

SPEED – An ASEE Initiative for A Nationally Recognized Development Program for Engineering Educators

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Abstract – For the past century, many organizations have published visions of what the technological needs will be in the future for the United States and how the engineering profession might change to meet those needs. There has also been a long-standing call to strengthen engineering and technology educators' capabilities and preparation to perform the task of educating students. A recent response to this call is SPEED: Strengthening the Performance of Engineering and Engineering Technology Educators across the Disciplines. SPEED is a concept for a nationally recognized professional development program supported by ASEE for engineering and engineering technology educators. In this paper, the authors describe the rationale behind the SPEED program, review related international activities, discuss opportunities and challenges for such programs in the United States, and explain SPEED's potential. The authors explicitly wish to use this paper as a platform to initiate a dialogue within ASEE about the SPEED concept.

Keywords: SPEED, Professional Development, Engineering, Engineering Technology, Teaching and Learning, Education.

THE NEED FOR SPEED

The ASEE SPEED program will uniquely provide a national framework for recognition of engineering and engineering technology instructional competence and excellence. Further, the ASEE SPEED program will serve as a

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vehicle enabling engineering and engineering technology educators to voluntarily and continuously strengthen the quality of teaching and learning in their classrooms.

Few would disagree with the idea that educating the next generation of leaders in both academia and industry is at the heart of what higher education is all about. This requires identifying the technological needs for the future, developing curricula with corresponding content, and delivering this content to many different types of learners in a variety of different formats.

While many faculty are dedicated to becoming outstanding educators, the general assumption is that holding a PhD in a core technical area is sufficient to be qualified as an academic educator. This no longer holds true (and maybe never did). The educator of the future needs to be able to teach in a number of different educational settings (in-class teaching, globally distributed distance education, virtual learning environments, synchronous and asynchronous delivery, etc.), and will have students from all walks of life, generations, countries and continents, cultural backgrounds, and so on. Class sizes will range from individual supervision to small groups, up to large groups of probably hundreds of learners. As more and more IT-enabled learning environments and educational tools emerge, new forms of instructional technologies, related pedagogical approaches to improve student learning, as well as associated assessment methods are to be developed. So who is going to educate and prepare the next generation of educators? While it is obvious that becoming a professional educator of the future and obtaining the relevant competencies and skills requires at least a minimum amount of formal qualification, training and experience, current practice does not sufficiently address this need.

For the past century many organizations have published their visions of what the technological needs will be in the future for the United States and how the engineering profession might change to meet those needs. The Engineer of 2020 [1], released by the National Academy of Engineering in 2004, is one example of such a vision. In response to these calls, engineering and technology departments have a long history of adapting to changing societal needs so that their graduates will possess relevant skills and knowledge vital to potential employers. From an educational perspective, this involves the development of new pedagogical approaches, the design of tailored programs and courses, novel ways to deliver them, etc.

In parallel with the changing engineering and technology curriculum, there has also been a long-standing call to strengthen engineering and technology educators' capabilities and preparation to perform the task of educating students. This latter call, however, has remained virtually unanswered for more than a century.

It is time for US engineering and technology programs to act on this need and to extend faculty expertise with formalized professional development in education [2, 3].

Despite the facts that today's faculty face intense requirements for research productivity many schools are now moving into this direction. It is through ASEE initiatives such as CCSSIEE (Creating a Culture for Scholarly and Systematic Innovation in Engineering Education) [4] and SPEED (Strengthening the Performance of Engineering and Engineering Technology Educators across the Disciplines) [5] that both faculty and academic leadership on a broader scale have started to realize the positive impacts that formal education-related preparation may have on their overall performance as researchers and educators.

ORIGINS OF THE SPEED MODEL: PROFESSIONAL FACULTY DEVELOPMENT AND RECOGNITION ACROSS THE WORLD

Around the world, several programs to support professional qualification, development and/or recognition for those teaching in Higher Education are known. They vary considerably in scope, administration and reputation. However, the literature in this area is incomplete so some of the information provided here is based on personal experience and informal conference and workshop discussions.

