USE OF **REAL-WORLD DATA AND INFORMATION** IN THE CLASSROOM

Evolution of a K-14 Teacher Preparation Model

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Community colleges are uniquely poised to prepare tomorrow's teachers to use internet-based tools and curriculum resources to enhance learning. Through the U.S. Department of Education-funded Pathways project, almost 250 faculty from over 40 community colleges nationwide have incorporated new tools and resources into their courses while modeling best practices in technology-based instruction to their students; approximately 6,900 preservice teachers have been affected by this program.

The League for Innovation in the Community College is an international organization dedicated to catalyzing the community college movement. The League hosts conferences and institutes, develops web resources, conducts research, produces publications, provides services, and leads projects and initiatives with more than 850 member colleges, 165 corporate partners, and a host of other government and nonprofit agencies in a continuing effort to make a positive difference for students and communities. Information about the League and its activities is available at www.league.org.

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FOREWORD

The increased use and availability of computers and the internet in all segments of society require that public schools adequately prepare students for the 21st century. Consequently, teachers must also be ready to integrate technology effectively into their teaching. Our nation's need for adequately trained teachers, along with the projected national teacher shortage, necessitates that all levels of education join together to improve teacher preparation.

With more than 1,200 institutions across the nation, community colleges have worked closely with public schools and teacher development since their early beginnings. Today, community colleges are ideally positioned to begin and, in some cases, fulfill training for new teachers. For example, many prospective teachers receive their only college-level mathematics and science content courses at community colleges, and in Florida, community college transfers make up more than half of the students graduating from teacher education programs at state universities.

In addition to their historical commitment to learning-centered education, community colleges are some of the most technologically advanced institutions in all of higher education. By providing faculty in mathematics, science, language arts, and educational technology with a world-class training and professional development opportunity, Community College Pathways to Improved Teacher Preparation Through Technology (Pathways), used the community college expertise and resources to address public schools' need for teachers equipped to prepare students for the 21st century.

Whether graduating high school students enter the workforce or enroll in higher education, they need to know how to use modern technologies. The relationship between a nation's allotment of workers with the latest information technology skills and that nation's capacity to develop a globally competitive workforce has clearly been established. Community colleges have long served as a vital resource for individuals seeking the skills needed to enter into or advance in employment, and they continue to have an important role in preparing future members of our nation's workforce. Pathways has improved the working skills of community college faculty in mathematics, science, language arts, and educational technology as they have learned to use internet-based resources to facilitate student engagement. Pathways also promises to improve the skills of future teachers who, as students, saw these strategies and practices modeled by participating faculty. Taken one step further, the students of these future public school teachers may have an increased likelihood of developing the information technology skills needed to be successful in a 21st century workforce.

The League for Innovation in the Community College is proud to have collaborated with the Center for Innovation in Engineering and Science Education at Stevens Institute of Technology, Bank Street College of Education, Cuyahoga Community College, Maricopa Community Colleges, Miami Dade College, Polaris Career Center, Education Commission of the States, National Association of Community College Teacher Education Programs, and the Institute for Learning Technologies at Teachers College, Columbia University, in the implementation and management of Pathways.

Edward J. Leach
Vice President, Programs and Services
League for Innovation in the Community College

"This is a world in which a very high level of preparation in reading, writing, speaking, mathematics, science, literature, history, and the arts will be an indispensable foundation for everything that comes after for most members of the workforce. It is a world in which comfort with ideas and abstractions is the passport to a good job, in which creativity and innovation are the key to the good life, in which high levels of education—a very different kind of education than most of us have had—are going to be the only security there is."

Tough Choices or Tough Times: The Report of the New Commission on the Skills of the American Workforce
National Center on Education and the Economy, 2006

In the early 1990s when the internet was just starting to be used by the general public and web browsers such as Netscape were still in their infancy, the Center for Innovation in Engineering and Science Education (CIESE) at Stevens Institute of Technology received funding from the National Science Foundation to explore uses of the internet in K-12 science and mathematics education and to identify applications of the internet that would add significant value to teaching and learning in science and mathematics. As a result of this pioneering study, CIESE coined the phrase, "unique and compelling applications of the internet," to describe those learning experiences that (a) cannot be accomplished through other tools or technologies, such as static resources including textbooks or CD-ROMS; and (b) use the internet to engage students in educational activities consistent with inquiry-based science. These include deeper, longer-term investigations; critical analysis; collaboration; exploration of meaningful, real-world phenomena; use of real-time data or data collected through global telecollaboration; use of primary source material; and publishing of student-created artifacts (McGrath 2001; McKay & McGrath 2006).

Through the National Science Foundation grant and others that followed, CIESE went on to develop, disseminate, and conduct teacher professional development on the use of unique and compelling internet-based applications. In the NSF-sponsored program, CIESE reached 3,000 educators from 700 schools in New Jersey with hands-on professional development in the use of unique and compelling applications of the internet. This three-year program led to a five-year, U.S. Department of Education Technology Innovation Challenge Grant in which Stevens led a multistate partnership to demonstrate a large-scale, capacity-building model. This model included teacher professional development in the use of the internet for K-12 science and mathematics education, administrator training, classroom support, and curriculum alignment. In this U.S. Department of Education grant, Alliance+, Stevens partnered with Cuyahoga Community College in Ohio, Miami Dade College in Florida, Maricopa Community Colleges in Arizona, Polaris Career Center in Ohio, and the League for Innovation in the Community College to deliver a teacher professional development program, *SavvyCyberTeacher*®, that, over the five years of the program, reached 8,000 educators and an estimated 400,000 students from 67 districts throughout Arizona, Florida, and Ohio.

BREAKING NEW GROUND IN K-12 TEACHING AND LEARNING

Unique and compelling internet applications differ from many uses of technology in teaching and learning, which stress the use of productivity tools or internet research that is usually little more than searching for existing text or images. One example of a unique and compelling application is the use of two internet-based real-time databases—aircraft flying in U.S. skies and wind velocities at high altitudes—to engage high school students in real-world investigations of vectors. Students access dynamic data to chart the course of an airplane against air currents, make predictions about destinations and arrival times, then check their predictions against real-world results. The *SavvyCyberTeacher*® program, an intensive 30-hour, hands-on graduate-level course developed as part of the Alliance+ project, enabled community college faculty, teachers, and administrators to receive technology training in the context of core content and problem-based instructional approaches using internet-based applications such as this.

