2018

How to Have Your Cake and Eat It Too: Embedding Experimental Research in Your Courses to Improve Student Learning and Performance

Sarah Grison
Parkland College, sgrison@parkland.edu

Recommended Citation
https://spark.parkland.edu/psych_fac/14

Open access to this Presentation is brought to you by Parkland College's institutional repository, SPARK: Scholarship at Parkland. For more information, please contact spark@parkland.edu.
How to have your cake and eat it too: Embedding experimental research in your courses to improve student learning and performance

Sarah Grison, Ph.D.
Associate Professor of Psychology & Coordinator of Center for Excellence in Teaching and Learning

https://tinyurl.com/ydcmfsbs
docgrison

January 3, 2018

I needed a way to have it all: Evidence-based teaching & learning (EBTL)

Our Teaching & Learning goals:
- Engage in assessment of Learning Objectives (SLOs)
- Reveal student attitudes
- Improve teaching practice through research
- Facilitate student learning through research
- Develop own classroom research
- Learn about/contribute to SOTL literature

Why are you here?
Please respond on a laptop, smart phone, etc. Then we will discuss your needs.

www.polleverywhere.com

Goals for our interactive EBTL workshop today...

1. Is there an easy way we can engage in EBTL?
2. How can we use EBTL to improve student outcomes?
3. What other EBTL research might be beneficial?

An EBTL process should combine empirical research in psychology with instructional design

The Empirical Research Cycle

Click here to see Angelo & Cross’ instructional design model in Classroom Assessment Techniques (Chapter 4)
The result is an EBTL process that can help you “Have it all”

**STEP 1** Decide what your goals are for the research

**STEP 2** Dig in the literature for prior research!

**STEP 3** Embed research into class design for direct assessment (formative/summative; qualitative)

**STEP 4** Embed tools in class for indirect assessment of attitudes (formative/summative; quantitative)

**STEP 5** Gather direct and indirect data after the relevant class(es) and analyze

**STEP 6. Communicate results and “close the loop”!**

---

What goals might be important for you to investigate?

*Let’s turn to our neighbors to discuss this.*

- Cognitive goals (e.g., Bloom’s taxonomy)
- Academic skill goals (e.g., reading, writing, etc.)
- Content goals (e.g., types of memory stores, etc.)
- General education goals (e.g., reasoning and inquiry)
- Institution-specific student learning objectives
- Professional skills (e.g., responsibility, etc.)
- Personal skills (e.g., time management, etc.)
- Character skills (e.g., self-control, growth mindset, etc.)
- Teaching goals (e.g., improving rapport, etc.)

---

Two examples of resources you can use to investigate your goals

- Student skill goals
- Teacher behavior goals

Click to access survey on six learning goals
(by Angelo & Cross, Ch 2)

Click for the Teacher Behavior Checklist
(Keeley, Smith, & Buskist, 2006)

---

Some of your goals reflect common issues explored in EBTL!

- Poor engagement in class
- Lower reading skills
- Bad study habits for homework
- Study habits: The art of testing, editing, and watching TV with an open textbook nearby

---

Goals for our interactive EBTL workshop today...

1. Is there an easy way we can engage in EBTL?
2. How can we use EBTL to improve student outcomes?
   - **Example 1:** Increasing learning from engagement in class
   - **Example 2:** Aiding performance through homework on reading & repeated testing
   - **Example 3:** Improving outcomes with online homework tools
3. What other EBTL research might be beneficial?

