

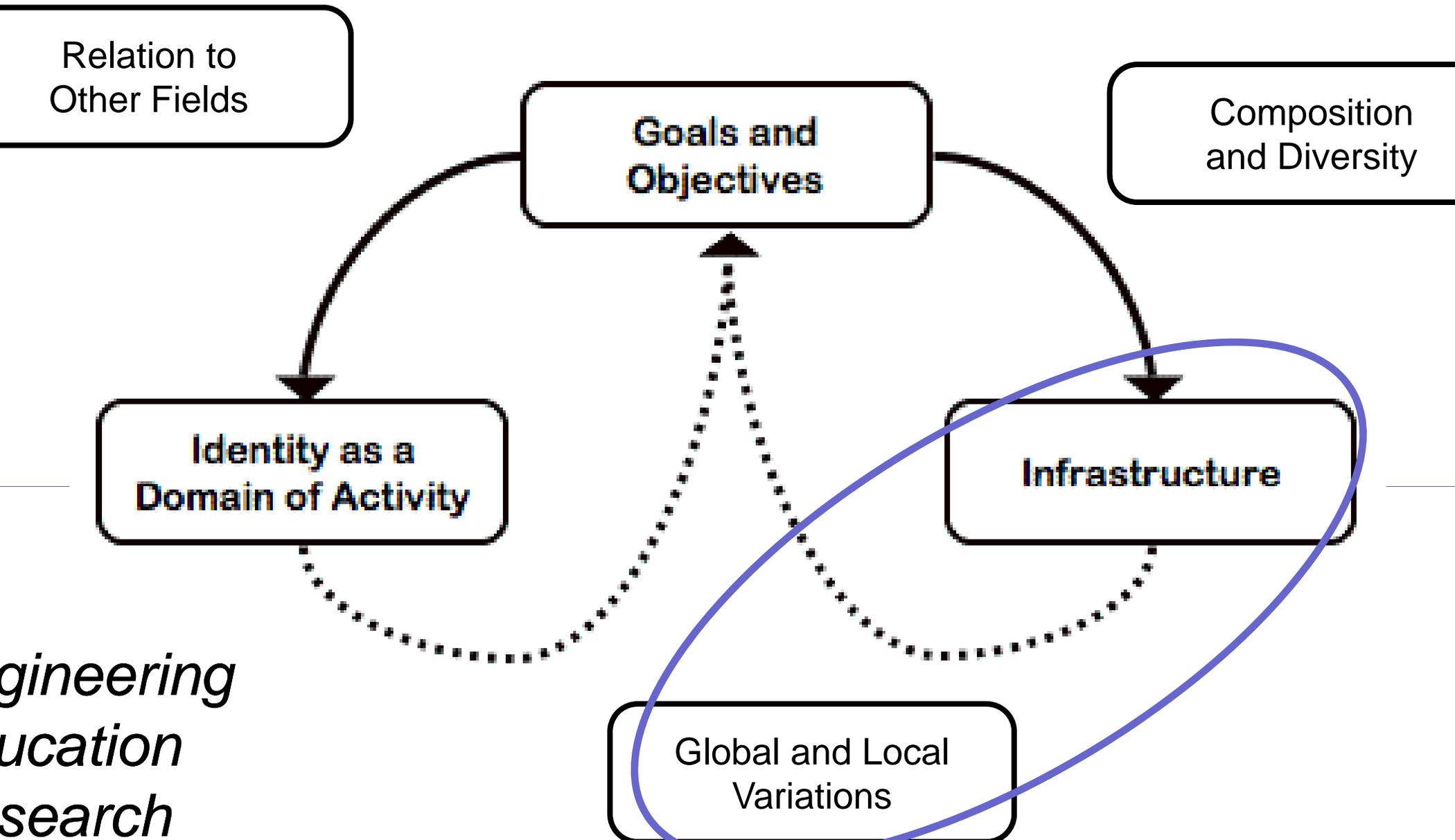
Internationalizing Engineering Education Research: Mapping Countries and Keywords to Identify New Collaborative Horizons

Brent K. Jesiek, Ph.D. (Purdue University)
bjesiek@vt.edu

Maura Borrego, Ph.D. (Virginia Tech)
Kacey Beddoes (Virginia Tech)
Miguel Hurtado (Purdue University)