An analysis of existing models reveals the following programmatic elements to guide comparison:

- *Who is the governing association or body for the professional development program?* – These may be state entities, national or international societies, associations or academies, institutions, etc.
- *Who is responsible for professional development program enforcement?* – Enforcement may occur through accrediting agencies, state agencies, institutions, associations or academies, etc.

- *How is the professional development program implemented at the national level?* – The program may be nation wide, international, or locally controlled.
- *How is the professional development program implemented at the local level?* – Internal or external personnel may coordinate, deliver, and document professional development activities. Mentors may or may not be used or required.
- *How is the professional development program included in accreditation?* – Accreditation may require teaching certification for all or some faculty, documentation of professional development activities, or other teaching related items.
- *Is participation compulsory or voluntarily?* – Participation requirements vary widely.
- *Who is/are the target group(s)?* – While some countries focus on professional development for junior faculty, others address all those teaching in technical, engineering-related domains.
- *What is the professional development program duration?* – There may be multiple sequential levels of professional development activities and/or achievement, and programs vary from short courses to continuous development.
- *What is the professional development program content?* – Cultural expectations regarding teaching and learning can heavily influence the content of the professional development activities.
- *How are qualifications recognized and/or rewarded?* – Relationships between tenure/promotion and professional development vary from non-existent to tightly coupled.

Clearly criteria, standards, and policy regarding professional qualification for teaching in higher education are unique to each nation's needs, interests, and cultural expectations. Initial training of university teachers has been established in every university in the United Kingdom, Norway and Sri Lanka and, as alluded to before, is becoming increasingly common in many other countries [6]. From beginning as small in scale, low in credibility and poorly supported, substantial training of 120-500 hours duration is now well embedded in many institutions across multiple nations, is often compulsory and is sometimes linked to probation or tenure. Major programs include a coherent series of meetings and various learning activities spread over a period of 4-18 months, usually with elements of both formative and summative assessment. Many of these programs are so-called postgraduate certificate courses subject to formal academic approval and quality assurance, which in addition lead to nationwide professional registration.

Significant progress with regard to professional qualification, development, and recognition of engineering educators has been made in the UK [7-11]. At some institutions, every new tenure-track hire has to participate in and successfully complete a compulsory 30 credit hour accredited training program in Teaching and Learning in Higher Education to pass probation and earn tenure. Successful completion also leads to certification and professional registration, and hence nationwide recognition based on common standards.

While the UK system mainly targets those teaching at university level, within the European Union the focus is on all those involved with teaching technical, engineering-related subjects. The International Society of Engineering Education (IGIP) [12] at their headquarters in Austria have created a training program open to all "teaching teachers". Participation is voluntarily and often used as a means of continuous professional development to support career development. Successful completion of their program leads to professional registration as ING-PAED IGPP (International Professional Engineering Educator).

IGIP, together with SEFI, the European Society of Engineering Education [13] (the equivalent of ASEE in the US) represent the largest network of higher education engineering institutions and of individuals involved in engineering education in Europe. It promotes information exchange about current developments in the field of engineering education between teachers, researchers and students in the various European countries.

While both the British and the Austrian/International programs are accredited, other countries have just embarked on the avenue of professional educational training. In Australia, for example, a number of efforts have been initiated at the federal level to ostensibly track and improve teaching quality. However, some claim these efforts are based on

criteria that do not have the strength to make real changes in the quality of teaching occurring in engineering [14]. However, there are individual institutions whose engineering programs have made first moves towards more formal requirements regarding teaching quality [15].

As yet, little is known about corresponding developments in Asia. Sources from Japan report on the development of a ranking scheme that links salary of faculty to practical experience of an educator in their chosen field [16].

