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Ludmila Nunes
Purdue University

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FROM THE LAB TO THE CLASSROOM: RESEARCH AT THE INTERFACE BETWEEN COGNITIVE SCIENCE AND EDUCATION

Ludmila D. Nunes
Research Associate,
Center for Instructional Excellence

nunes@purdue.edu



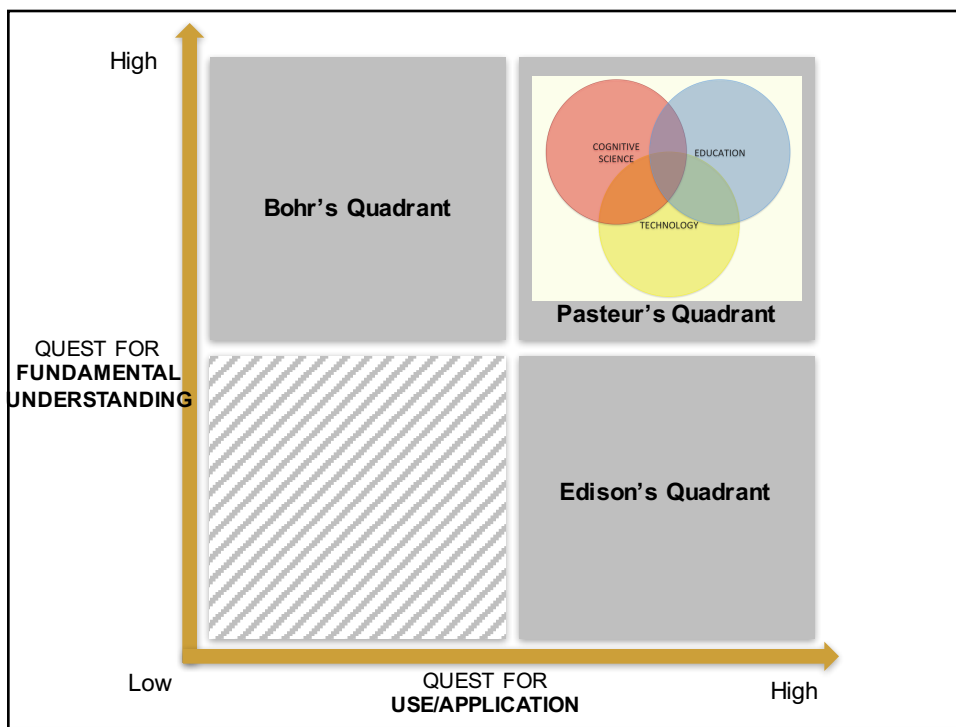
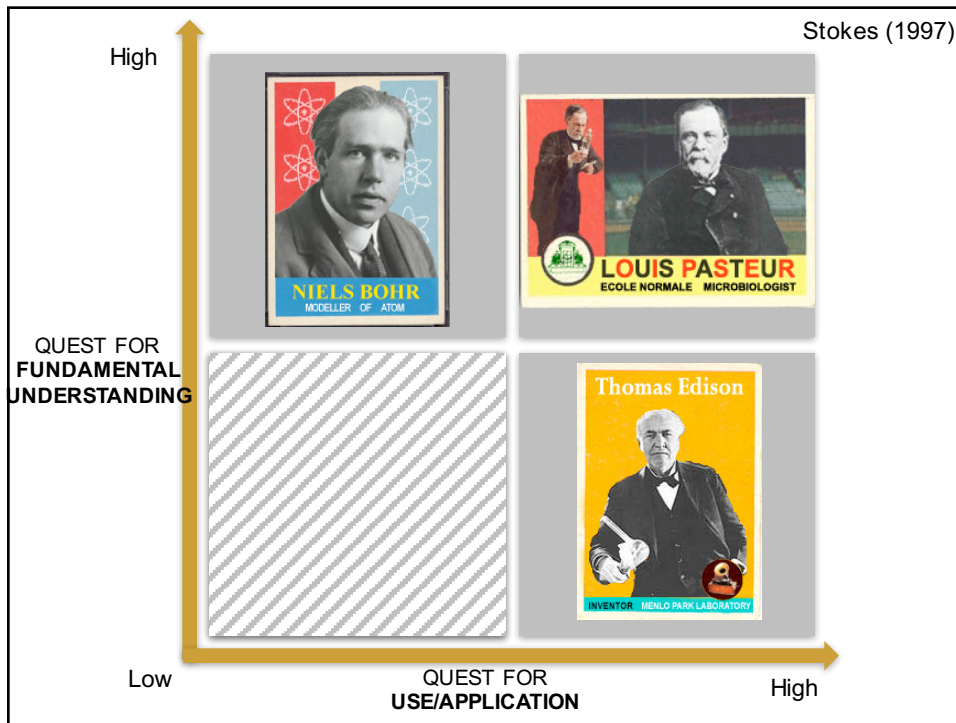
First in the World
Program



Bridging the Gap Between Research and Practice in Education
29th APS Annual Convention, Boston, MA
May 25-28, 2017

OVERVIEW

- Stoke's Quadrants – Fundamental vs. Applied research
- The problem(s)
- Experimental Tetrahedron – in the lab vs. in the classroom
- In the classroom experiments – Common issues
- How to overcome challenges
- Design suggestions
- Example 1: Comparison group design
- Example 2: Within-subjects design
- Conclusion



