



The Engineering Pathway: Year 2 Update and Accomplishments

The Engineering Pathway is a portal to high-quality teaching and learning resources in engineering, applied science and math, computer science/information technology, and engineering technology and is designed for use by K-12 and university educators and students. The K-12 engineering curriculum uses engineering as a vehicle for the integration of hands-on science and mathematics through real-world designs and applications that inspire the creativity of youth. Users may search over K-12 engineering lessons and activities, as well as other K-12 resources, by many criteria – including content focus area, grade level and educational standards. K-12 community resources include professional development opportunities and research findings. Higher education resources may be discovered by multiple criteria including discipline, audience, resource type, title, author/creator, special topics, pedagogical interventions or by selected collection. Higher education community resources include support for ABET accreditation, research and scholarship, curricula development and extracurricular activities for students. Additional features include outreach information and materials, diversity resources, professional society and career planning information, personalized workspace, disciplinary communities and the ability to contribute and comment on resources. The Engineering Pathway's goal is to provide resources that help teachers, parents, faculty, and practicing engineers to inspire more of today's students to follow an engineering path as their way to understand and improve the world. Accomplishments to date are summarized below.

1. Goal 1: Merge NEEDS and *TeachEngineering* to form the Engineering Pathway

Launched *Engineering Pathway* website for the November 2006 NSDL meeting with both K-12 and Higher Ed community pages. Added K-Gray "broadening participation" pages (engineering recruitment, diversity and professional societies); general "about us; site map; help; "first time users"; search and browse (K-12, Higher Ed, All); login and registration; workspace; expanded cataloging; reviews; primary and secondary ownership of metadata in collections; relations between metadata records; use statistics overall and for each metadata record; monthly themes; single sign-in with NSDL; interoperability with search between EP and NSDL. Upgraded metadata formats, vocabulary and upgraded records.

2. Goal 2: Stewardship and Growth of the K-Gray Engineering Pathway

EP has gone well beyond our goals in the growth of resources, tripling our metadata records. Count to date (7-25-2007): ACM-Women (1,019), *International Journal of Engineering Education* (60), NEEDS (6,064), PAIRS-Service for Broadening Participation in Computing (16), Pr2ove-it (547), *TeachEngineering* (635); Tomorrow's Professor (670) and the VaNTH Engineering Research Center (52). In addition, EP has grown the number of special topics associated with the Engineer 2020 project, ABET accreditation, integrated research and education centers, and GK-12 initiatives. See these special topics in our browse page at: <http://www.engineeringpathway.com/ep/browse/series/>.

3. Goal 3: Align Curricular Materials with Appropriate ABET or K-12 Standards (Community Stewardship)

The K-12 team concurrently explored numerous approaches to find the best way to provide *TeachEngineering* — and EP users — with the science and math educational standards correlations for all TE content for every state. We evaluated numerous standards alignment policies and approaches that included a comparative analysis between CAT, SAT (both CNLP), CIS (JES&Co) and Academic Benchmarks. Implementation of educational standards alignments for all states became a bottleneck because NSDL standards suppliers were not ready with their tools. After much exploration, we concluded

mid-year that our original concept of state-to-state alignment will not yield rich results, e.g., mining curricula for teachers. Thus we decided to do standards correlation via some kind of intermediary, central, rich repository of terms and/or from multiple sources through an importance-flooding approach. Thus, while we made much progress in the educational standards tools analysis and comparison, we re-thought our standards-alignment plan and embarked on a new approach to create an interface such that users can choose the standards alignment tool they want to use (or all tools if they do not care), rather than relying on a single “best” one.

The Higher Ed team added ABET-accredited disciplines to controlled subject list for search, browse and cataloging. Re-cataloged metadata to align with ABET disciplines. Revised system to allow mapping to multiple disciplines and added ABET student learning outcomes. All Higher Ed resources were aligned to student learning outcomes using a hybrid of human experts and computational linguistic algorithms. Ahead of schedule, most of the resources have been aligned.

4. Goal 4: Grow Participation (Community Stewardship)

Formal partnerships with new collections have been developed with: ACM – Women, Center for the Advancement of Scholarship on Engineering Education, National Academy of Engineering, *International Journal of Engineering Education*, National Center for Women in Information Technology, Tomorrow's Professor, Stanford University and PAIRS-Service for Broadening Participation in Computing. Many more partnership agreements are currently underway. We are behind schedule in working with all professional societies. Based on the results from our Fall 2006 evaluation, we decided to complete upgrades to the *EP* site and launch the disciplinary community pages before formally contacting the professional societies. Informal contact has been made with the IEEE to provide them with an initial look at *EP* and to receive informal feedback on MOU opportunities. We plan to complete this goal by the end of Year 2. American Society of Mechanical Engineers (ASME) has agreed to work with us on a prototype and we are currently working on the MOU. We have agreement to ingest some of their resources and use their news feed. They will use *EP* from their K-12 and Higher Ed websites.