Supported by NSF #DUE-0810990

Creating a Virtuous Cycle of Development



Expanding Global EER

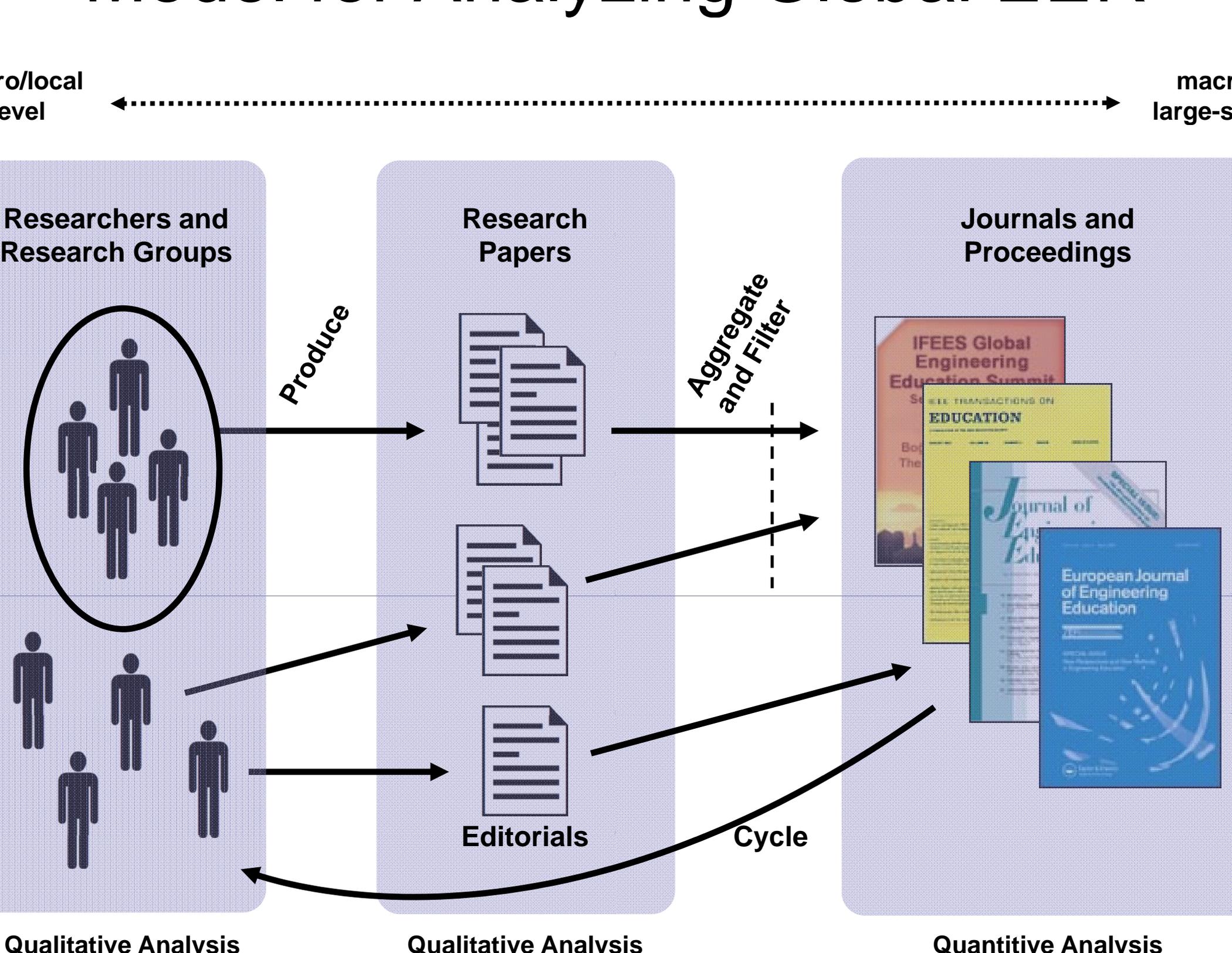
Expanding Global Engineering Education Research Collaborations (NSF #DUE-0810990)

What kinds of engineering education research are being done in what specific nations and regions worldwide? If we detect significant variability, how do we account for it?

Which specific engineering education research content areas are most likely to benefit researchers through targeted international collaboration?

What are proposed models for mutually beneficial engineering education research collaborations?

Outcome: Series of International Workshops



Main Data Sources for Analysis

▶ EER Publications, 2005-2008

IJEE

EJEE

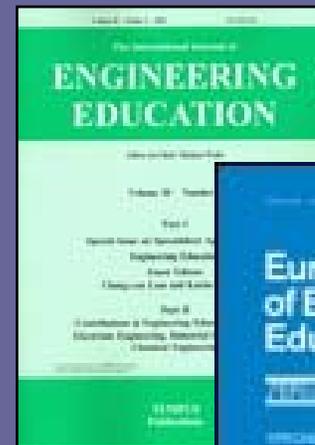
SEFI Proceedings

*ASEE Global
Colloquia Proceedings*

AAEE Proceedings

JEE (non-U.S. only)

▶ 2000+ total papers



What counts as “research”?

Criteria from *Scientific Research in Education*
(Shavelson and Towne, 2002):

Pose significant questions that can be investigated empirically.

Link research to relevant theory.

Use methods that permit direct investigation of the question.