With regard to lessons learned, Gibbs and Coffey [6] investigated the effectiveness of university teachers' training involving 20 universities in 8 countries. In their study they showed evidence of a positive impact on teachers and on students' ratings of their teachers, when compared with a control group (that did not change or got worse over the same period). A group of teachers in training and their students were studied at the start of their training and one year later. A control group of new teachers (who had received no training) and their students were studied in the same way. Evidence was reported for changes over time relating to three measures: (i) student ratings of their teachers; (ii) the extent to which teachers described themselves as teacher-focused and/or student-focused in their approach to teaching; and (iii) the extent to which these teachers' students took a surface approach and/or a deep approach to learning.

In a detailed study of a training program designed explicitly to change teachers' conceptions of teaching, Ho et al. [17] demonstrated the following chain of influence: training goals and training processes → teachers' approaches to the teaching and learning environment → their students' approaches to learning. This is important since conceptions of education (and misconceptions as well) tend to drive educational approaches, which in turn influence how students study and, ultimately, what types of learning outcomes are achieved.

Based on both statistical evidence (such as that alluded to in the studies above) as well as a substantial amount of informal and anecdotal evidence, the success of professional development programs in the educational sector has encouraged more and more countries across the world to begin to implement various types of programs. There is also a growing demand for professional certification and registration in the educational sector. Long-term, this might have a significant impact on faculty recruitment, promotion and tenure, salary development, and from an institutional perspective accreditation and fund raising. While these statements appear to hold true in general, there does not appear to be any single "best option" to be implemented within the US in the short term considering the current cultural and societal context.

For a more detailed discussions of the above-mentioned models as well as an overview of education-related faculty development initiatives in the US such as ASCE's ExCEED, CIRTL's STEMES, and others please refer to [18].

CHALLENGES AND OPPORTUNITIES IN PROFESSIONAL EDUCATION-RELATED FACULTY DEVELOPMENT IN THE US

Utschig and Schaefer have outlined important opportunities and challenges relating to formal education-related faculty development on a large scale [19]. Questions explored are: What major opportunities exist regarding moving towards educational professional qualification for US Higher Education institutions, their faculty and students, industry, and society as a whole? How can resources be synergistically integrated to support such an effort? What are the major challenges or barriers present that must be overcome in order to create such a system? In response to these questions, they present a concept map to explore how faculty educational development could support and greatly enhance an entire system revolving around faculty development in teaching and learning. Utilizing and reflecting upon the literature, major issues considered that relate to the questions above include various roles in the higher education engineering community; relationships between educational research, student learning outcomes, and engineering faculty; resources supporting engineering education, and the implication of different faculty reward structures. Analysis indicates that pieces already in place offer great potential to create the Engineering Education of 2020 for "The Engineer of 2020" if key barriers are addressed.

An at a glance overview of the challenges and opportunities identified and thoroughly discussed in [19] is presented below:

TABLE I (SOURCE: [19])