---

Example 1: Increasing learning from engagement in class

**Goal:** Does using student response systems (SRs) improve learning?

**Literature:** Danisloky et al. (2013) - elaborative interrogation & distributed practice

**Research Design:** Classroom experiment for 4-9 chapters across 30 sections with 154 TA's

**Attitudes:** Embedded survey on students' feelings, thoughts & behaviors about SRs

**Data collection:** Pre-test 2 weeks prior, 4 classes; Post-test at 2 and 12 weeks after

**STEP 1** Goal: Does using student response systems (SRs) improve learning?

**STEP 2** Literature: Danisloky et al. (2013) - elaborative interrogation & distributed practice

**STEP 3** Research Design: Classroom experiment for 4-9 chapters across 30 sections with 154 TA's

**STEP 4** Attitudes: Embedded survey on students' feelings, thoughts & behaviors about SRs

**STEP 5** Data collection: Pre-test 2 weeks prior, 4 classes; Post-test at 2 and 12 weeks after

**STEP 6. Communicate results and “close the loop”!**
This paper reviews what cognitive psychology reveals about the 5 most beneficial practices for student learning. Click for Dunlosky et al., 2013 (see Table 4)

- Participants: 297 Intro Psych students completed all phases
- Materials: MCQs on Learning & Memory answered via SRSs
- Design: Experimental (2 chapters x less/more Qs x Lectured on/Not lectured on)

- Procedures:
  - Pre-Test: 16 MCQs online 2 weeks before classes
  - In-Class: CROSSED design to present SRS Qs
  - Post-Tests: 16 MCQs online 2 & 12 weeks after classes

Using SRSs in class to answer 8 questions vs. 4 questions predicted better performance 2 weeks later when that material had NOT been presented in class.

Results of logit mixed model analysis at Post-Test 1, two weeks later (Luke, Grison, Shigeto, & Watson, 2010) Click to access the research here: https://works.bepress.com/sarah-grison/5/

And using SRSs in class to answer 8 questions versus 4 questions predicted better performance 12 weeks later for students who reported reading less than 50% of the textbook.

Results of logit mixed model analysis at Post-Test 2, 12 weeks later (Luke, Grison, Shigeto, & Watson, 2010) Click to access the research here: https://works.bepress.com/sarah-grison/5/

Example 1: Using SRSs to increase engagement in class

- Having more SRS questions predicts improved learning
- The benefit of SRS use persists to the end of the term for students who read less
- Students who read less benefitted more from having more SRS questions

"The best aspect is how it keeps us involved with "do it yourself" tools."

Example 2: Aiding performance through homework on reading & repeated testing

- Goal: Do test homework questions or repeated online quizzes predict better grades?
- Literature: Nguyen & McNally, 2014: 3R – influences embedded questions aid reading; Py et al., 2016: test enhanced learning
- Design: 2 classroom correlation studies controlled with mixed logit analyses
- Attitudes: Used embedded classroom assessment techniques to get attitudes about pedagogies
- Data collection: 18 chapters of notes and online quizzes and 10 exams

STEP 6. Communicate results and "close the loop"!
Example 2:
Step 2 – Literature

This Society for the Teaching of Psychology publication includes several articles about how cognitive principles, such as how reading strategies (Nguyen & McDaniel, 2014) and test-enhanced learning (Pyc, Agarwal, & Roediger, 2014) can improve student learning. Click for articles in Applying Science of Learning in Education, 2014

Example 2: Step 3 - Design

- **Participants:** 10 Intro Psych students placed into a special section for “at-risk” students
- **Materials:**
  - 18 chapters of homework questions on text LOs (note matrices)
  - 18 chapters of online MCQs quizzes with repeated attempts
  - 10 exams of 40 MCQs each
- **Design:** Correlational
- **Procedures:**
  - Each week students did the reading homework and online quiz
  - Exams covered 2-4 chapters, each chapter was covered twice

Example 2: Correlational results

Higher performance on homework questions about text reading and online quizzes allowing repeated attempts were both correlated with higher exam grades


Click to access the research at: https://works.bepress.com/sarah-grison/2

Example 2: Results of logit mixed model analysis for statistical control

Best performance on exams were predicted by a combination of requiring written homework about text reading and doing repeated practice with online quizzes.

(Watson, Grison, Luke & Shigeto, 2010). Click to access the research at: https://works.bepress.com/sarah-grison/2

Example 3: Improving outcomes with online homework tools

- **Active engagement with the text** during reading and repeated online quizzes BOTH enhance learning for at-risk students
- **Could be due to orienting them to critical concepts**
- **Or due to repeated accessing of memories** of material

Kobie and other students during a class activity.