Provide explicit, coherent chain of reasoning.

Replicate and generalize across studies.

Disclose research to encourage professional scrutiny and critique.

Simplified criteria: Present empirical data

e.g. surveys, learning assessments, interviews, etc.

<i>International Journal of Engineering Education (IJEE)</i>			
2005	128	40	31%
2006	148	64	43%
2007	133	68	51%
2008	124	78	63%
<i>European Journal of Engineering Education (EJEE)</i>			
2005	45	14	31%
2006	64	20	31%
2007	62	19	31%
2008	51	31	61%
<i>Australasian Journal of Engineering Education (AJEE)</i>			
2006	2	2	100%
2007	9	7	78%
2008	N/A	N/A	N/A
<i>Proceedings of the SEFI Annual Conference</i>			
2005	80	7	9%
2006	107	36	34%
2007	173	48	28%
2008	144	68	47%
<i>Proceedings of the ASEE Global Colloquium Annual Conference</i>			
2005	193	69	36%
2006	172	54	31%
2007	118	30	25%
2008	143	63	44%
<i>Proceedings of the AAEE Annual Conference</i>			
2006	81	44	54%
2007	77	41	53%
2008	N/A	N/A	N/A
<i>Journal of Engineering Education (JEE) – non-U.S. authors only</i>			

Table 2. Number of Qualifying Papers by Author Country of Origin

Author Country¹	No. of Papers	Author Country¹	No. of Papers	Author Country¹	No. of Papers
United States	315	Israel	7	Korea	2
Total – EU	257	Hong Kong	5	Latvia	2
Australia	154	Japan	5	Palestine	2
United Kingdom	54	Malaysia	5	Poland	2
Spain	37	Brazil	4	Slovenia	2
Germany	28	Colombia	4	UAE	2
Netherlands	28	India	4	Czech Republic	1
Turkey	23	Greece	4	Iran	1
South Africa	22	Norway	4	Nigeria	1
Sweden	21	Romania	4	Oman	1
Denmark	20	Thailand	4	Pakistan	1
Finland	19	Chile	3	Puerto Rico	1
Canada	17	Italy	3	Qatar	1
Belgium	10	Kuwait	3	Saudi Arabia	1
New Zealand	10	Lebanon	3	Sierra Leone	1
France	9	Russia	3	Trinidad & Tobago	1
Mexico	8	Singapore	3	Ukraine	1
Portugal	8	Slovakia	3	Zimbabwe	1
Taiwan	8	Hungary	2	Total – All Data	888²

¹ Shaded cells indicate European Union (EU) member countries.

² Total is larger than total papers (n= 815) due to double counting of multi-authored papers.

Accounting for EER Trends

Case Study: Australia

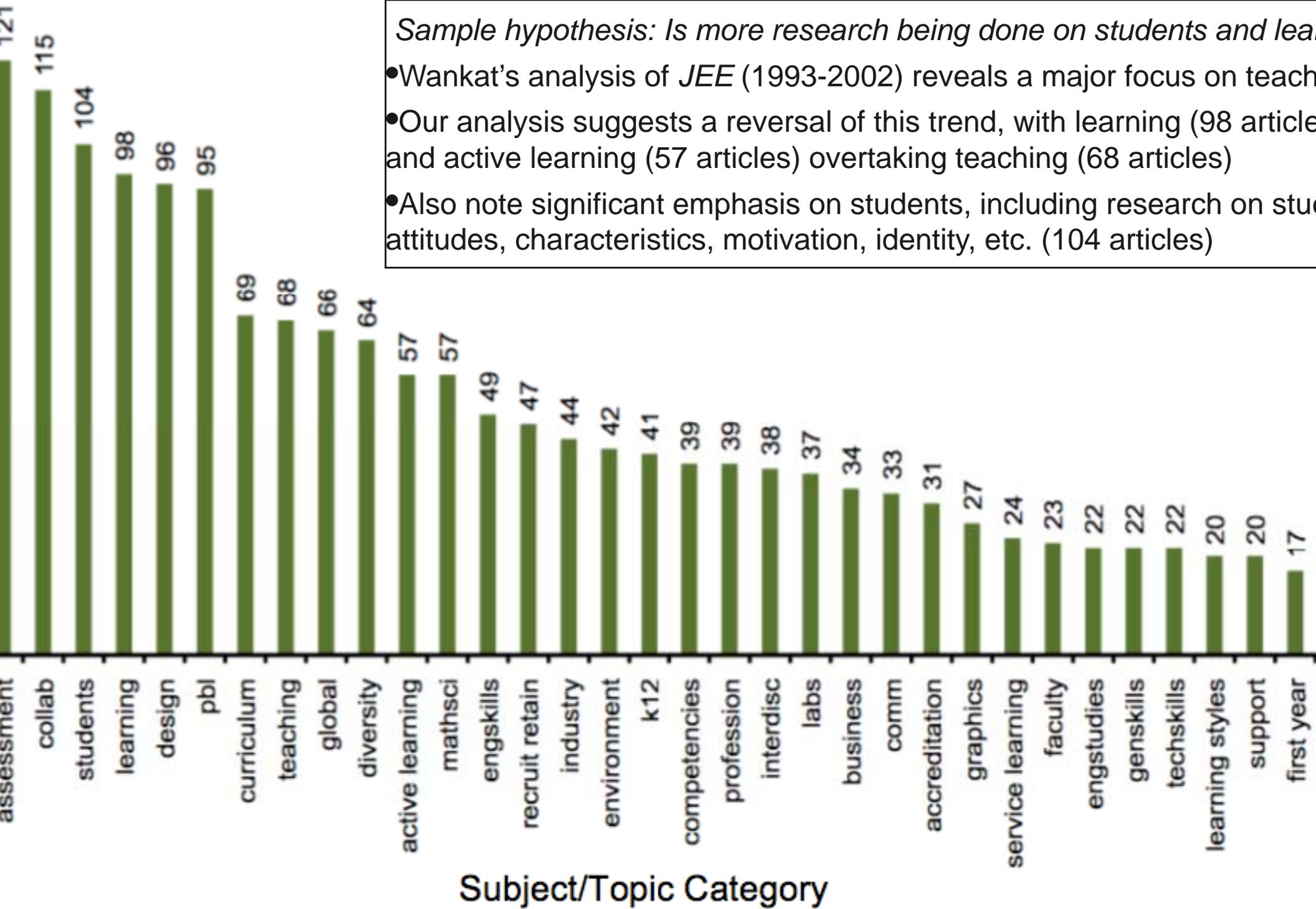
Vibrant and cohesive community and professional society (AAEE); well-established conferences and publication outlets; funding (ALTC); early shift to outcomes-based accreditation