OPPORTUNITIES AND CHALLENGES REGARDING IMPLEMENTATION OF FORMAL EDUCATION-RELATED FACULTY DEVELOPMENT ON A LARGE SCALE

	Opportunities	Challenges
Roles	<ul style="list-style-type: none"> To provide clarity of purpose for all in educating our students (society). To make the various roles of professional educators transparent to key stakeholders of the university system (students, parents, industrial partners). Have a multi-level structure of professional educators who teach in engineering disciplines (higher education, vocational training, short courses for continuous professional development, etc.). For high-level associations (NAE, ASEE, ABET, NSF, etc.) to help define minimum content of professional development programs and accredit such programs. Capitalize on admin heavy participation in leadership of national organizations like NAE, ASEE... to effect change. Departments – chairs have opportunity to guide outcomes. For institutions/department to certify individuals completing professional training programs. 	<ul style="list-style-type: none"> As of today, there is no formal qualification needed to teach in Higher Education. PhD in core technical area does not necessarily mean professor is qualified to be an effective educator. There is no professional recognition for educators. Institutions – retain independence in light of pressures from national organization such as NAE, ASEE, NSF, etc. Leading change for all in the face of traditional faculty autonomy ... Additional requirements and classifications based on demonstrated teaching knowledge/skills/ability. Disconnects between different needs for different roles.
Rewards	<ul style="list-style-type: none"> Formal recognition and certification for individual educators (faculty) after successful completion of a program (equivalent to P.E. in Engineering Education). “Excellence in Learning and Teaching” recognition and certification for institutions/departments with a certain minimum percentage of professionally trained educators. Alignment of formal faculty recognition with institutional missions. Preferred consideration/eligibility regarding grant applications (funds for learning and teaching related research and development projects) for certified institutions/departments. Better education for students taught by formally qualified and certified educators. Faculty freedom to embark on different or additional research area: scholarly Engineering Education related research. Additional flexibility in presenting P&T portfolio contents Increase of revenue for certified institutions/departments by offering professional educational programs at various levels of certification to other departments and/or external participants. Influence/power: certified institutions/departments/individuals may be asked to serve on high-level committees or task-forces charged with shaping the future of engineering education. Long-term, the number or percentage of professionally trained educators may play a role in accreditation. 	<ul style="list-style-type: none"> National interest in and awareness of professional Engineering Education needs to be raised significantly. Change of perception: traditional engineering faculty needs to be persuaded that Engineering Education as a research area is valuable and important in any branch of engineering. High-level associations, such as National Academy of Engineering, ABET, ASEE, ASME, IEEE, etc. need to buy into professional development programs and convey to engineering institutions and departments that they are expected to move toward that direction. Raise competition for and value of rewards giving recognition for excellence in teaching and learning. Setting up a national committee to oversee formal recognition and certification process. Get industry support/buy in.
Resources	<ul style="list-style-type: none"> Interdisciplinary research synergy leading to additional grant opportunities. Current engineering education community can take on the responsibility to lead this field of professional development. Established teaching and learning centers with engineering expertise may use their resources (faculty, staff, and facilities) to offer programs to other departments and external academic 	<ul style="list-style-type: none"> Administration of professional development programs across all levels (national, state-wide, institutional, departmental). Significant seed funding is needed to develop, administer and establish programs, publish materials, advertise etc. Increasing funds (internal and external) for teaching facilities and equipment. Providing time for faculty to take part in such programs. Enhancing data demonstrating impact of faculty development in this area: ex; Flagship pilot programs targeting various levels of certification are needed to demonstrate usefulness and impact.

	<i>units or participants.</i>	
Relationships	<ul style="list-style-type: none"> • <i>Cross-disciplinary research between faculty from engineering and education leading to joint scholarly publications and research grants.</i> • <i>Funding agencies can further emphasize relevance of educational components to their programs.</i> • <i>Closer collaboration between high-level associations to jointly shape the future of Engineering Education at a national level.</i> • <i>Elevate public image and occupational status of engineering educators.</i> • <i>Raise students' and parents' confidence in education offered at higher education institutions.</i> • <i>High-level associations can work together toward a common goal.</i> • <i>More frequent and active participation in international Engineering Education community to compare US standards to European and Asian standards in order to become leaders on a global scale.</i> 	<ul style="list-style-type: none"> • <i>Institutions and departments do not have sufficient personal able to foster such developments.</i> • <i>Overcome fear of making teaching and learning a public exercise rather than autonomous activity.</i> • <i>Convey to public all the roles of an educator. They need to understand that it means much more than the traditional teaching at school as practiced decades ago.</i> • <i>Agree on how to evaluate performance on common scales and utilizing all stakeholders.</i>

Fortunately, current conditions in the US, as outlined in Table I, display more opportunities than challenges. This indicates great potential for moving forward, as we are doing with the current SPEED initiative. Fostering and growing relationships among the various constituents in the engineering education community, along with delivering rewards that match the language in mission statements and professional expectations for promotion and tenure, are certainly possible under current conditions. However, the challenges (though relatively smaller in number) still represent significant barriers. Resources, both in funding and human capital, will always be insufficient unless a clear shift in roles occurs such that professional development and faculty performance in engineering education philosophically become clear competitors with research. Currently, there is no infrastructure in place to support a philosophical shift in how faculty, departmental, and institutional roles can leverage widespread implementation of faculty development as educators in engineering. Nonetheless, overcoming these barriers is essential. Without doing so it will be virtually impossible to offer an Engineering Education of 2020 that achieves the learning outcomes desired for The Engineer of 2020.