Three differentiated levels of *SavvyCyberTeacher*®—elementary, middle, and high school versions—each emphasized core subject matter content presented in an inquiry-based mode and tied explicitly to state and national curriculum standards; technology skills, including web page development and use of software tools; collaborative learning; and constructivist approaches to instruction. The professional development model of *SavvyCyberTeacher*® employed an inquiry-based approach to enable teachers to master learning objectives much the way their students would, thus deepening their own understanding of science, mathematics, and other interdisciplinary content areas. As a culminating project, each teacher developed an implementation plan, using simple web page templates by a free web page hosting resource, for use of a unique and compelling project in their own classroom.

Through a two-tiered turnkey training program, initial training and orientation was provided by Stevens Institute of Technology to a core group of community college faculty at Maricopa, Miami Dade, and Cuyahoga Community Colleges, who then provided face-to-face mentor training and follow-up support to school-based lead teachers in their respective communities. Mentor teachers in turn trained classroom teachers within their

Additional studies showed that 86 percent of classrooms that participated in an evaluation of the *SavvyCyber-Teacher®* program demonstrated noteworthy gains in the science and mathematics learning objectives being tested....

home school districts. This model was supported by detailed training materials, a mentor teacher handbook that included specific instructions and resources for delivering effective training, as well as a classroom teacher handbook that included all materials covered in the program. Additionally, a computer-based quality assurance system, known as the DataFeed system, was developed and used to provide immediate feedback regarding the extent to which participants mastered each session's learning objectives and the quality of the training, through a self-reporting system. DataFeed system reports were used to monitor the consistency and quality of the training and to make mid-course corrections if warranted.

Results from an external evaluation conducted by Harcourt Education Measurement showed that *SavvyCyberTeacher®*-trained educators felt better prepared to teach problem-solving skills; spent less time lecturing; reported improved ability to teach complex concepts; were better able to conduct small group learning activities; could more easily implement cooperative learning approaches; and were better able to effectively manage diverse learning styles. Additional studies showed that 86 percent of classrooms that participated in an evaluation of the *SavvyCyberTeacher®* program demonstrated noteworthy gains in the science and mathematics learning objectives being tested (Yepes-Baraya 2003). Furthermore, a 2004 student impact study, also by Harcourt Education Measurement, showed statistically significant gains in students' science and mathematics learning, measured via pre- and post-tests, among elementary, middle, and secondary students using internet-based real-time data and telecollaborative projects (Yepes-Baraya 2004).

The implementation model created for this project resulted in a powerful training and support infrastructure involving community colleges to provide training, outreach, and follow-up classroom support to neighboring school districts. The goal was to build capacity within participating schools by establishing relationships with the community colleges, training mentor teachers, and providing ongoing support for classroom teachers. Colleges of teacher education in each of the three community colleges supported their faculty teaching the *SavvyCyberTeacher®* course by granting the equivalent of two graduate credits.

The expanding role of community colleges in teacher preparation became apparent over the course of the project. As the nation continues to face a critical teacher shortage, community college teacher education programs are seeing an increase in enrollment. According to the National Association of Community College Teacher Education Programs (NACCTEP) database, 1,011 community colleges and technical colleges indicate they offer some type of teacher education program. Most prevalent are associate degrees that meet requirements for the first two years of a four-year teacher education degree. Some also offer postbaccalaureate programs that provide a viable alternative pathway to teacher certification. In addition, a few two-year institutions, like Miami Dade College, have initiated four-year degree programs in order to meet workforce demand and provide degree access to more students. These trends, encouraged by such organizations as the League for Innovation in the Community College and NACCTEP, are likely to play a major role in American education in the decade ahead.

COMMUNITY COLLEGE PATHWAYS PROJECT

The vision of a national dissemination plan for new internet-based resources and educational strategies to preservice teachers through a network of community colleges led to an award from the U.S. Department of Education's Preparing Tomorrow's Teachers to Use Technology (PT3) grant program to create the Pathways project, a community college program that included elements of *SavvyCyberTeacher®* specifically targeted to community college students and courses. Called Savvy Cyber Professor, this faculty development program adapted unique and compelling curriculum materials and training resources according to needs expressed by community college faculty. The objective of Pathways, the name of the PT3 grant under which Savvy Cyber Professor was developed, was to improve the way preservice teachers learn science, mathematics, language arts, and education and education technology content by providing community college faculty with tools and resources to model effective, technology-based teaching in these courses. The overall goal of the project was to improve the way preservice teachers who take content courses in community colleges teach these subjects when they are in their own K-12 classrooms. Pathways built on the Alliance+ collaboration between Stevens Institute of Technology and Cuyahoga Community College, Maricopa Community Colleges, Miami Dade College, Polaris Career Center, Bank Street College of Education, and the League for Innovation in the Community College, and added partnerships with the National Association of Community College Teacher Education Programs and Columbia University Teachers College.

This three-year initiative was designed to reach 200 faculty from 33 community colleges and included a 26-hour online faculty training program called the Savvy Cyber Professor, a library of approximately 200 internet-based real-world learning objects in science, mathematics, language arts, and teacher education and education technology as well as membership in an online community to support course implementation. Because it uses technology as a catalyst for critical thinking and problem-solving, the Pathways project represents a curricular innovation as well as an organizational change process to improve teaching and learning in community colleges. By creating and infusing rigorous, technology-supported curriculum content that is delivered via authentic learning experiences, the

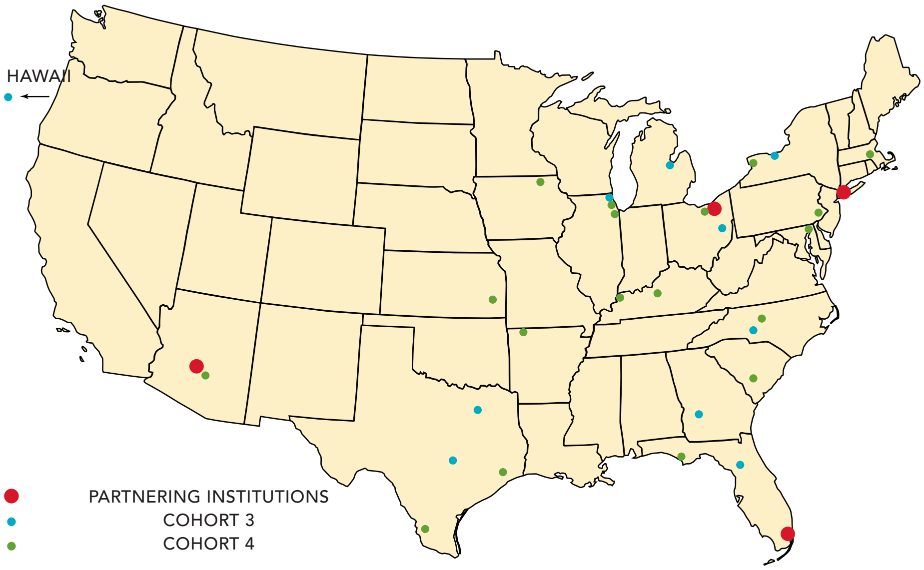
Because it uses technology as a catalyst for critical thinking and problem-solving, the Pathways project represents a curricular innovation as well as an organizational change process to improve teaching and learning in community colleges.

project has enabled a cadre of leadership faculty to experiment, innovate, pilot, refine, and implement both course content and new instructional strategies.

