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Hands Across the Oceans

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U.S. National Science Foundation

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NSF Mission and Facts

- "promote the progress of science" and "advance the national health, prosperity, and welfare.“ (NSF Act 1950)
- NSF receives approximately 30,000 - 35,000 proposals each year for research, education, and training projects, of which approximately 10,000 are funded
- 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations, and other research institutions throughout the United States

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NSF Mission and Facts

- $5.5 billion agency that supports STEM (Science, Technology, Education, Mathematics) research
- $950 million in STEM **education** funding
- Support for:
  - ✓ Curriculum
  - ✓ Teacher enhancement
  - ✓ Technology research
  - ✓ Education research

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Directorate for Education and Human Resources

1. Prepare the next generation of science, technology, engineering, and math (STEM) professionals and attract more Americans to STEM careers.
2. Increase the technological and scientific literacy of all Americans so that they can exercise responsible citizenship and acquire STEM knowledge that is appropriate for life-long career opportunities.
3. Broaden participation (diversity) and close the achievement gap in STEM.
4. Attend to critical workforce needs requiring significant math and science skills and knowledge.

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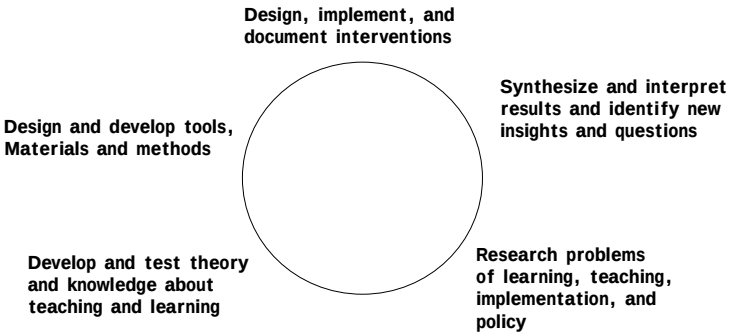
Where are We Headed?

Cycle of Discovery, Innovation and Application



Adapted from RAND Mathematics Study Panel (*Mathematical Proficiency for all Students: Toward a Strategic Research and Development Program in Mathematics Education (p.5) OERI, U.S. Department of Education)* Sept. 2002

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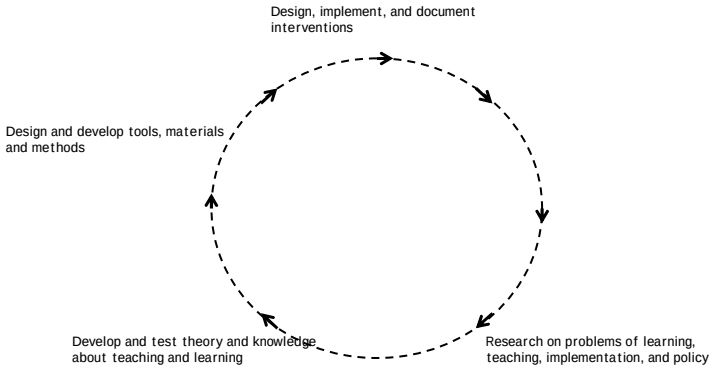

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EU – US "Hands Across the Atlantic"

- Started in 1995 as a treaty for scientific cooperation with the EU's fifth framework
- Program director to program director
- Bureaucracy's had to be overcome
- In 1996 – 6 areas in computing sciences identified
- In 1998 – 3 areas in education research identified from multimedia education and training
- Resulted in funded ITR collaboration (2003) and collaboration with 2 6th framework integrated projects + informal collaborations

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International Digital Library Collaborations

- Proposals invited from Europeans to participate in US led digital library projects
- Serving as a model for pan-pacific digital library collaborations
- Justified by the international nature of cultural resources and the desire to share those resources

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International Language Technology Collaboration

- **Joint EU-US program on language translation**
- **Interest by EU for internal language translations + intelligence and military uses**
- **Interest by US for military and intelligence uses**
- **Interest by industry and researchers for "universal communication services"**

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Modalities of Support

- **Small Grants for Exploratory Research:**
  - ✓ **US Principal Investigator is part of funded International Project**
  - ✓ **PI contacts NSF Program Officer as to appropriateness of support**
  - ✓ **PO determines that support is appropriate and asks for a SGER proposal**
  - ✓ **Proposal is written and funded (up to $200,000)**
- **Supplements to Existing Grants**

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GRAND TECHNOLOGY CHALLENGE
Provide a Teacher for Every Learner: Scalable, Learner Centered Networks

- networked and face-to-face communities of learners composed of peers, teachers, mentors, domain experts, avatars, and "cognitive" tutors that collectively approach the effectiveness of a one-on-one human tutor.
- Tap into rich, universally accessible digital libraries with books, articles, music, paintings, primary source material, data sets, and 3-D representations of cultural and natural landmarks.
- Learners learn at their own pace and in their own style and receive continuous, customized, and meaningful feedback and assessment.
- Learn anytime, anywhere—an advantage that is particularly important for adults struggling to balance the competing demands of work and family.

"Grand Research Challenges in Information Systems, Computing Research Association, Washington, DC (2003)"

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"Lesser Challenges"
Distributed Pedagogy and Learner Models

- **Rich modeling of learner knowledge (epistemological)**
- **Rich modeling of cognitive structures**
- **Connections between epistomologies and cognitive structures**
- **Pedagogy tied to learner knowledge and cognitive structures**
- **Effective models of learner interactions given learner knowledge and cognitive levels**

(Quantification of Zone of Proximal Development)

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Semantic Analysis of Text and Language

- **Provides tools for interfacing humans and text and language resources**
- **Need advances in LSA and associated text clustering and summarization**
- **Need advances in knowledge linking algorithms**
- **Need advances in semantic understanding in general domains.**

(Natural language understanding – a holy grail of AI)

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Intelligent Knowledge Management

- **Processes and designs that can be captured and reused**
- **Visualizations and other knowledge presentation techniques**
- **Knowledge indexing and searching algorithms**
- **Understanding of visual scenes – classroom video interpretation + others**

(Knowledge management and utilization over complex, multimedia domains)

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User Modeling and Assessment of Learning

- **Accepted taxonomies of desirable knowledge and skills leading to models of content, competency, and pedagogy**
- **Better automatic measurements of ongoing learning**
- **Better architectures to support assessment**
- **Individualization of assessment – e.g. reflect the multidimensionality of human learning**