“I have been able to get away without reading. But, in this class, it is almost impossible to get by without reading.”
Example 3: Step 2 – Literature

- Click for Gurung, 2015
- Click here for Adesope et al., 2017
- Click here for the original article by Roediger & Karpicke, 2006

Example 3: Step 3 - Design

- **Participants:** 2 sections of Intro Psych students
- **Materials:**
  - 14 chapters of online homework questions
  - 14 chapters of online quizzes with MCQs
- **Design:** Experimental (2 terms x more/less online homework)
- **Procedures:**
  - Each week students did the online homework and online quiz afterwards

<table>
<thead>
<tr>
<th>Section 1</th>
<th>Section 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Online homework for Odd chapters only</td>
<td>A: Online homework to 1000 points</td>
</tr>
<tr>
<td>B: Online homework for even chapters only</td>
<td>B: Online homework to 2000 points</td>
</tr>
</tbody>
</table>

Example 3: Correlational results

- Logit mixed model analyses showed **no effects.**
- But, greater completion of online homework was associated with higher quiz grades.

Example 3: Results on attitudes about online homework

- How much of the online homework did you do?
- How much did it help you understand the ideas?
- Students self-reported using the online homework a lot, liked it, and believed it helped them understand the material.

Example 3: Doing online homework is associated with better quiz performance

- Students’ attitudes show that they enjoy doing online homework and believe they learn from it
- While there is a relationship between completing online homework and higher quiz scores, there is likely a third variable causing the effect
- Additional research will have to explore what that is

Example 3: What is the take-home message about these EBTL studies?

- You can improve student outcomes!
- Actively engage students in class with SRSs to improve learning
- Facilitate active reading of the text & doing repeated quizzes online to improve performance
- Encourage students to repeatedly practice with material using online homework tools
- Learn attitudes about course materials and activities to make changes

---

Melvin doing online homework

“It encouraged me to go back and read over things that I didn’t understand.”
Goals for our interactive EBTL workshop today...

1. Is there an easy way we can engage in EBTL?
2. How can we use EBTL to improve student outcomes?
3. What other EBTL research might be beneficial?

How might you investigate one of your goals using EBTL research? **Turn to your neighbor again to discuss this please!**

EBTL can help investigate a variety of important topics

<table>
<thead>
<tr>
<th>Question</th>
<th>Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do character skills impact performance and learning (self-regulation, conscientiousness)?</td>
<td>Duckworth &amp; Seligman, 2017</td>
</tr>
<tr>
<td>How does mindset influence persistence and outcomes?</td>
<td>Muenks &amp; Miele, 2017</td>
</tr>
<tr>
<td>What improves development of rapport with students?</td>
<td>Webb &amp; Barrett, 2014</td>
</tr>
<tr>
<td>Can improving media literacy help students evaluate information?</td>
<td>Kahne &amp; Bower, 2017</td>
</tr>
</tbody>
</table>

Tips from the trenches

- Investigate getting IRB approval
  - Often “exempt” but may want to access to students’ files
- Be careful of how to design for performance vs learning goals
- Motivate participation and performance
  - e.g., Give extra points on grade for correct answers
- Avoid practice effects
  - Two tests with different questions on same concepts
  - So we must choose what Learning Goals to focus on
- Examine difficulty across two tests
  - Pre-test: Half of students do Test A & half do Test B
  - Post-test: Half of students do Test A & half do Test B
  - Analyze for difficulty of both tests & revise as needed

Thank you very much for giving me the opportunity to work with you!

- Any questions or thoughts?
- Please feel free to catch me here at NITOP
- Or you can email me at sgrison@parkland.edu
- Feel free to grab this PPT and other resources at:

https://tinyurl.com/ydcmfshs
What is the best aspect of the workshop?
What would you change?

Please respond on a laptop, smart phone, etc.

www.polleverywhere.com