Through a competitive application process facilitated by the League for Innovation in the Community College, teams of four faculty members—one each from science, mathematics, language arts, and education and educational technology—from 33 institutions across the country were selected to take, over the course of the project, the Savvy Cyber Professor (SCP) course. They did so in four cohorts, which extended over four years; the original three-year grant received a no-cost extension. The course was developed and tested in the first year and then delivered to cohorts of faculty from around the United States over the following three. In Year 1 (2003-2004), the testing phase, three of the partner institutions that helped develop the course, Cuyahoga, Miami Dade, and Maricopa, then beta-tested it with a small number of faculty at their home institutions (Cohort 1/Beta). In Years 2 and 3, these same three partners delivered the course to additional faculty at their own institutions, while Stevens Institute of Technology delivered it to faculty from a consortium of community colleges in New Jersey (Cohort 2). In Year 3, the project went national, as Stevens Institute of Technology and Polaris Career Center delivered the course to 11 community colleges spread across the country (Cohort 3). In Year 4, the course was delivered by Cuyahoga, Miami Dade, and Maricopa faculty to 18 additional community colleges, also spread across the country (Cohort 4). Both Cohorts 3 and 4 began with face-to-face meetings of all participants at the League for Innovation's *Conference on Information Technology*, held in Dallas, Texas, in 2005 and Charlotte, North Carolina, in 2006. By the end of the fourth year, the project had reached faculty in 19 states *(Figure 1)*.

Savvy Cyber Professor, which was developed and tested by the partner institutions during the first year of the grant, is an eight-part, blended-mode program that includes initial face-to-face hands-on instruction and an asynchronous, online experience during which each participant develops a peer-reviewed real-world learning object (RWLO).

Figure 1. States with faculty participating in the project



BUILDING A LIBRARY OF REAL-WORLD LEARNING OBJECTS

RWLOs are discrete units of instructional content that use the same types of unique and compelling internet resources that were used in *SavvyCyberTeacher®*, including real-time data, primary sources, and global telecollaborations. RWLOs contain student-centered activities that fully integrate these types of internet resources and also provide the instructor with steps for implementing the internet-based activities in their courses. RWLOs differ from typical learning objects in that they ultimately engage students in authentic activities that are uniquely possible only through the use of the internet and provide compelling real-world learning experiences. RWLOs are designed to be small, discrete units of content able to be shared by faculty and students taking similar courses in other institutions.

RWLO templates, in either Microsoft Word or HTML formats, were provided to faculty to ensure ease of use and consistency in RWLO development. The structure of the RWLOs was formalized to include eight components: an overview, student learning objectives, procedural instructions for instructors, content materials for students, assessment, linkages to course competencies, supplementary resources, and recommendations for integration into course material *(Figure 2)*.

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Almost 80 percent of participants from Cohorts 2, 3, and 4, excluding the beta cohort, reported that they had never taught a web-based lesson or unit, and over 90 percent had never used real-time data.

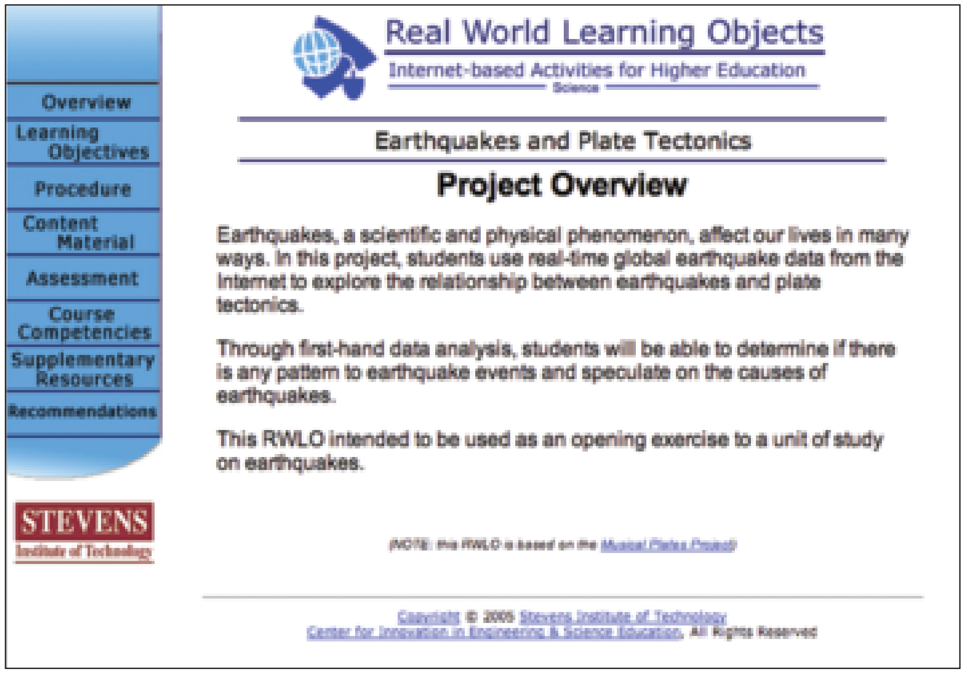


Figure 2. RWLO opening page, with eight components on left

RWLOs incorporate many of the themes associated with constructivist learning and teaching, including multiple perspectives, authentic activities, and real-world environments (Fosnot 1996; Derry 1996; Bransford et al. 1999). Faculty participating in the Savvy Cyber Professor program are engaged in constructivist learning from the onset of the course. They are challenged to find unique and compelling uses of the internet to incorporate into a lesson for their students and quickly embark on creating their own RWLO designed around these resources. These are novel instructional resources, not frequently used by faculty in their coursework. Almost 80 percent of participants from Cohorts 2, 3, and 4, excluding the beta cohort, reported that they had never taught a web-based lesson or unit, and over 90 percent had never used real-time data. Creating their own product to use in their courses specifically for their own needs not only required that they have a good understanding of the nature and use of learning objects but also increased the likelihood that they would actually implement the RWLO in their courses. Previous research has shown that postsecondary educators can be motivated to use learning objects in their courses by providing assistance in finding learning objects and developing them (Bratina, Hayes, & Blumsack 2002). Not only does the creation of faculty-developed RWLOs augment the RWLO library for others to draw upon, but equally important, it serves an essential training and implementation purpose as well.