In making the *Engineering Pathway* the publication site of choice for K-12 engineering colleges nationwide, we continued to encourage and work with external providers to publish their K-12 engineering curricular content. Collaborated with and/or obtained initial curricular content from the following: Drexel University, Georgia Tech, University of Maine at Orono, University of Colorado at Boulder's Laboratory for Atmospheric and Space Physics (LASP), University of Colorado at Boulder's Network for Earthquake Engineering (NEES), Duke Augmentative and Alternative Communication Rehabilitation Engineering Research Center (RERC), Johns Hopkins, North Carolina State, Michigan Technological University, University of Virginia, San Francisco Exploratorium, WEPAN, Texas A&M, Tufts University, Vanderbilt University and Oregon State University. Expect uploading new content from University of Virginia and Oregon State University this year. Worked with Learn NC, a well-respected, North Carolina standards-based digital library, to make *TeachEngineering/EP* one of their top web picks. Provided a short teachers guide to Learn NC in order to be a featured top web resource in the coming months. Revised the TE and K-12 EP marketing and dissemination plan. Working with ASEE, decided on a broad conceptual marketing commitment for fiscal year 2007-08 focused on rollout of a three-state (Colorado, Massachusetts and North Carolina) and national higher education *TE* campaign, doubling as an opportunity to test, assess and learn in preparation for a national rollout once *TeachEngineering* has standards alignments for all 50 states. Timing targets September 2007 to jive with the beginning of the academic year.

Launched Higher Ed Disciplinary Communities with Associate Editors. There are currently disciplinary communities for each major ABET-accredited computer science and engineering disciplines (29). See: <http://www.engineeringpathway.com/ep/community/index.jhtml>. Working with the NSDL CI, we held a workshop on June 24, 2008 with general ASEE participants and the Associate Editors. For more information see: http://www.engineeringpathway.com/ep/about/ep_asee.jhtml.

5. Goal 5: Develop and Implement a Quality Control / Review Process (Quality Stewardship)

All new *EP* resources are reviewed for quality, using separate criteria for K-12 and Higher Ed. All *EP* resources are checked for bad links twice weekly; those with questionable links are annotated with "link to resource may not be available". We added the ability to search over comments for all resources. The "most commented" and "most downloaded" resources are accessible on the K-12, Higher Ed and disciplinary pages.

As a pilot, the K-12 team is forming a 5-6 person inaugural editorial board of teachers and engineering educators to apply their new review criteria and rubrics. The K-12 team is planning to initiate the "K-12 EP Premier Award" in 2008 by announcing it in June 2008 at the K-12 Division business meeting at the ASEE annual meeting. Nominations will be open to any K-12 resource in *EP* that has been published in *TeachEngineering* as of 12/31/2008 — thus setting the quality standard and requiring that the winning curriculum by default be dynamically aligned to the science and math standards in all 50 states.

The Premier Award Jury met and the Premier Award 2006 was announced and presented at the October 2006 Frontiers in Education conference. The 2006 winner was: "Web-based Center for Automated Testing (Web-CAT)" by Stephen H. Edwards. See: http://www.engineeringpathway.com/ep/learning_resource/summary/?id=6B54F8A4-40CD-46A9-A620-075205BA3662. The 2006 Premier Award reviews for the winner as well as the non-winner nominations have been added to *EP*. All new Higher Ed resources are reviewed through out RSS feed of new resources using established ingestion criteria. Disciplinary Associate Editors have created "Editor's Choice" reviews of their picks for top resources.

6. Goal 6: Create a Nonprofit Strategy and Partnership for Sustainability

Met with the *EP* Advisory Board in June, 2006. The meeting provided a number of suggestions of avenues for sustainability. The second *EP* Advisory Board meeting will be scheduled by the end of Year 2. Continued to work with selected partners for funded support of *EP*. Revised timeline for sustainability plan as our initial investigations showed that the site needed to be more fully developed before credible pilot revenue-generating partnerships could be developed.

7. Goal 7: Core Integration

In November, *Engineering Pathway* "single sign-on" became operational; now anyone with an NSDL login can use it to also log into the *MyWorkspace* at *EP*, add comments or catalog resources. Revised metadata schema based on new NSDL metadata guidelines. Worked with CI evaluation project, including log tracking with Omniture.

In support of a new educational standard alignment approach led by OSU researchers, the K-12 team developed and tested a program to harvest the DLESE AAAS strand maps of STEM learning progressions, with the hope that use of these data improves search results. Worked with NSDL providers on K-12 standards alignment.

Worked with the NSDL-CI to run user workshop at the AAAS Annual Meeting on February 17, 2007 and the ASEE Annual Meeting on June 24, 2007.

8. Goal 8: Dissemination

Complete list of publications, workshops and presentations is at the *EP* publications website.

9. Goal 9: K-Gray Engineering Pathway Evaluation

EP Advisory Board meeting held on June 2006 with a focus on user interface and sustainability strategies. During the Fall 2006 semester, Dr. Nancy Van House from the UC Berkeley I-School conducted a user needs analysis and evaluation of the *EP* website. This thorough review pointed out many areas of improvement in the user interface and functionality. Most of these recommendations have been implemented. Maintained and posted web statistics at: <http://stats.smete.org/full/>.