

The following is taken from Kacey Beddoes, Maura Borrego, and Brent K. Jesiek, "Identifying Opportunities for Multinational Collaborations in Engineering Education Research." Presented at REES 2009 in Queensland, Australia. Full paper can be downloaded here:

http://rees2009.pbworks.com/f/rees2009_submission_30.pdf

e-Learning: Current Approaches and Future Opportunities

The following is based on an in-depth bibliometric study of English-language engineering education journal articles and conference papers published 2005-2008 in: *Australasian Journal of Engineering Education*, *European Journal of Engineering Education*, *International Journal of Engineering Education*, and *Journal of Engineering Education* (non-U.S. authors only), *Proceedings of the Australasian Association for Engineering Education Annual Conference*, *Proceedings of the ASEE Global Colloquium on Engineering Education*, and *Proceedings of the European Society for Engineering Education (SEFI) Annual Meeting*. The database includes more than 800 empirically grounded publications from 54 countries.

Of 885 publications in our engineering education research database, 118 were related to e-learning. Information about the countries represented in the database is summarized in Table 1.

Table 1: Individual Country Counts and Multinational Collaboration Counts

<i>Country</i>	<i>No. of articles*</i>	<i>Collaborating countries</i>	<i>No. of articles</i>
Australia	36	US + Taiwan	4
US	34	Australia + UK	1
The Netherlands	7	New Zealand + Canada + Taiwan	1
New Zealand	7	New Zealand + UK + US	1
UK	7	Sweden + US	1
Spain	6	UK + US	1
Sweden	4	US + China	1
Taiwan	4	US + France	1
Canada	3		
Germany, Hong Kong, Hungary, and Japan	2 each		
Brazil, Denmark, Finland, Israel, Italy, Latvia, Mexico, Norway, and Turkey	1 each		
* including multinational collaborations			

Also, as summarized in Table 1, only 11 of the 118 publications (or 9.3%) involved multinational collaborations. Multinational collaborations are most often the result of researchers working with colleagues at institutions where they formerly worked or studied. We suggest, therefore, that there is much potential for promoting cross-national collaboration given the large number of researchers interested in this topic.

We coded each paper based upon the primary approach(es) that the authors took. The approaches and the number of papers in which they appeared are summarized in Table 2. By far the most common type of research involved the description and assessment of an initiative undertaken by

the authors. Examples include wikis, games, video conferencing, online courses and labs. This approach was broken down into more specific categories that are represented by the first, second, and sixth rows in Table 2. The next most common type of approach was to compare online and in-person learning gains and/or preferences. There were also researchers who were concerned specifically with strategies for assessing online learning, and many also discussed modes or frameworks for improving assessment. Also important for this discussion are the eight articles that took some general aspect of learning or a learning theory as their starting point, and investigated online learning specifically in relation to that theory. Examples include one article that investigated the relationship between different learning styles and e-learning and another article that was concerned with how communities of practice develop with e-learning.

Table 2: Frequency of approaches to distance education

<i>Approach</i>	<i>No. of articles*</i>
describe and assess online learning and testing tools	77
describe and assess virtual lab	21
compare distance and in-person student learning and preferences	13
present mode/framework for assessment of online learning	11
study theory or learning more broadly (in distance ed context)	11
describe and assess learning with mobile devices	8
encourage faculty to use online learning effectively	7
present negative aspects or challenges of online learning	6

* total higher than 118 because some papers were coded into multiple categories

Our analysis reveals that research on e-learning has tended to emphasize specific interventions, coupled with assessment as necessary. The majority of researchers are currently focused on implementing and describing their own interventions and/or initiatives at individual universities. This is perhaps not surprising given that developing functional technological interventions in education often demands much time and energy. However, now that researchers are beginning to look beyond their individual interventions to ask questions about theory and assessment, generalizability (or at least situating results in an international landscape) will become more and more possible. Collaboration across international boundaries is one way to move beyond individual interventions and promote thinking about the possibilities and horizons of e-learning. One next step would be for researchers and other faculty currently focused on interventions to work with those international colleagues who are developing more advanced assessment methodologies, such as those whose work falls into the fourth row of Table 2. Since less than a quarter of the articles we analyzed are methodologically and theoretically focused, there is a great deal of untapped opportunity for research collaboration.

There are also opportunities to expand upon the observed trend of connecting e-learning with other important themes in engineering education. Within the distance education publications in our dataset, certain other themes were visible, including: problem and project based learning; teamwork and collaborative learning; lifelong learning; and green and environmental engineering. Perhaps most significantly, international education initiatives and collaborations are also a recurring topic in articles on e-learning, suggesting that scholars are already thinking beyond national boundaries. We suggest that using online tools to foster the development of the technical and professional skills in these and other areas is an especially notable and forward-looking way to think about e-learning. However, innovative e-learning interventions should be accompanied by the development of robust theoretical foundations, systematic assessment strategies, and research on the potential generalizability of findings and transferability of successes. Cross-

national collaborations can help support these types of goals, while also stimulating comparative research and establishing best practices.