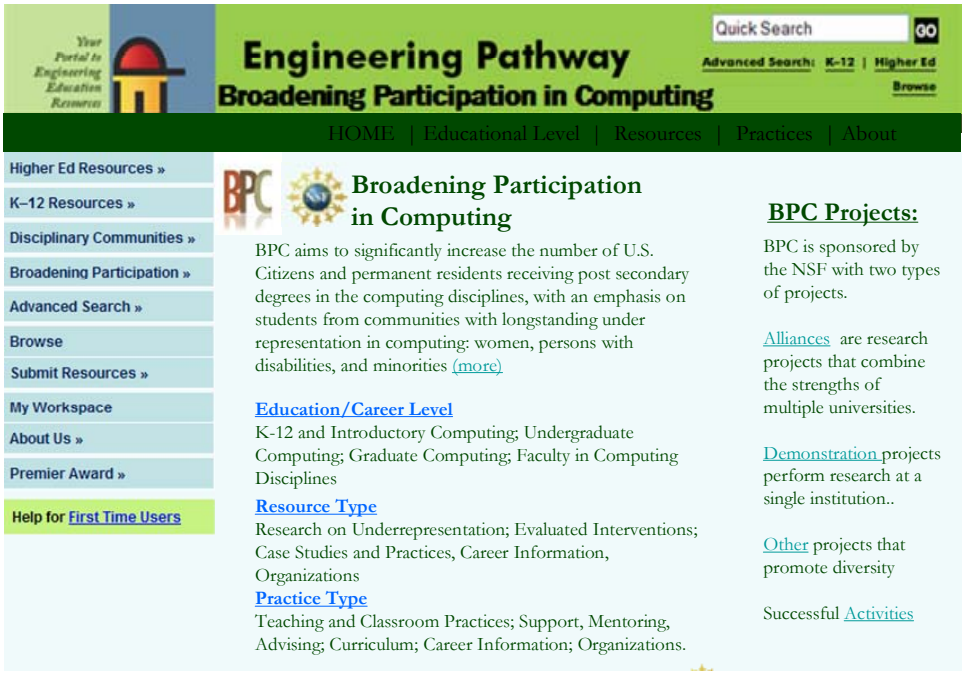
Christopher Znerold, an undergraduate student earning a Technology, Arts, and Media Certificate at the University of Colorado, created a logo for our project. The OLPA Webmaster said that no special permission was required to use the NSF logo in the middle of the letter C, though we can present it in various versions. For example, one version explains what BPC stands for, while another is very small, is cropped, and has no NSF logo so that it can identify resources that have been catalogued in the BPC Collection in the Engineering Pathway Digital Library. The full logo is shown below. A similar version, but without the NSF logo embedded, was used in the 20-foot banner for the shared booth at the ACM Special Interest Group in Computer Science Education conference in March (Portland). The NSF logo was left out so that it was not assumed that NSF was the only funder of all the organizations sharing the booth. Our hope is that any BPC project will feel free to use the logo.

Figure 1: SIGCSE Shared Booth

Metathesaurus Development and Discovering and Cataloguing Resources

The PAIRS team developed a metathesaurus to support search for resources already available online fitting the criteria and to support cataloguing, so that each resource in the BPC collection can be found both through browsing and through searching. Resources are browsable under several categories, depending on how the user approaches a search. These categories need to be tested, but a preliminary draft is shown in Figure 2 (which has an early version of the BPC logo).

Figure 2: Draft BPC Browse Categories



Search functionality will go beyond the browsable categories to include terms identified by the catalog team and inserted into each record. These terms were developed first by Lecia Barker, who identified a broad set of terms that combined, could be expected to be found in a relevant resource (e.g., journal article, culturally-relevant assignment). A partial view of search terms is shown in Figure 3. There were so many that we discovered that Google can only combine about 30 search terms at a time).

Figure 3: Search Terms and Search Strategy (Partial Table View)

Concept: As people catalog into the BPC collection, they should use as many existing pull-down menus as are clearly relevant. Then, keywords describing several categories (see below) should be added to the box (what box? In EP) in as many of the following categories as possible, given that it is known or made evident by the resource.

We need to be sure that the terms in the cataloguing box show up only if they are in quotes – entire string, not software or engineering but "software engineering" – how can we do that?

