



Achieving Excellence in Engineering Education

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CASEE



The Challenge:

Engineering education faces challenges associated with its content, structure, delivery, and relevance

- **Changes in the social, political, and economic environment**
- **Interest in engineering is declining**
- **We don't teach as we should**



NAE's Role and Goals

● NAE

- History
- Honorific
- Authoritative Advisor

● NAE's activities in education

- Reinterpreted Membership Criteria
- Committee on Engineering Education
- Gordon Prize
- Center for the Advancement of Scholarship on Engineering Education (CASEE)



CASEE's Goals:

Foster Excellence in Engineering Education by

- **Building Bodies of Knowledge**
- **Supporting Communities of Scholars**
- **Promoting Diffusion**



CASEE's Mechanisms:

Organizational Affiliates (academic and industrial)

- Research Community (13 affiliates)
- Implementation Network (11 affiliates)
- Dissemination Channels (5 affiliate)

Individual Affiliates

- Affiliated Scholars (7 non-engineers)
- Senior Fellows (4 engineers; can serve 1-6 semesters)
- Post-doctoral Fellows (serve 12 months)

Tools

- Strengthen research base (e.g., Virtual journal)
- Translate research to practice (e.g., What works clearinghouse)



Organizational Affiliates

Research Community

- AZ State COE
- Colorado Schl of Mines
- CPST
- Georgia Tech WST
- TX A&M TEES-EAD
- Penn State
- Berkeley COE
- Georgia Tech COE
- MIT – DUE/TLL
- NSF CAEE CLT
- NSF VaNTH ERC
- Stanford COE
- U of WA COE

Implementation Network

- ASCE BOK Cur Cmte
- Auburn LITEE
- Cornell COE
- Iowa State U COE
- Purdue Schls of Eng
- SUNY Albany
- Texas A&M Univ COE
- Univ of Mich COE
- U of TX COE