Similarly, when community college students use the RWLOs in their coursework, either as in-class assignments or homework assignments, they are immersed in constructivist learning due to the nature of the authentic data or resources the RWLOs promote. Students are faced with real-world problems, data, issues, and materials to examine. The problems are sometimes ill-defined and are often complex, forcing the students to actively participate in the learning process in order to construct meaningful knowledge. By incorporating RWLOs into science, mathematics, language arts, and educational technology courses, faculty can both model effective technology-based instruction to preservice teachers and improve student engagement and achievement in core courses.

The problems are sometimes ill-defined and are often complex, forcing the students to actively participate in the learning process in order to construct meaningful knowledge.

A website, www.rwlo.org, was created for hosting all of the RWLOs. The software tool, Edesk, was customized and installed on www.rwlo.org to allow users to upload RWLO files and create personal portal pages with simplicity and ease. Edesk provided a mechanism for users to upload a variety of file types, including Word and PowerPoint files, without the need to learn web page authoring skills.

Participants in the Savvy Cyber Professor course comprised teams of four faculty from 33 community colleges. As part of the course, participants were partnered first with another participant in their own academic discipline and then with someone from their own institution. The partnerships were critical for both the RWLO development and review processes. Academic discipline partners assisted each other with the selection of topics for RWLOs and with the fine tuning of the steps and content of their RWLOs. Institutional partners were responsible for providing objective feedback regarding the design and understanding of the RWLO. By the final session, about 90 percent of the participants felt that it was beneficial to have a partner from the same institution. As part of the course design, RWLOs were reviewed by partners as well as by the course instructor before going through a formal peer-review process.

Once completed, the RWLOs were submitted for a rigorous peer review using an online submission form and then automatically entered into an online tracking system and given a unique identifying code. Peer reviewers were project partners who were practicing community college faculty in a similar discipline. Reviewers accessed the author's RWLO through a hyperlink and then completed an online review form to evaluate the RWLO for four different criteria: subject content, RWLO format, pedagogical content, and design. Upon completion of a review, RWLO authors were notified via email and directed to an online repository of review comments. Once revisions were completed, the author would submit the RWLO for a second and final review. The final review was conducted by the lead project

For the final Savvy Cyber Professor course implementation, which was completed in spring 2007, 98 percent of the participants who completed the course submitted a real-world learning object for review.

partner who confirmed that all criteria for the RWLO were met and then formally accepted it for library publication. If the RWLO still needed revision, the final reviewer would provide the relevant comments and the process would continue.

The partners, instructor, and peer-review process, although time consuming and labor intensive, resulted in high-quality RWLOs published in the RWLO library. For the final Savvy Cyber Professor course implementation, which was completed in spring 2007, 98 percent of the participants who completed the course submitted a real-world learning object for review. To date, 78 percent of those RWLOs have been accepted for publication in the library and a number are still going through the peer-review process.

EXAMPLES OF REAL-WORLD LEARNING OBJECTS

Science RWLOs

- **Earthquakes and Plate Tectonics.** Students use real-time global earthquake data from U.S. Geological Survey websites to explore the relationship between earthquakes and plate tectonics.
- **Global Polio Eradication.** Using the World Health Organization website, students evaluate weekly updates on the actual number of people with polio and the countries in which polio is endemic and imported. Students graph data by week or by year to hypothesize about trends.
- **Relative Velocity and Vectors.** Students access real-time flight data from aircraft over the United States to determine air velocity from ground and wind velocity.

Mathematics RWLOs

- **Using the Equation of a Line to Determine the Rotational Rate of the Sun.** Students use sunspot solar coordinates to create a linear position versus time graph and calculate the equation of this line to determine the rotational rate of the sun.
- **How Much Does This House Really Cost?** This project allows students to investigate how much they would actually pay for a house through a 30-year fixed-rate mortgage, with interest included, after 30 years. Students use real-time interest rates available for different areas of the country.
- **Rate of Change of Temperature.** Students determine in which month the temperature increases most rapidly, decreases most slowly, and changes most slowly for a major city of their choice in the United States.

Language Arts RWLOs

- **Understanding the Writing Process Through Walt Whitman's Notebooks.** Students investigate the writing process by reviewing how Whitman revised and refined his ideas and poems as he wrote, using digitally archived notebooks from the Library of Congress.
- **The Grapes of Wrath.** Students view and analyze selected historic photos and documents taken during Great Depression, identify a moment or scene in the novel they could illustrate, and create a report album documenting a self-selected scene or moment from the book.
- **Using Global Communication to Strengthen Critical and Persuasive Thinking.** Students develop persuasive ideas and opinions for a persuasive essay assignment via international online internet discussion correspondence.

Educational Technology RWLOs

- **Discover Educational Listservs – Portals to New Information.** Students review many listservs in their discipline and are given the assignment to sign up for one and post an introductory email.
- **Using Excel to Create a Climatogram.** Students use real-time climate data from the internet to create a climatogram.
- **Quick: Let's Collaborate Using a Wiki!** Students telecollaborate using an editable webpage called a wiki.

Although the original goal was to reach 200 faculty from 33 community colleges, by the end of four years, 249 faculty from 41 community colleges had participated in the Savvy Cyber Professor course *(Figure 3)*. In addition, a total of 170 real-world learning objects had been accepted into the RWLO library and are freely available for other faculty members to use or adapt for their own courses *(Figures 4 and 5)*. They are in all four of the subject areas.

