The University of New Hampshire's Teaching and Learning Center:
Applying Science of Learning with STEM Faculty

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Two-Part Multimedia Presentation

• Part 1: I will have words, both written and spoken.
• Part 2: Multimedia part, with words (written and spoken) and graphics.
  • Catherine Overson will present three examples of our in-vivo studies in STEM that illustrate our approach and show the beneficial impact of our cognitively-based intervention strategies.
History of Our Center’s Work on Applying the Science of Learning

We have worked with faculty over the past 10 years to design, implement, and assess the impact of cognitively-based instructional methods in courses university-wide, including in STEM.

- Funded by the Davis Educational Foundation.
Center Staff

• director
• associate director
• science of learning project coordinator
• assessment coordinator
• research associates
Events Leading to CEITL/Faculty Collaborations

- Faculty come to us with a teaching/learning question
- Faculty respond to a call placed by CEITL in an area of work/grant interest
- Faculty attend a workshop which leads to further collaboration
- Department request for CEITL presentation
- Faculty respond to CEITL website identifying several potential project possibilities

Forming Collaborations
Stepped Process

Teacher identifies a learning need

We (CEITL) select learning principles that respond to the teacher's learning needs

Together, we make a decision to support and implement an intervention or work on a “project” with the teacher
If a project, CEITL staff will:

1. Design
2. Implement
3. Assess learning impact of our selected intervention

- Visit Catherine Overson’s poster presentation to learn about three examples of in-vivo projects we have done in STEM areas.
General Observations

• Our work is based on the notion of ‘transfer appropriate instruction’ (cf. Mark McDaniel).

• Best illustrated by Ken Koedinger’s and colleagues knowledge-learning-instruction framework.
General Observations

We have been impressed that the interventions we have examined have often—usually—produced “main effects”

• retrieval practice promotes learning, retention, and transfer;
• spacing of study promotes better exam performance than massed study;
• self-explanation of textbook material leads to better exam performance than summarization of that material; etc.
General Observations

Given the nature and amount of ‘noise’ involved in this kind of work, it is impressive that consistent and sometimes robust effects are found.
However, these interventions are not always equally effective for all students.

Examples:

- Concept maps and background knowledge
- Guiding questions and reading skill (Stiegler-Balfour and Benassi)
- Retrieval practice and overall academic skill.
General Observations

• However, these interventions are not always equally effective for all students.

• Examples:
  - Concept maps and background knowledge
  - Guiding questions and reading skill (Stiegler-Balfour and Benassi)
  - Retrieval practice and overall academic skill.
General Observations

Other examples:

• Elizabeth Bjork, Robert Bjork and colleagues: redundancy in multi-media presentations

• Faria Sana, Joe Kim, and colleagues: effects of blocking and interleaving of practice. Some conditions blocking . . .

• Paulo Carvahlo, Rob Goldsteone, and colleagues: self-regulation of study—benefits of blocking of study for students who choose to block.
Next set of challenges for teaching and learning centers and for science of learning researchers