SPEED IN A NUTSHELL

At the beginning of this paper the need and rationale for professional faculty development and recognition programs in the US is presented. This is followed by an overview of potential opportunities and challenges. The next step is to present an overview of one initiative aimed at creating a professional faculty development and recognition program for the US: SPEED – *Strengthening the Performance of Engineering and Engineering Technology Educators across the Disciplines*.

The Vision of SPEED

The ASEE SPEED program will uniquely provide a national framework for recognition of engineering and engineering technology instructional competence and excellence. Further, the ASEE SPEED program will serve as a vehicle enabling engineering and engineering technology educators to voluntarily and continuously strengthen the quality of teaching and learning in their classrooms. SPEED will be a recognized national program embraced by a variety of institutions and rooted in the extensive recent work of the ASEE led Creating a Culture for Scholarly and Systematic Innovation in Engineering Education (CCSSIEE) project [4] and complementing the goals and activities of the NSF funded and graduate student oriented Center for the Integration of Research, Teaching and Learning (CIRTL). SPEED is a transformational, career spanning professional development program which will produce a cadre of highly capable engineering and engineering technology educators to train The Engineer of 2020 and beyond. Further, it will effectively guide engineering and engineering technology educators across the boundaries represented in Barr and Tagg's paradigm shift from teaching-centered instruction to learning-centered instruction [20]. The central goal of the ASEE SPEED program is to positively and significantly impact the quality of engineering education across all engineering and engineering technology disciplines through faculty development.

Intended Outcomes of SPEED

The specific intended outcomes designed to achieve this goal will produce both significant intellectual merit and truly broad impact. The intended outcomes are: (1) create and validate a set of measurable performance criteria for three levels of educator performance (2) strengthen and expand relevant communities of practice (3) catalyze a provider network for SPEED program content (4) add continuously evolving value to engineering and engineering technology educational practice (5) develop operational details for management of SPEED within ASEE.

Accordingly, the following results are expected to come out of the SPEED initiative:

- Agreement about what engineering and engineering technology educators should know.
- Set of performance criteria built with community input.
- Framework for a national discussion for a set of metrics to measure performance.
- Set of designed SPEED content delivery mechanisms to enhance performance of participants.
- Group of possible SPEED content providers who have participated in the SPEED planning process.

As a result of the ASEE SPEED program, the engineering and engineering technology education community (and STEM education community by extension) will have available a set of tools for development of instructional expertise; a community consisting of program leaders, providers, participants, and informed stakeholders; a program management infrastructure supported through ASEE including web, print, and institutional knowledge; and a broad national visibility supported by significant dissemination efforts reaching both targeted and general audiences.

Intellectual Merit and Broader Impacts of SPEED

SPEED is an initiative to significantly advance the current state of faculty development by providing several critical elements that are currently lacking in the patchwork of existing efforts. Specifically, the project seeks to build consensus for a coherent and nationally visible framework for professional development consisting of accepted performance criteria and metrics for engineering educators. These critical but currently missing elements are provided through the significant community building elements of the project and through housing the framework under the auspices of ASEE. Further, the program design itself will lead to significant new knowledge regarding engineering education due to the constructive alignment of the intended outcomes, data collection, assessment and evaluation procedures, and research. Key questions addressed within the context of SPEED are:

1. How and to what extent do elements of the SPEED program encourage faculty participation?
2. What is the pedagogical content and educational scholarship that engineering and engineering technology faculty could benefit from learning?
3. What are the performance criteria (and expectations for performance at various levels) of various constituents of the SPEED program?
4. What are appropriate means for assessment of these performance criteria and where is there a need for the development of new assessment tools and approaches?