Figure 3. Participation by participants and institutions

TOTAL COHORT	COMMUNITY COLLEGES	PLANNED PARTICIPANTS	ACTUAL PARTICIPANTS
1/BETA TEST	3	8	12
COHORT 2	9	72	128
COHORT 3	11	48	45
COHORT 4	18	72	64
TOTALS	**41**	**200**	**249**

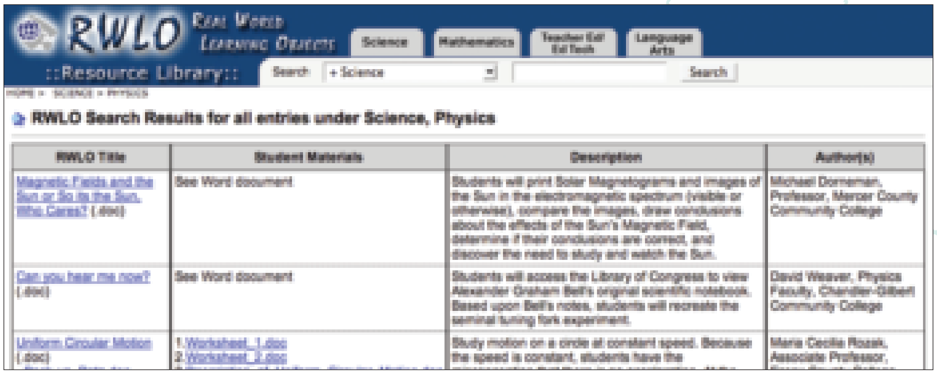
Figure 4. RWLO library

Figure 5. RWLO library by subject area

DISCIPLINE	ACCEPTED	AS PERCENT
LANGUAGE ARTS	54	32%
SCIENCE	47	28%
MATH	41	24%
EDUCATION/EDUCATION TECHNOLOGY	28	16%
TOTAL	**170**	**100%**

RWLOs can be browsed by subject area or searched for by discipline or author. A description is provided for each RWLO as well as a link to the material that an instructor would need to implement the RWLO. A separate link is provided for any student materials so students can access the required instructions and handouts quickly and easily *(Figure 6)*.

Figure 6. RWLO library contents



EVALUATION

The evaluation of Savvy Cyber Professor was conducted by the Institute for Learning Technologies at Teachers College, Columbia University. As noted, the Pathways project had two overarching goals. The first was to improve the ability of community college faculty to effectively integrate internet-based tools and curriculum resources into their courses. This was to be done through the development and facilitation of the Savvy Cyber Professor (SCP) course, during which each participant would create a real-world learning object that would integrate unique and compelling internet resources. The RWLOs would then be reviewed, revised, and submitted to the RWLO library. The course was to be delivered to four cohorts of faculty from four disciplinary areas over the three years, for a total of 200 participants, and by the end of the project it was expected that the RWLO library would include approximately 200 RWLOs.

The evaluation plan laid out the following measures of impact on the faculty who participated in the SCP course:

- Adaptation of existing or creation of new RWLOs for use in courses;
- Increased use of RWLOs in courses;
- Course redesign to accommodate use of RWLOs;
- Changes in pedagogical practice, (less directed, more inquiry based; less lecture, more exploration) to accompany the effective use of RWLOs;
- A demonstrated understanding of the role of internet resources in the classroom; and
- Increased collaboration and communication among faculty across participating schools and within disciplines in each school.

The second goal was to increase the ability of P-12 teachers to integrate these same resources into their own courses by increasing the percentage of preservice teachers among community college graduates who had themselves used these resources in their community college classes and had observed others using them during service learning. The expectation was that faculty who successfully completed the SCP course would integrate internet-based tools and curriculum resources into their classrooms in ways they had not before, thus providing models for preservice teachers when, at a future date, they themselves would be teaching. A total of 6,960 students were to be affected.

By the end of Cohort 4, 249 faculty from 41 community colleges had participated in the SCP course, 25 percent more participants and 24 percent more community colleges than originally anticipated.

Success in achieving the second objective was thus dependent on the success in achieving the first objective. It was to be measured by

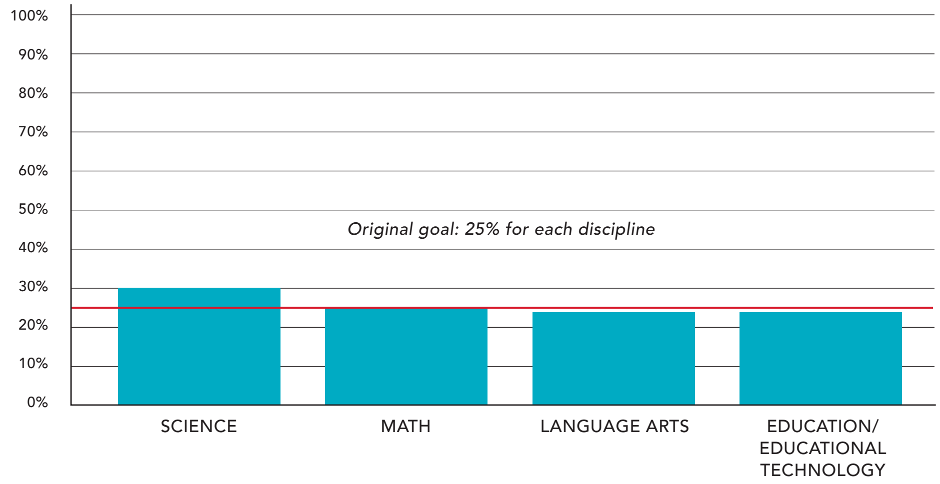
- Increased use of RWLOs in classes taken by preservice teachers.
- Increases in learning through use of RWLOs as measured by embedded assessments.
- A demonstrated understanding of the role of internet resources in the P-12 classroom, as gained through coursework.

The evaluation instruments included precourse, postcourse, and six-month follow-up surveys for all SCP participants, and postcourse surveys for all facilitators, as well as interviews with selected participants and most facilitators.

By the end of Cohort 4, 249 faculty from 41 community colleges had participated in the SCP course, 25 percent more participants and 24 percent more community colleges than originally anticipated. For detailed analysis of all the data in the following sections, see Lowes and Lin 2007.

The goal of having equal numbers of faculty from the four disciplinary areas was more difficult to reach, primarily because in the early cohorts, the participants were recruited locally and tended to come from disciplines the facilitators knew best. By the end of Cohort 4, science predominated, but the other three disciplines were more evenly represented *(Figure 7)*.

Figure 7. Participants by discipline



THE JOURNEY: PARTICIPATING IN THE SAVVY CYBER PROFESSOR COURSE

"The course gives great insight into online instructional design." —Participant

"Excellent opportunity that emphasizes the shift in pedagogy needed to improve learning in present and future students." —Participant

"Good experience and I like having the product at the end. I would do another!" —Participant

Registering for the Savvy Cyber Professor course was the first step on a multistep journey that took the participants through the course's eight sessions, during which they created a real-world learning object and submitted it for external review, received feedback, made changes if asked, resubmitted it for inclusion in the RWLO library, and used it in their own courses.