Group	A	Major Area	A	Goals/Methods	IF	Research Words
Women, woman, girl,	N	Computing	N	"Research experience for	NO	(all terms separated by OR)
Girls	D	"computer science"	D	undergraduates"	T	
Gender		"information science"		REUs	SC	*Outcomes*
Female		"information systems"		Undergraduate research	HO	*Experiment*
Male		Informatics		(opportunity)	LA	*Assessment*
African-American		"computer engineering"		UROP	RL	*Measures*
Black (usually with a capital B)		"information technology"		Mentor	Y,	*Results ("results of")*
		Computational		"Peer mentoring"	TH	*Focus groups*
Hispanic		"digital media"		"Tier mentoring"	EN	*Interviews*
Latino/a		Software engineering		"Peer teaching"	"A	*Findings*
Hispano/a				PLTL	ND	*Survey*
Chicano/a				"Peer tutoring"	"	*Pre-test*
Native American				"Team-oriented"		*Post-test*
American Indian				"Increase awareness"		Method
Pacific Islander				"Studio approach"		Tracking
Alaskan native				"Fine arts approach"		Implementation
Disability				"Online discussion"		"Formative assessment"
Hearing-impaired				"Discussion group"		"Formative evaluation"
Deaf				"Online community"		"Summative evaluation"
Blind				"Classroom climate"		Comparative
Visually impaired				Climate		Goals
				"Group learning"		Objectives
Misc (usually used				"Small group learning"		"Performance criteria"
				Cooperating AND learning		Model
				Collaborative AND learning		Factors

Group	A	Major Area	A	Goals/Methods	IF	Research Words
with one or more of the other terms abge:				Teams		Impact
Underrepresented				"Group projects"		Validity
Minorities				"Confidence building"		Instrument
Minority-serving				"Building community"		"Assessment method"
Ethnic				"Communal housing"		Methodology
Racial				Clustering		Predictors
Diversity				"Faculty development"		Behaviors
				"Learning communities"		Benefits
				"Faculty mentoring"		Quantitative
				"Student community"		Qualitative
				"Bridge courses"		"Inter-rater reliability"
				"Supplemental instruction"		Measured
				Reform		"Relationship between"

The search team included three undergraduates: Chad Montgomery (Berkeley), Russ Mehring, and Quinn Rehnerfeldt (both Colorado). Students searched over the course of several weeks and created an annotated EndNote database. They then were trained to identify the poles of an accept/don't accept continuum. This reduced the size of the database so that only absolute "yes" and "maybes" remained. This set of resources is being catalogued into the Engineering Pathway site and tagged with the BPC collection by undergraduate Amanda Walton (Colorado School of Mines) under the direction of Tracy Camp. She is using a much-reduced version of the search terms for tagging resources. A partial view of the keyword chart is shown in Figure 4. Each resource will be tagged with at least one criterion from each of several categories (group (e.g., type of disability), major area (e.g., computer science), goal (e.g., engagement), intervention (e.g., meaningful assignment), evidence type (e.g., experiment), barrier type (e.g.,

stereotype threat), organization (e.g., STARS Alliance).

Figure 4: Metathesaurus for Tagging Resources (Partial View)