Ancillary benefits of the SPEED program are improved/more efficient teaching and learning, increases in retention for underrepresented groups, and the fact that the program casts a wide net utilizing the national and well known ASEE with programming designed for all types of institutions involved in engineering and engineering technology education. And finally,

- Participants will be poised to be more competitive for educational-related grants (such as through NSF).
- Participants will be enabled for more effective and efficient activity in and outside the classroom, leaving significant additional time for other pursuits including technical research.
- Better education for students taught by formally qualified and certified educators will result in
 - higher retention rates,
 - better trained students and
 - more satisfied employers.
- Faculty will better able to pursue interdisciplinary collaboration through greater appreciation and respect for the educational aspects of colleagues work,
- National public recognition of professional engineering educators will positively impact perceptions of the engineering community.

SPEED and the ASEE Community

The SPEED program, when implemented as a national model, will be a transformative program. Engineering and Technology faculty members will be able to engage in a more comprehensive design of their courses, from materials used to pedagogy employed. They will be better equipped to use information already available in the educational arena. It is likely that there will be more requests for funding on educational projects. The scholarship of teaching will be held in a higher esteem by these faculty who go through a SPEED program [21,22,23,24]. None of this will happen, however, without having the proper buy-in and commitment from the various constituencies that such a transformation will affect.

The major constituencies impacted by the SPEED program will be students, faculty, administrators and industry. All of these constituencies have both unique and overlapping goals. Accordingly, our strategy is to engage them directly, with both general approaches and more specific interactions.

Engagement of students in SPEED will occur through student committees of the technical organizations, such as AIChE, ASME, IEEE, etc. Specific information will be disseminated to these groups, who will then provide this information to local student chapters on campus. In particular, we will share the literature on educational reform in engineering and the benefits to students when faculty are trained in appropriate pedagogy. We will lay out the details on the objectives of program and what faculty will be trained to do once they have achieved the various SPEED levels. We will ask for feedback from those national student organizations as well as provide a means for students to feedback information through a website. In particular, we will be interested in whether we have missed a consensus or universal concern of the student constituency and, if so, we will attempt to incorporate this into the SPEED program.

Faculty engagement and administrative engagement on SPEED has already begun. The 2009 ASEE Annual Conference and Exposition included a paper introducing the SPEED program to the general ASEE community [5]. Refinement of the SPEED program will be presented at the 2010 ASEE Annual Conference as well as at the ASEE-SE Sectional Conference. Liaisons have already been identified from important groups such as the Engineering Deans Council and Engineering Technology Council specifically directed to the SPEED activity. Invited speakers are already being gathered to present at a mini-plenary session at the 2010 ASEE Annual Conference, and a special SPEED Advisory Council is already in place which represents some of the most respected minds in engineering education.

Proposed SPEED Conceptual Design and Validation Pilot Activities

This initial portion of the SPEED project pilot development effort has been designed and will run for four years. Early activities include (a) identifying the items comprising the core competencies and outcomes of faculty for three separate levels of the SPEED program, (b) conducting focus groups at two partner sites (University of Michigan and Georgia Tech-Savannah) to solicit feedback about the SPEED Level 1 program, (c) designing a SPEED Level 1 program based on the feedback, and (d) engaging various constituencies in the process while establishing community buy-in. Mid-term activities include pilot testing the SPEED Level 1 program at the two partner sites, continuing to engage the broad community and solicit feedback, and fully implementing the SPEED Level 1 program at the two partner sites. Activities at the end of the project include expanding the network of national SPEED Content Providers and conducting a national implementation of the SPEED Level 1 Program at multiple locations. Throughout the entire project, the SPEED team will continue to engage with relevant constituencies to disseminate our findings and report our work to the broad academic community while seeking constructive feedback on the program.

These SPEED development and implementation activities are described in additional detail in Table II. This description includes who is leading the various program efforts and **highlighted** mechanisms for others to get involved (via feedback and/or participation).