As the participants embarked on their journey, the course went through its own journey. As the results from each cohort were reviewed, they were translated into modifications and enhancements of both course content and delivery. There was a high attrition rate among Cohort 1/Beta and Cohort 2 participants, and the facilitators and participants all provided detailed feedback, both in surveys and in interviews. This led to extensive revisions in the course as presented to Cohorts 3 and 4. The course was streamlined, the timeframe was adjusted, the RWLO design process was simplified, and a detailed tracking system was created, using Google spreadsheets, so each facilitator could see each participant's progress through the course and the RWLO review process.

In addition, changes were made to the organization of the participants. First, facilitators were made responsible for specific students, generally in their own discipline, and were expected to follow up with them. In fact, following up with individual participants became a major component of each facilitator's work. Second, during the first face-to-face session, each participant was paired with a participant from another institution in the same discipline. This was done not only to address the project goal of increasing collaboration among faculty across schools and within participating institutions, but also to build a sense of obligation that would help keep participants on track to finish. For Cohort 4, this was modified to create two partnerships: a discipline-based partnership for the first half of the course and an institution-based partnership—with partners from the same college—for the second part. As a result, the attrition rate seen in Cohort 2 had been almost entirely eliminated by Cohort 4, when 94 percent of those who started the course finished it *(Figure 8)*.

Figure 8. Finishers as a percent of starters

	COHORT 2	COHORT 3	COHORT 4
TOTAL STARTED	128	45	64
DROPOUTS ALONG THE COURSE	35	7	4
FINISHERS	93	38	60
COMPLETION RATE	**73%**	**84%**	**94%**

LESSONS LEARNED

Each cohort produced a different set of lessons. Perhaps the most important lesson came from Cohort 1/Beta and Cohort 2: The testing process is very time consuming but absolutely essential and should not be rushed. A second lesson learned from the first two cohorts seems obvious but in fact was a casualty of the collaborative course-creation process. It was that an online course needs to be as short and efficient as possible but still cover the necessary material. Lesson three was that in addition to the final goal—in this case, producing a real-world learning object online—an online course needs to have a series of intermediate goals that keep the participants on track. Fourth and finally, interaction among participants needs to be carefully structured, not only online in the discussion forums but also offline, where a great deal of the collaboration took place.

Cohorts 3 and 4, when the project went national, provided other lessons. Having an easily accessible tracking mechanism that is updated regularly by someone other than the facilitators increased the facilitators' ability to follow up with the participants assigned to them. Second, organizing the participants into pairs created an additional opportunity for participants to work together, which many found helpful; however, if the partnerships fell apart, both participants could be lost. Therefore, it was important to limit the timeframe for interactions that needed to occur across geographic distances.

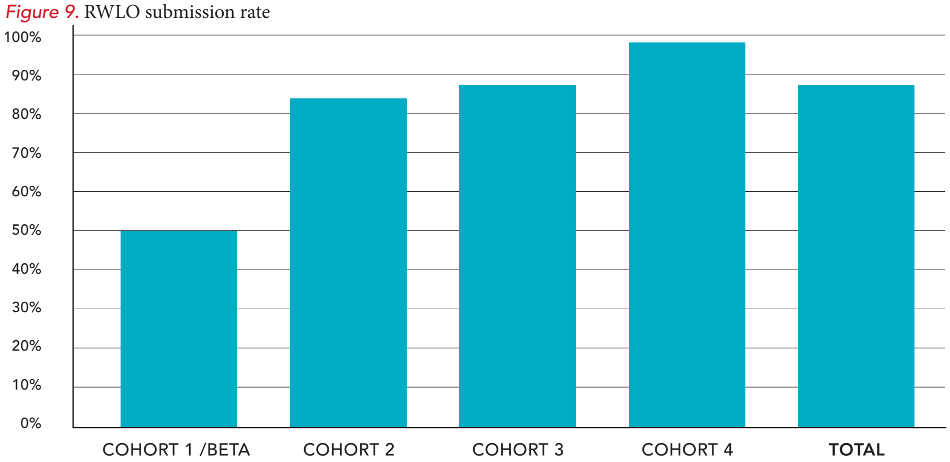
THE JOURNEY: COMPLETING A REAL-WORLD LEARNING OBJECT

> *"I think the RWLO elements (from overview to assessment) included in the web template help instructors make well-organized and thoroughly developed/comprehensive activities."*—Participant
>
> *"I found creating my RWLO quite a challenge although I know I benefited from the experience. Setting up my RWLO made me use those critical thinking skills that we tell our students to use when they are required to do a project. I also had the opportunity to view the RWLOs of my colleagues and watch how theirs evolved. My experience was worthwhile and as a bonus, I can access the RWLO Library which has RWLOs with ideas that are usable."*—Participant

Completing the online sessions of the SCP course was the second step in the participants' journey. The third step was completing a real-world learning object and submitting it for formal review. Here again, attrition was an issue, particularly in the early cohorts. Over the course of the project, not only did the submission rate improve in terms of the percent of those who started the course, but the percent of those who finished and also submitted RWLOs improved as well. By Cohort 4, almost all participants had submitted RWLOs for review *(Figure 9)*.

By Cohort 4, almost all participants had submitted RWLOs for review.

Figure 9. RWLO submission rate



Once submitted, the RWLO was reviewed by faculty from a partner institution different from that of the facilitator. The reviewer either accepted the RWLO immediately or returned it for revision and resubmission. Few RWLOs have been accepted without revision, so this was another point at which attrition might have occurred. The review process as originally designed proved cumbersome and slow, which also reduced the likelihood of resubmission.

Although it was expected that the participants would use their own RWLOs in their classrooms, it was an unexpected finding that about two-thirds of each cohort also reported that they planned to use, with or without modification, RWLOs they had found in the library.