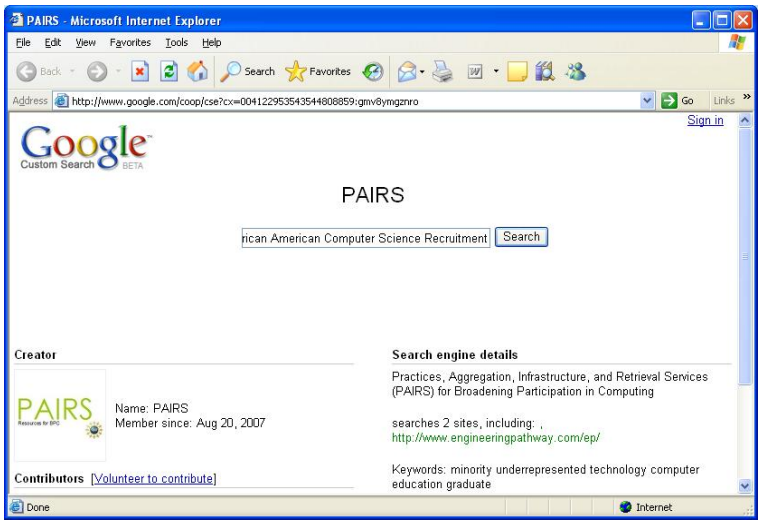
Group	Major Area	Goal	Intervention Type	Evidence type	Barrier type	Organization(s) mentioned
Women, woman, girl, Girls Gender Female Male	Computing "computer science" "information science" "information systems" Informatics "computer engineering" "information technology" Computational "digital media" Software engineering This list may be missing some things	recruitment attract, recruit engage, engagement retain, retention "Increase awareness" Enhance (students') interest Motivate Motivational Advance (to graduate school)	"Research experience for undergraduates" REUs Undergraduate research (opportunity) UROP	evaluated intervention "supported by other research" promising practices unevaluated intervention Research experiment evaluation assessed intervention, unassessed implementation of practice supported by other research unevaluated evidence-based survey, survey instrument	bias classroom climate stereotype threat attitude/s confidence awareness belonging	ncwit, national center for women & IT, national center for women & information technology, national center for women and information technology\ there are probably others mentornet (check to see if already there) Note: I believe that ACM-W is already selectable by a pull-down menu and we do not need to repeat it in keywords
African-American Black African American (without the hyphen)			Mentor "Faculty mentoring" "Peer mentoring" Peer mentor "Tier mentoring" "Peer teaching" Faculty-student interaction Student-faculty interaction Student-student interaction			
Hispanic Latino, latina Chicano, chicana						
Native American American Indian Pacific Islander Alaskan (native) Hawaiian			PLTL Peer-led team learning			
Group	Major Area	Goal	Intervention Type	Evidence type	Barrier type	Organization(s) mentioned
Disability disabled Hearing impaired Deaf Blind Visually impaired Accessible			"Peer tutoring" "Group learning" "Cooperating learning" "Collaborative learning" "Studio approach" "Fine arts approach" "Online discussion" "Discussion group" "Online community" "Building community" "Learning			
Misc (usually used "with" one or more of the other terms above): Underrepresented Minorities Minority Under-represented Minority-serving						

Alice Agogino at Berkeley has been reviewing the collection to ensure that the policies for ensuring that the collection is of high quality are enforced.

Custom Search Appliance

Michael Smith (Berkeley) developed an experimental custom search appliance using Google Custom Search tools. The site is a platform for testing keywords and other terms in the Engineering Pathway BPC Collection. Queries submitted to the custom site search Engineering Pathways using weighted keywords. Search results can be grouped into subcategories (e.g., “Recruitment” or “Retention”). The site is a useful tool for testing new keywords and category topics related to BPC. A sample of the search results is shown in Figure 5.

Figure 5: Google Custom Search Tool with Sample Query



Initial Interface Design

An intuitive, instructive interface has been designed by Cheryl Seals and a team of graduate students from the Auburn University computer science department for the BPC Collection in the Engineering Pathway site. The goal of the interface design project was to create a landing page which would implicitly instruct a user about the kinds of practices that increase diversity in computing. For example, it is hoped that by viewing the words under the main categories, a user will understand that certain types of practices are preferred for broadening participation. A technical report from the redesign research is available in the Findings section of this report, authored by Dr. Seals, Vasavi Chilamantula, Manasa Nimmakalaya, Ravikant Agarwal and Achilles Hamiltorus, *"Broadening Participation in Computing Search: Web Site Design to enhance access of a BPC community,*" Auburn University Computer Science Technical Report, December, 2007. Figure 6 and Figure 7 describe the initial and final interface designs. Figure 11 illustrates the results of a user-study to test the usefulness and usability of the interfaces.