Collaboration Patterns

- ▶ Average of 2.7 authors/paper across full data set
- ▶ 169 of 815 papers (21%) list only one author, majority of papers (57%) have 2-3 authors
- ▶ 66 of 815 papers (8%) have co-authors affiliated with two or more countries (US, UK, Australia, Germany most common)

Table 3. Category Codes and Descriptions (descending order of occurrence)

Category Code	Description
tech	Educational/Instructional Technologies, inc. Online, Distance, Web-based Learning
assessment	Assessment, Evaluation, Grading, Outcomes, Quizzes, and Tests
lab	Collaborative, Group, and Team Learning and Skills
students	Student Attitudes, Characteristics, Identity, Motivations, Perceptions, Personalities
learning	General Learning Topics, inc. Deep, Enhanced, Inclusive, Informal, Lifelong
design	Design Education, Methods, Practices, Processes, Projects, Skills, and Thinking
	Problem- and Project-Based Learning
curriculum	Design, Reform, and Development of Courses and Curricula
teaching	Teaching, inc. Pedagogy, Methods, Modes, Skills, Strategies, and Teacher Training
global	Global Competence and Education, Intercultural Skills, Foreign Language, Mobility
diversity	Diversity, inc. Gender, Masculinity, Minority, Race, Women
active-learning	Active, Experiential, Hands-on, Inquiry-based, and Interactive Learning
mathsci	Math and Science Education, Scientific Literacy, Scientific Thinking
skills	Engineering Skills, inc. Creativity, Innovation, Problem-Definition/Solution, Systems
recruit-retain	Recruitment and Retention, inc. Attrition, Pipeline
industry	Industry-Related Education and Training, inc. Cooperative, Vocational, Work-Based
environment	Environment Ethics Sustainability and Social Responsibility



Sample hypothesis: Is more research being done on students and learning?

- Wankat's analysis of *JEE* (1993-2002) reveals a major focus on teaching (68 articles)
- Our analysis suggests a reversal of this trend, with learning (98 articles) and active learning (57 articles) overtaking teaching (68 articles)
- Also note significant emphasis on students, including research on student attitudes, characteristics, motivation, identity, etc. (104 articles)

Current and Future Research

Current Research

- Update and finalize results with full data set (884 articles)
- Refine, verify, and finalize keyword-category map
- Produce 2-D visualization/map of keywords and categories
- Case studies: Australia, India, UK, Portugal, Canada, Mexico

Future Research

- Update and finalize results with full data set (884 articles)
- Refine, verify, and finalize keyword-category map

Internationalizing Engineering Education Research: Mapping Countries and Keywords to Identify New Collaborative Horizons

Brent K. Jesiek, Ph.D. (Purdue University)
bjesiek@vt.edu

Maura Borrego, Ph.D. (Virginia Tech)
Kacey Beddoes (Virginia Tech)
Miguel Hurtado (Purdue University)

Supported by NSF #DUE-0810990