However, after the review process was redesigned to provide speedier feedback, the resubmission rate improved dramatically. By Cohort 3, almost 90 percent of submitted RWLOs were in the library, and it is expected that the rate for Cohort 4, which ended in spring 2007, will be equally good when all of the RWLOs are finished. *(See Figure 10.)*

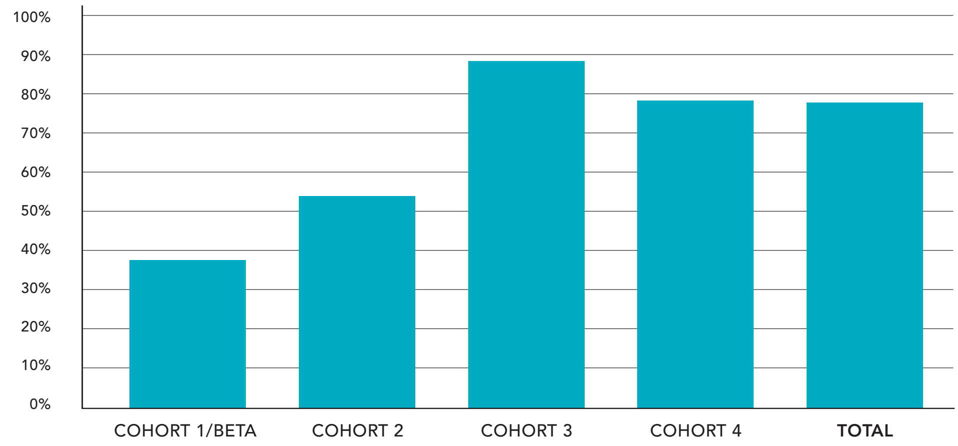


Figure 10. Number of RWLOs accepted

LESSONS LEARNED

Two important lessons were learned about the RWLO-creation phase of the project. First, the RWLO review process, which was designed to assure the quality of the RWLOs in the library, had to be completed as fast as possible or participants would lose their momentum and their RWLOs would never be completed and accepted into the library. Second, although reviewing was a time-consuming process that seemed logical and fair to share among the partners, doing so without setting up a system to ensure inter-rater reliability risked uneven quality of the final product. This was particularly true as additional faculty from the partner institutions were recruited into the project as facilitators and reviewers. In general, faculty who were newer to the project had the highest acceptance rates, while faculty who had been involved with SCP (and its predecessor, *SavvyCyberTeacher*®) were more critical and more likely to send RWLO submissions back for revision.

THE JOURNEY: IMPACT ON CLASSROOM PRACTICE

> *"I will be more conscious of the real-world potential of internet resources. I did not realize that there are some unique aspects of real-time online databases that can make classrooms more interesting and relevant, so that is a good thing. I will in future be alert to apply those possibilities in my courses."* —Participant
>
> *"Taking this class has raised an awareness about internet possibilities that, with time, will influence more and more of what I incorporate into my classes."* —Participant

After creating and revising a real-world learning object, each participant's final step was to use it and any other resources found while participating in the course with students, and particularly with students who were likely to become teachers. Thus, participants modeled for their students the kind of curriculum they could eventually use in their own classrooms. The goal was to reach 6,960 preservice teachers. By the end of the project, participants estimated they had approximately 7,200 preservice teachers in the classes in which they planned to use their RWLOs. If they continued to use their RWLOs in subsequent semesters, the figure would be much higher.

Although it was expected that the participants would use their own RWLOs in their classrooms, it was an unexpected finding that about two-thirds of each cohort also reported that they planned to use, with or without modification, RWLOs they had found in the library. By Cohort 4, the percent planning to use library RWLOs reached almost 75 percent, undoubtedly because by that point there were many more choices in the RWLO library.

The end-of-course survey asked for the participants' intentions, but there was no assurance that these would translate into action. To capture any longer term effects on the participants' classroom practice, and therefore on their students, two follow-up surveys were sent to all those who had completed the course at least six months previously. In general, intentions had translated into practice, with most participants having used their RWLOs in class and assigned them as homework. Those who had not used their RWLOs in class reported that they were no longer teaching the course for which the RWLO had been developed or that they did not have access to adequate technology in their classrooms.

In addition to creating and using RWLOs, another goal of the project was to have faculty use more internet resources in their courses in pedagogically effective ways. Before taking the SCP course, a surprisingly large percentage of the participants were not using the internet with their students except when resources, such as a website accompanying a textbook, were provided. A second unintended consequence of the project was, therefore, to increase

Eighty-two percent of respondents reported that they were using more internet resources in general as a result of the course, some in planning courses, some as assignments in courses, and some for both purposes.

the use of unique and compelling internet resources as much as, if not more than, the use of newly created RWLOs. Eighty-two percent of respondents reported that they were using more internet resources in general as a result of the course, some in planning courses, some as assignments in courses, and some for both purposes. Further, most reported that they had found these during the exploration phases of the SCP course *(Figure 11)*.

Figure 11. Since participating in SCP, are you using more internet resources…

	AFFIRMATIVE RESPONSE
IN PLANNING YOUR COURSES?	65%
IN ASSIGNMENTS TO STUDENTS?	61%
THAT YOU FOUND WHILE TAKING SCP?	66%
THAT YOU FOUND IN OTHER RWLOs?	44%

Those who reported no change in their use of internet resources fell equally into two categories: (1) those who were already using them and (2) those who had not used them in the past and did not change as a result of taking the course. About half of those who did not change taught math or science courses, which rely heavily on textbooks; this may make it more difficult for the faculty who teach them to change past practices.

In response to the open-ended question that asked how participating in SCP had changed their day-to-day classroom activities, many participants focused specifically on how it had enabled them to use internet resources more frequently. They wrote:

- *"I search the internet for ideas constantly now."*
- *"I now see that there is a larger variety of online resources than I at first thought."*
- *"I am more aware of using the internet more frequently and [am] using it in such assignments."*

Another open-ended question asked specifically about how the respondents' out-of-class assignments had changed. These changes also involved increased use of the kinds of internet resources used in the RWLOs, even when they were not using the RWLOs themselves. Their comments were

- *"I look more for real-time or primary sources data."*
- *"I require my students to look more at primary sources."*

