Implementation and Feasibility

Goals:

- The goal of this workshop is to help NCSES set an agenda to inform its methodological research and improve its data collection programs to better **measure and assess the implications of convergence for the science and engineering S&E workforce and enterprise.** The event will bring together scientists from a variety of disciplines, as well as experts in science policy, university administrators, and other stakeholders, to review and provide input on **defining convergence** and **measuring its impact on science and scientists.** The workshop will help NCSES refine and prioritize its data collection and methodological research in this area.

Questions of Particular Interest to NCSES

1) Relative to the other concepts that we can measure in the context of existing science and technology indicators, and within NCSES's current surveys and reports, how valuable would it be to construct national-level measures of convergence /interdisciplinary research (IDR)? Should these measures be sought in addition to existing measures or should it replace some existing measures?
2) What is NCSES (and NSF) doing now that contributes to the measurement of convergence/IDR, and how much do we know (or not know) about the extent and effectiveness of convergence/IDR at present?
3) What, if any, kinds of questions about the emergence of convergent/IDR research are of greatest value to the nation? In particular, which questions provide valid and actionable information? When thinking about this question, one could consider new ways of collecting this information or methods that have been tried before…

Why Measure?

- Emilda asked “ Can we create more confusion than clarity? Can we accurately reflect impact of convergence on science?”
- Indicator or Impact?
  - Indicator

    A baseline of frequency to identify change over time? US compared to international? US only?
    Frequency of occurrence? Amount of funding? Training of workforce to participate?

  - Impact

    On what – increase in collaboration / convergence, solving lager problems faster, more efficiently?

1. Background

Deep integration across disciplines to tackle compelling scientific and societal challenges

Convergence (National Academies (2014)): An approach to problem solving that cuts across disciplinary boundaries.

Convergence integrates knowledge, tools, and ways of thinking from diverse disciplines including but not limited to scientific fields, engineering disciplines, social and behavioral sciences, and beyond to form a comprehensive synthetic framework for tackling scientific and societal challenges that exist at the interfaces of multiple fields.

Convergence research features two primary characteristics: deep integration across disciplines; and research that is driven by a specific and compelling problem. By merging diverse areas of expertise in a network of partnerships, convergence stimulates innovation from basic science discovery to translational application.

See also Dear Colleague Letter: Growing Convergence Research, March 23, 2018 (https://www.nsf.gov/pubs/2018/nsf18058/nsf18058.jsp

Defining Convergence

- Common and not common elements of definitions
  - Focused on a specific problem
  - Translational ability
  - Diversity (disciplines, team member backgrounds, cultures)
  - Integration

  Subjective aspects
  - Specific / compelling problem
  - Deep integration- social, cognitive measures

How to measure?

- Qualitative
- Quantitative
- Mixed?

Ways NCSES has tried to measure

- Collecting areas of study from PhD
  - Look at those with more than one discipline
  - Measures training that crosses disciplines but not actual collaboration
- Measuring interdisciplinary expenditures
  - Challenges in accuracy of reporting, may not capture all collaborations or extent of them
- Measuring interdisciplinary disciplines (nano technology, neuroscience, AI)
  - Not inclusive of all types of convergence, may morph into their own disciplines over time
- Bibliometric
  - Captures successful output but may miss all attempts

Feasibility and implementation

- Can it be measured without a solid definition?
  - At the individual level
  - Break into component parts

    Identifying discipline, collaborators (disciplines, geography, etc.) , focus of collaboration (type of problem solving),
  - Can be very burdensome – opportunity cost of asking other items
- At institutional level
  - Asking components
- What about at funding level?
  - When grants are issued, projects are funded
- Can impact be measured?
  - What would outcomes look like?

    At most basic level interdisciplinary but this does not seem to address convergence

    other aspects may be harder to measure in quantitative study