TABLE II
SPEED ACTIVITIES

Activity	Purpose	Description
<p>Community building</p> <p>Led by Don Visco, Michael Prince, Norman Fortenberry, JP Mohsen</p>	<p>Solicit candidate <i>content</i> (what faculty should know), <i>performance criteria</i> (what faculty should be able to do), and possible <i>metrics</i> with three corresponding levels</p>	<p>Engage the community by attending ASEE national and sectional meetings and holding workshops and special sessions. Conduct surveys and focus groups (within and outside ASEE consisting of key constituents such as: Engineering Deans Council, Engineering Technology Council, industry, student groups, potential providers, and potential participants). Create a program website with feedback mechanisms.</p>
<p>SPEED Design and Feedback Summits</p> <p>Led by Cynthia Finelli, Dirk Schaefer, and Tris Utschig</p>	<p>Build consensus on SPEED pedagogy and delivery options based on <i>content</i> and <i>performance criteria</i> choices for each of three levels</p>	<p>Develop core competencies and outcomes for 3 levels of recognition Hold focus groups with key constituents at two partner sites, followed by focus groups at the national ASEE meeting, which include potential SPEED Content Providers drawn from an array of provider types (academic, non-academic, regional, national, in-person, virtual, etc.).</p>
<p>SPEED workshop implementations</p> <p>Led by Cynthia Finelli, Dirk Schaefer, and Tris Utschig</p>	<p>Explore and pilot selected pedagogy and delivery options for SPEED Level 1 workshops; conduct national delivery of SPEED Level 1 workshop</p>	<p>Pilot test the SPEED Level 1 Program at the two partner sites (University of Michigan and Georgia Tech – Savannah). Deliver SPEED Level 1 Program at two partner sites. Later implement national delivery of SPEED Level 1 Program, utilizing broad network of SPEED Content Providers.</p>
<p>SPEED Provider Network formalization</p> <p>Led by Michael Prince, Don Visco, Tris Utschig, and ASEE personnel</p>	<p>Develop regional and national delivery outlets for various elements of the SPEED Level 1 Program.</p>	<p>Work with a subset of SPEED Feedback Summit attendees and a broad range of potential providers for national implementation of SPEED Level 1. Invite representative group of future participants (to react to design, demonstrate that their ideas are valued, and show that we will be capable of meeting their needs). Engage in preliminary work for implementation of SPEED Levels 2 and 3.</p>
<p>Documenting results</p> <p>Led by Tris Utschig and ASEE personnel</p>	<p>Determine whether deliverables have been met and collect data for evaluation questions</p>	<p>Document results in real time. Work with external evaluators. Publicly share the resulting knowledge.</p>

CLOSURE AND CALL TO ACTION

The potential educational and societal impact of SPEED is significant. Not only might the SPEED program impact the practice of engineering education, but it may also connect participants across multiple contexts. For example, participants may be better able to pursue interdisciplinary collaboration through connections developed in the SPEED program both within and across disciplines. Finally, SPEED may positively impact public perceptions of engineering education through high quality learning produced in participant classrooms and clear recognition of SPEED participant qualifications as professional engineering educators. The authors explicitly wish to use this paper as a platform to initiate a dialogue within ASEE about the SPEED concept.

REFERENCES

- [1] National Academy of Engineering, *The Engineer of 2020: Visions of Engineering in the New Century*, National Academy Press, 2004, ISBN 0309091624, 118 pages.
- [2] J.P. Mohsen, "GUEST EDITORIAL – SPEED: A Concept for Enhancing the Quality of Engineering Education," *Journal of STEM Education*, Vol.10, No. 1, 2009, pg. 5-6.
- [3] J.P. Mohsen, "PRESIDENT'S LETTER – Professional Development Is Key" *PRISM*, ASEE, Sept. 2009.
- [4] ASEE, *Creating a Culture for Scholarly and Systematic Innovation in Engineering Education – Phase 1 Report*, ASEE, Washington, DC, 2009, ISBN 9780878232031, 33pages.