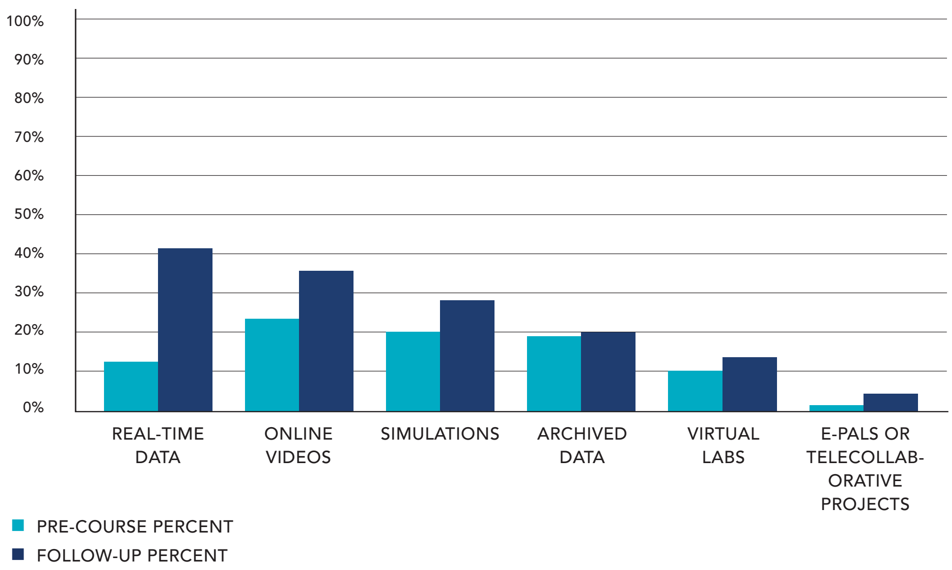
- *“I make them more RWLO oriented.”*

- *“I send students to websites for simulations.”*

- *“[I] use more virtual lab exercises outside the classroom.”*

Although increased use of internet resources represents progress, the goal of the project was to encourage the use of unique and compelling internet resources, defined as those that were unique because they could not be found except on the internet and compelling because they relate to real-world learning. As Figure 12 shows, only a small percentage of participants reported that they had used these types of resources before the SCP course. The percent increased dramatically for the use of real-time data and online videos, and somewhat for the other types of unique and compelling resources *(Figure 12)*.

Figure 12. Percent of participants who reported using unique and compelling internet resources before and after SCP



In response to an open-ended question that asked how using internet resources helped them meet their course objectives, many of the respondents wrote specifically about the benefits of real-world examples in engaging students in learning:

- *“The students love it. They tell me that using the real-time data or real archived data shows them that what we are learning in class is really used by people in the real world. It shows* *them that it isn't just words in a book; it is a real-life thing that affects them and the world around them. It is a very effective tool in my class."*

- *"Real-world scenario, greater student interest, on average."*
- *"Using real-world data allows the students to better connect their world to the classroom."*
- *"They get their hands dirty with real data. This is much better preparation for the real world than using rather sterile data in textbooks."*
- *"I think students appreciate using real-life and real-time data rather than problems from textbooks. It makes the math much more applicable."*

Others wrote that using the internet had helped students take responsibility for their own learning....

The survey did not ask specifically if participants had redesigned courses after participating in SCP, but many wrote about such redesign in their responses to the open-ended question about changes in their day-to-day classroom activities. Some were making major changes as a result of the course, while others were integrating more technology in a general way:

- *"I actively try to find real-time data and real-world simulations to use with lessons. I am trying to convert most of my older paper-and-pencil lab activities to internet-based or real-time-based activities."*
- *"I believe that participating in SCP changed my day-to-day activities by allowing me to create more learning activities by using the internet."*
- *"The project has presented me with excellent contextual modeling of lesson/object integration!"*

Others wrote that using the internet had helped students take responsibility for their own learning, and also emphasized how their expectations had changed:

- *"They are required to take responsibility [for] their education and play an active role in the classroom."*
- *"They learn to be independent thinkers and evaluate validity of website information."*
- *"I extended what I think I can do in class.... It showed me that I can set higher expectations."*
- *"I'm expecting students to navigate their way through online assignments on their own a bit more."*

- *"Students understand that they must do more and take more responsibility for their academic success."*
- *"I expect students to be net-savvy and don't make exceptions, although I'm willing to spend time to bring them up to speed."*

Finally, as noted, one objective of the project was to encourage communication and collaboration among faculty in each participant's own discipline and school. The primary method for doing this was by creating partnerships. For Cohort 3, these were between SCP participants who were in the same disciplines but at different institutions. However, only 41 percent felt they received helpful feedback from these partnerships, compared to 74 percent who felt they had received helpful feedback from faculty in their own schools. As a result, for Cohort 4, the disciplinary partnerships were confined to the first part of the course, after which partnerships between participants who were from different disciplines but at the same institution took their place.

An analysis of the partnerships showed that having a successful partnership was highly correlated with finishing the course. Partnerships were most effective when both partners were engaged and when they worked at the same pace through the RWLO development process. If one partner faded away or fell behind, the other felt stranded and tended to fade away as well. As a result, for Cohort 4, long-distance partnerships were confined to the early parts of the course, after which the on-campus partnerships took precedence. In addition, for Cohort 4, the final session was an online showcase. Although only one participant from each institution was required to attend and present, in most cases all four participants attended, indicating that the on-campus partnerships had encouraged collegiality among participants.

In addition to partnerships, it was hoped that participants would share their RWLOs with other faculty on their campuses. In the follow-up survey, 65 percent reported that they had shared their RWLOs with other faculty at least once, and 40 percent had done so more than once, with another few saying they planned to do so *(Figure 13)*.

An analysis of the partnerships showed that having a successful partnership was highly correlated with finishing the course.

Figure 13. Have you shared any RWLOs with other faculty?

	TOTAL	PERCENT
YES, MORE THAN ONCE	29	40%
YES, ONCE	18	25%
NO, BUT I PLAN TO	3	4%
NO	21	29%
N/R	2	2%
TOTAL	**73**	**100%**

SUSTAINING PATHWAYS EFFORTS

The RWLO Library will continue to be available and accessible by faculty at any educational institution free of charge. Faculty members who have developed RWLOs will be able to update their RWLOs whenever necessary. The Pathways partners continue to promote the RWLO library and related training for how to use and adapt RWLOs to faculty at their own institutions and at national and regional conferences. As a result of faculty interest in using RWLOs without going through the entire development process, a three-hour, face-to-face professional development program was developed to instruct faculty who had not taken Savvy Cyber Professor on how to find and adapt RWLOs from the RWLO library for use in their own classrooms.

Ideas for sustaining the Savvy Cyber Professor professional development program in a fee-based model have been explored at length. Issues that have surfaced to sustain the program include instructor availability, the need for a permanent course management system to house the course material, and the need for an alternate peer-reviewed learning object repository to house the RWLOs since implementing the project-supported peer-review system would require ongoing financial support for peer reviewers.

The Pathways project partners are also considering the development of new K-12 adaptations of course materials that focus on science and mathematics content based on new national educational priorities.

FOR MORE INFORMATION

More information about the Pathways Project can be found at
http://www.stevens.edu/ciese/pathways

The RWLO Library is freely available to all at
http://www.stevens.edu/ciese/pathways/rwlo

More information about the A+ project can be found at
http://www.stevens.edu/ciese/alliance

More information about the *SavvyCyberTeacher*® program can be found at
http://www.stevens.edu/ciese/savvycyberteacher

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