Dissemination Channels

- Rose Hulman
- Foundation Coalition
- Auburn
- NETI

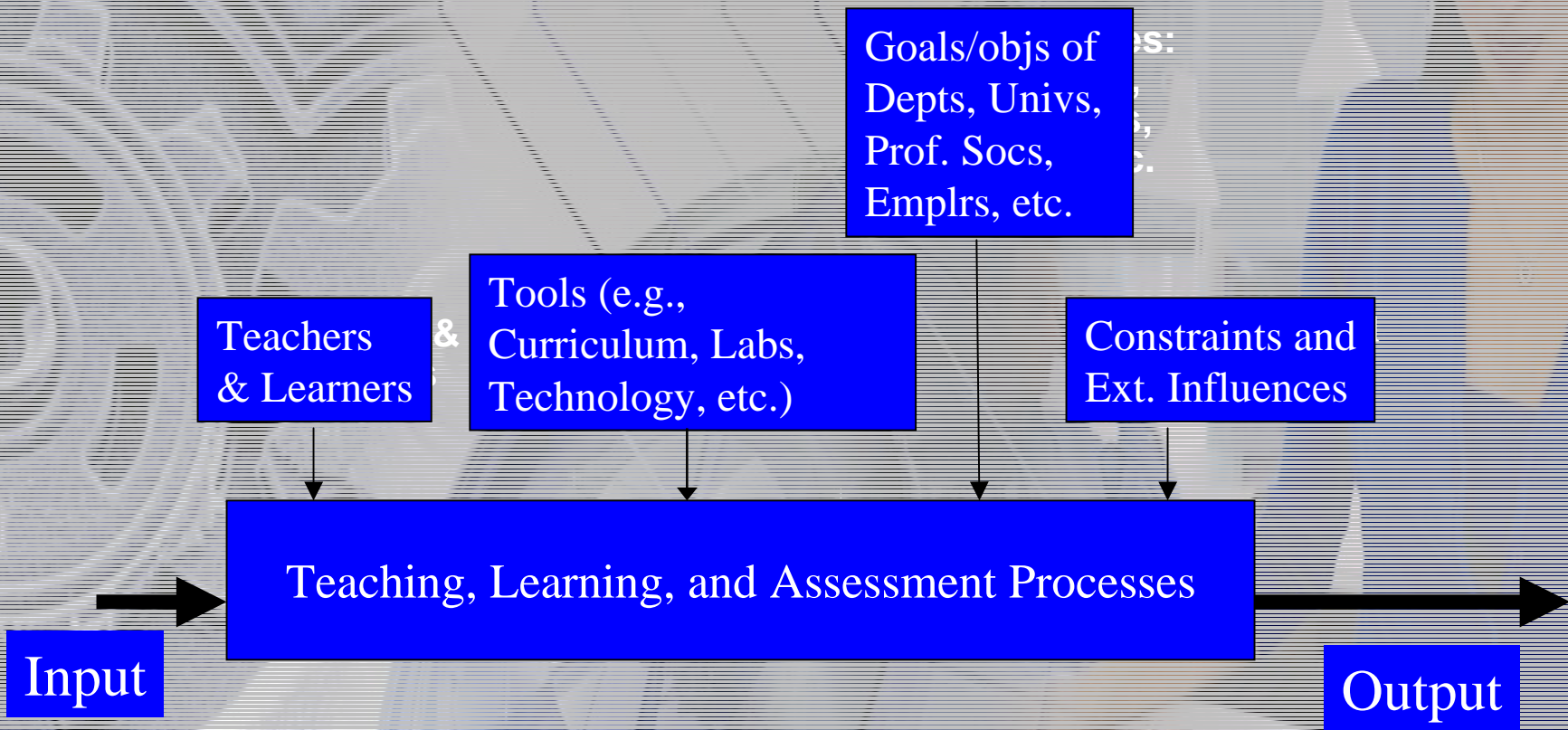


Metacognitive Activity

- **Foreground – Pursue our goals**
- **Background – Study the underlying processes that facilitate or impede their attainment**



Engineering Education as a Transformation Process



Transformation Process Model Inspired by Hubka and Eder (1988)



Sample Research Areas:

Teaching, Learning, and Assessment

- **Instruction, learning and assessment in formal, informal, and lifelong settings**
- **Student and instructor assessment**
- **Experiential learning environments and community practice**



Sample Research Areas:

Teachers and Learners

- Behavior and interactions among individuals and groups of instructors and students in various settings (motivation, mentoring, career development)
- Images of engineers and engineering held within the profession and their impact of teaching and learning
- Race, ethnicity, gender, physical ability, and social class as lenses for issues of access, participation, and success

SEE



Sample Research Areas:

Tools

- **How Interactions among curricula, instructional materials, and teaching affect learning**
- **Methods and effects of integrating latest content into curricula and labs**
- **Use of technology to structure educational environments and transform educational practice**



Sample Research Areas:

Goal Systems

- **Goals, roles, and interactions among learners, instructors, academic units, employers, professional societies, and other stakeholders**
- **Efficiency and effectiveness, and improvement of educational organizations**
- **Development and use of educational indicators of student learning outcomes, curricular quality, instructional climate, staffing conditions, demographics, finance, and accountability**

SEE



Sample Research Areas:

Constraints

- **Relationships among education processes and social, political, and economic constraints including community and culture**
- **Educational finance and its impact on policy**
- **Images of engineers and engineering held by the public-at-large and their impact on teaching and learning**



Sample Research Strand "Bodies-of-Knowledge"

Teachers and Learners

Tools

BOK

Teaching, Learning, and Assessment

CASEE



To Build the BoK:

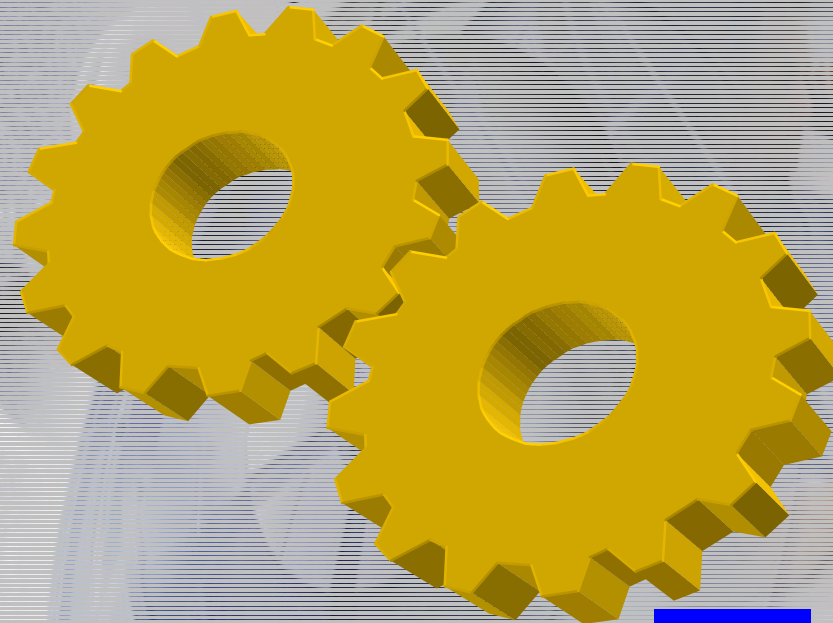
Bring the same rigor to education now applied to technical advances

