Transforming Education to Address Complex Futures
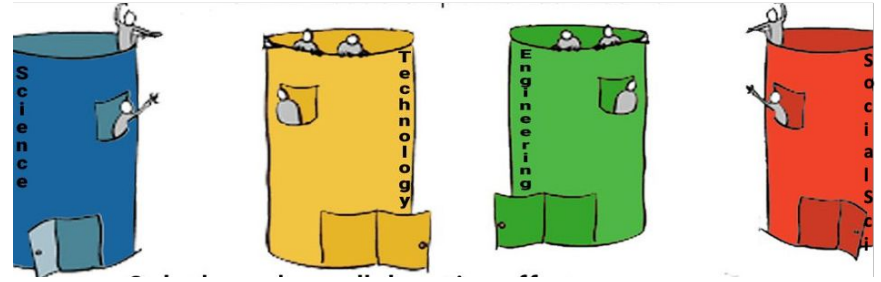
Elizabeth Endler (Shell)
Helga Huntley (Rowan U.)

Lea Jenkins (Clemson U.)
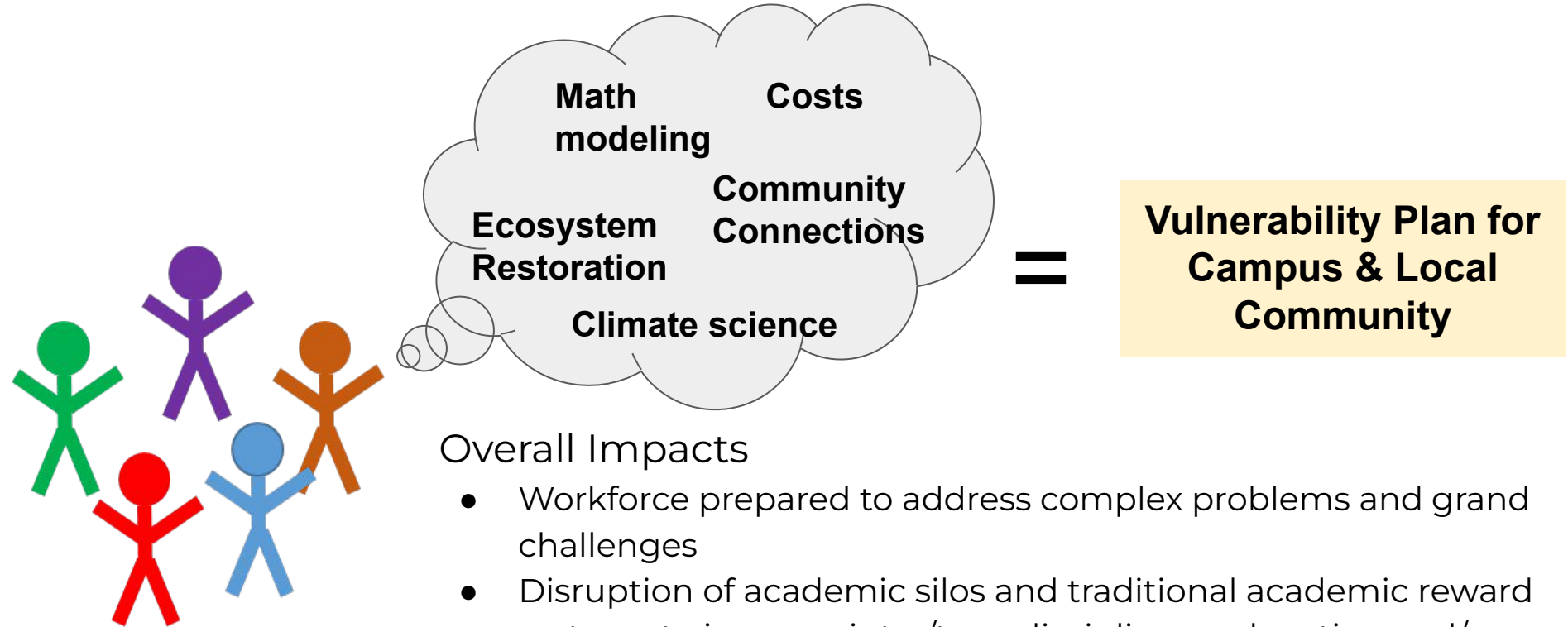Susan Powers (Clarkson U.)

The Problem

- Society's Grand Challenges are problems that span disciplines and cannot be solved in silos.
- The workforce of tomorrow needs to be **nimble** and **collaborative**.
- Today's education system is largely based on silos and emphasizes the ability to replicate over the ability to innovate.

We need critical and strategic THINKERS
who can envision the future and create solutions
developed in collaboration within an interdisciplinary team.

Vision: This is an example of what students can do

Math modeling

Costs

Community Connections

Ecosystem Restoration

Climate science

= **Vulnerability Plan for Campus & Local Community**

Overall Impacts
- Workforce prepared to address complex problems and grand challenges
- Disruption of academic silos and traditional academic reward systems to improve inter/transdisciplinary education and/or research collaboration teams
- General increase in climate and sustainability literate public

The Roadmap

The pilot….

- Fund several schools to develop and assess curricular change (NSF ADVANCE or ERC type grants)
- Gather input from industry and students to assess demand and need
- Curriculum / Course Adaptation
  - Incorporation of a grand challenge theme as a common thread in general education courses
  - Adapt content and pedagogy in existing disciplinary specific courses to be more responsive to today's needs
  - Multidisciplinary capstone project, individual research, or internship that involves economics and/or social science alongside natural science/math/engineering
- Train faculty to develop THINKERS
  - Based on existing literature
  - Continue to adapt to disseminate new successful approaches

- University Restructuring
  - Commitment to change academic structures to encourage and reward cross-departmental collaboration and reduce department-scale bean counting
  - Re-write tenure expectations to value applied projects, community service

Assess - Does it Work???

- Work with Education researchers
- Evaluate changes with
  - Students
  - Faculty
  - Institution
  - Employer satisfaction

Replication…

Challenges and Possible Solutions

Will there be buy-in from the universities?…from faculty?

> Start with a proof of concept; respond to industry needs; provide funding

> Not all faculty need to participate

Does this make sense (financially)?

> Greater marketability for jobs

> More cohesive educational experience

> Opportunity to enhance grant competitiveness

Does this dilute education?

> No, transdisciplinary themes can be woven into existing rigorous content (e.g. using pertinent examples to illustrate mathematical concepts)

How can equity concerns be addressed?

> Entry barriers should be addressed in the pilot programs

How does this contribute to research?

> Better thinkers make better researchers in the lab

> The pilots will also be the basis for research in STEM education.

How can we impact the wider community beyond college students?

> "Trickle-down" education: We educate teachers, who educate K-12

> Concepts can be incorporated in continuing ed and community colleges

> Encourage collaboration between regional institutions

Why now and why NSF?

- Global problems are complex: extreme weather, clean energy and its role in energy security, the global pandemic, supply chain challenges,...
- Current education structure is not set up to solve these efficiently and effectively.

- NSF "...supports basic research and people to create knowledge that transforms the future." The National Science Foundation has a ***unique position at the interface of scientific advancement and education, with expertise across disciplines and focused on far-reaching efforts that advance society***. NSF also has experience with funding award structures that are applicable to this topic, easing implementation.