- [5] Melsa, J.L., Mohsen, J.P., Schaefer, D., Utschig, T.T, and D.P. Visco, "Strengthening the Performance of Engineering and Technology Educators Across the Disciplines (SPEED)" *2009 ASEE Annual Conference & Exposition*, Austin, Texas, June 14-17, 2009, paper# AC2009-2538.
- [6] Gibbs, G. and M. Coffey, "The impact of training of university teachers on their teaching skills, their approach to teaching and the approach to learning of their students." *Active Learning in Higher Education*, 2004, 5(1), pg. 87-100.
- [7] CLTRHE, "Postgraduate Certificate in Learning and Teaching in Higher Education – Course Handbook," *Centre for Learning, Teaching and Research in Higher Education*, Durham University, UK, 2004.
- [8] CLTRHE, "Postgraduate Certificate in Learning and Teaching in Higher Education – EDUC40115 Foundations of Learning and Teaching – Module Guide," *Centre for Learning, Teaching and Research in Higher Education*, Durham University, UK, 2004.
- [9] CLTRHE, "Postgraduate Certificate in Learning and Teaching in Higher Education – EDUC40215 Scholarship of Learning and Teaching – Module Guide," *Centre for Learning, Teaching and Research in Higher Education*, Durham University, UK, 2005.
- [10] CLTRHE, "Postgraduate Certificate in Learning and Teaching in Higher Education – EDUC41030 Reflection on Learning and Teaching: Portfolio – Module Guide" *Centre for Learning, Teaching and Research in Higher Education*, Durham University, UK, 2005.
- [11] The Higher Education Academy, U.K. [cited 2008 January]; Available from: <http://www.heacademy.ac.uk/>.
- [12] The International Society for Engineering Education. [cited 2008 January]; Available from: <http://www.igip.info/>.
- [13] The European Society for Engineering Education. [cited 2008 January]; Available from: <http://www.sefi.be/>.
- [14] D.H. Cropley, "A Case for Compulsory Teaching Accreditation of Engineering Faculty". *IEEE Transactions on Education*, 2003.
- [15] M.G. Zadnik, M.G. et al., "A Teaching Quality Improvement Process: Implementing Change Using an Holistic Approach", *Higher Education Research and Development Society of Australasia Annual Conference*. Miri, Sarawak, 2004.
- [16] Yoshida, M., *JSEE_UT-SoE*. 2007.
- [17] Ho, A., D. Watkins, and M. Kelly, "The Conceptual Change Approach to Improving Teaching and Learning: An Evaluation of a Hong Kong Staff Development Program", *Higher Education*, 2001. 42: pg. 143-169.
- [18] Schaefer, D. and T.T. Utschig, "A Review of Professional Qualifications, Development, and Recognition of Faculty Teaching in Higher Education around the World" *2008 ASEE Annual Conference & Exposition*, Pittsburgh, Pennsylvania, 2008.
- [19] Utschig, T.T. and D. Schaefer, "Opportunities and Challenges in Professional Education-related Faculty Development in the US" *Frontiers in Education*, Saratoga Springs, New York, 2008.
- [20] Barr, R. B. and J. Tagg, "From Teaching to Learning: A New Paradigm for Higher Education." *Change* 27(6), 1995
- [21] Huber, M.T. and P. Hutchings, *The Advancement of Learning: Building the Teaching Commons*, San Francisco: Jossey-Bass, 2005.
- [22] Ciccone, A. and R. Myers, "Problematizing SoTL Impact," *ISSOTL Conference*, University of Wisconsin-Milwaukee, 2006.
- [23] K.A. O'Meara, *Rewarding Faculty Professional Service*, Boston: New England Resource Center for Higher Education, 1997.
- [24] K.A. O'Meara, "Encouraging Multiple Forms of Scholarship in Faculty Reward Systems: Does It Make a Difference?" *Research in Higher Education*, Vol. 46, 2005, pg. 479-510.

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