- **Devote increased attention to education research within engineering**
- **Incorporate relevant knowledge from other disciplines**
 - **Physics (both content and process knowledge)**
 - Cognitive Science and Neuroscience
 - Education
 - Psychology, Sociology



Sample Research Strand "Communities of Scholars"

Teachers (from Teachers and Learners)



COS

Goals

CASEE



To Build the CoS:

Education research must be valued in the engineering faculty rewards system

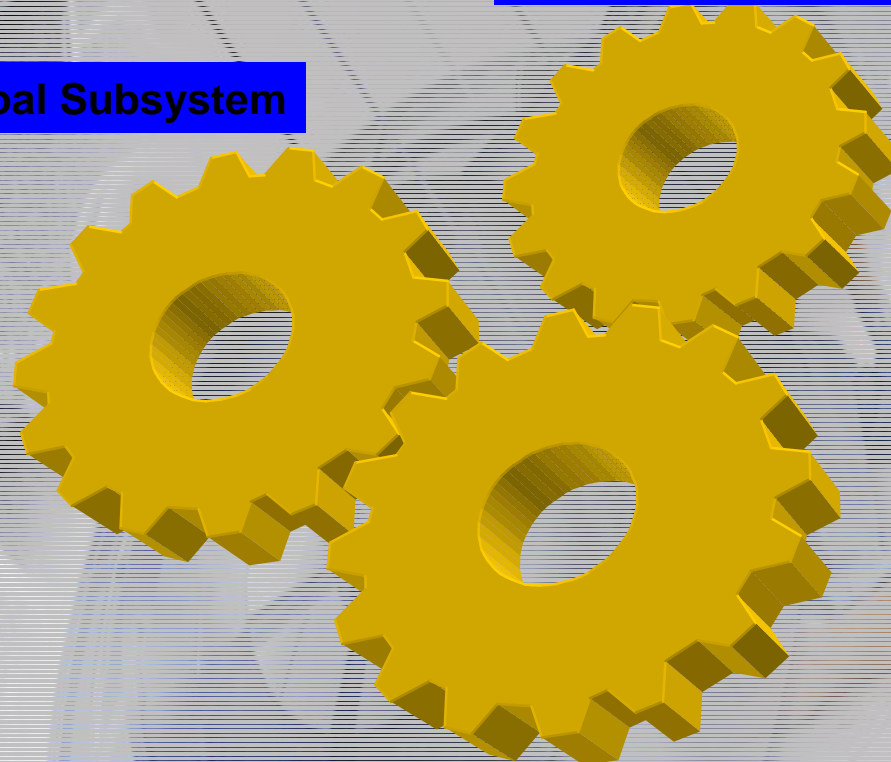
- **Promote scholarly communication on education among engineering faculty**
- **Develop broadly understood metrics for the assessment of **engineering education research****



Sample Research Strand "Diffusion"

Goal Subsystem

Constraints Subsystem



Diffusion

Other Three Subsystems



To Advance Diffusion:

Examine barriers and enablers to diffusion of innovations in education

- **Validate the applicability of diffusion studies conducted in other disciplines**
- **Identify how to mitigate barriers and promote enablers**



Action Plan:

Across the set of Research Strands

- Increase abilities to conduct, communicate, evaluate and use engineering education research
- Increase abilities to advance and apply education research methods and findings



Action Approach:

Conduct research on how to increase these abilities

- **Identify specific challenges and targets of opportunity**
- **Explore linkages across disciplines**
- **Engage in ethnographic and related research using CASEE affiliates**



Evaluation Questions:

- **Are we doing the right things?**
- **Are we doing them well?**
- **Are we having a national impact?**

We welcome your collaboration!