Figure 6: BPC Landing Page Redesign Version 1

Figure 7: BPC Landing Page, Final Version

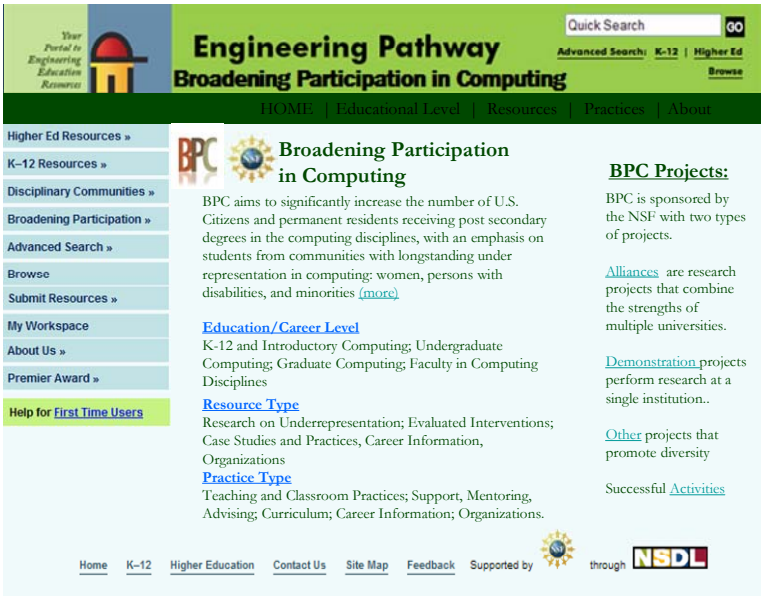
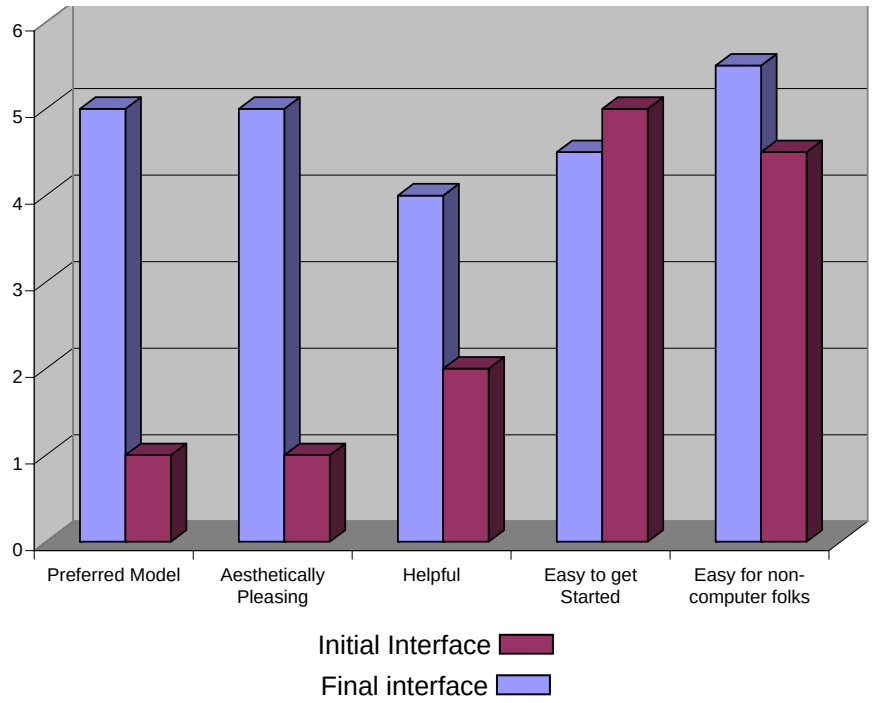


Figure 8: Response to Questionnaire on Landing Page



Outreach and Dissemination

Michael Smith led a tutorial on the search and cataloguing features of the Broadening Participation resources in Engineering Pathways with a group of educators from Historically Black Colleges and Universities at the AAAS HBCU-UP Conference, Washington D.C., October 6, 2008.

Figure 9: Michael Smith Presenting BPC Collection at AAAS HBCU-UP Conference

The PAIRS team was an integral part of a 30-foot exhibit booth at the ACM Special Interest Group on Computer Science Education with seven other organizations, including the Coalition

to Diversify Computing, four BPC alliances (STARS, A4RC, CAHSI, Empowering Leadership), the Computing Research Association Committee for the Status of Women in Computing, and the National Center for Women & IT. To let people know about the BPC Collection and to find out about resources we did not find in our search, Lecia Barker, Cheryl Seals, and Kim Kalahar handed out an 8"x5" color card eliciting nominations for resources to be included in the BPC collection. We sought nominations rather than asking people to actually catalog because this is a reviewed collection and the PIs as a group have set a policy that we should control what goes into it. The card is shown in Figure 10. The card was also handed out at the ACM Southeast Conference on March 28-29, 2008 at Auburn University and will be distributed at a variety of relevant venues. Paul Mackinney at Berkeley programmed a special page where the resources can be nominated for later review by Lecia Barker and trained undergraduates.

Figure 10: Nominate a Resource Card