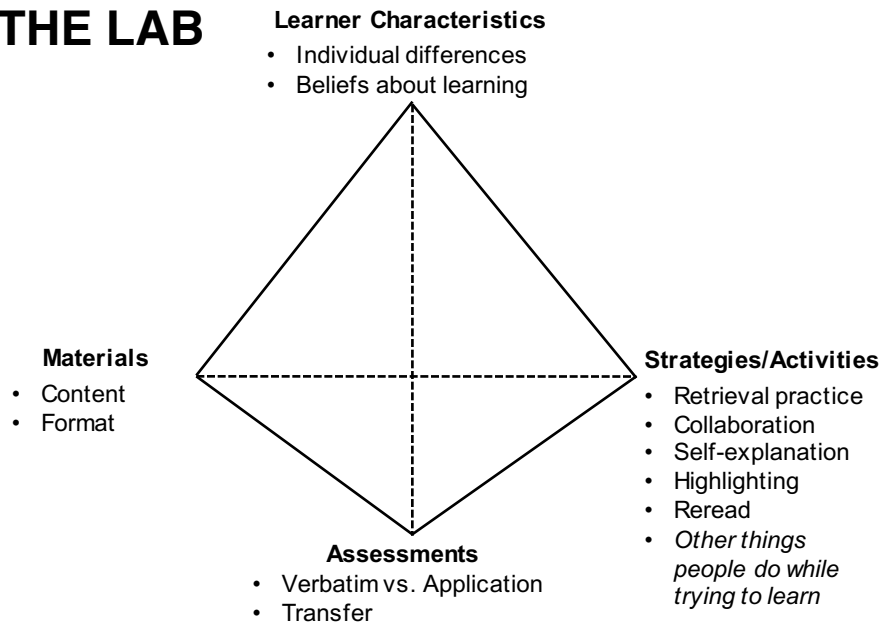
THE PROBLEM(S)

- Theoretical question – Lab experiment – controlled, precise, conditions should be replicable – *allow us to identify best practices?*
- Are the effects found in the lab applicable to a real-life learning set, like a classroom? Can we simply extend the lab findings to the classroom?

1. What characteristics should lab experiments have to be extended to educational practices?

2. What characteristics should research in the classroom have to be a good test of theoretical ideas and deepen our knowledge about how people learn?

IN THE LAB



Jenkins (1979) "Four Points to Remember"

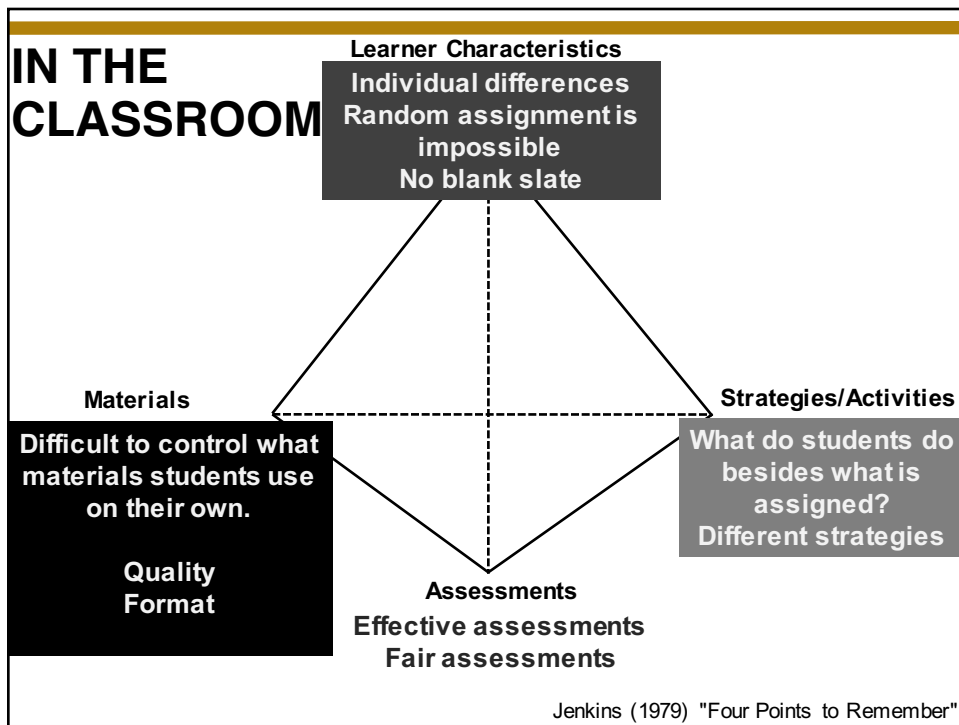
IN THE LAB - PROS

- Control
- Random assignment
- Large samples
- Can be fast-paced

IN THE LAB – ISSUES FOR TRANSLATION

- Lack of materials' authenticity
- Inauthentic activities (tasks, strategies)
- Irrelevant assessments
- Mismatch between tasks or assessment and real learning outcomes

But our focus today is on the issues of designing experiments for the classroom



IN THE CLASSROOM – COMMON ISSUES

- No control
- Random assignment is virtually impossible
- Students are not a blank slate
- Pacing/Timing
- Ethical concerns - any experiment in a classroom setting shouldn't harm any students' performance

IN THE CLASSROOM – COMMON ISSUES

- Most experiments in the lab are done with College students – transferring similar methodologies to K-12 settings is very difficult
- Also, data collection is usually very slow...

HOW TO OVERCOME THESE ISSUES?

IES What Works Clearinghouse

- Provides a set of design “rules” to identify if a study in Education meets quality standards
- Compiled evidence of effectiveness of strategies

WHAT IS THE WWC?

A TRUSTED SOURCE ABOUT WHAT WORKS IN EDUCATION

WHY
The work of the WWC helps teachers, administrators, and policymakers make evidence-based decisions.

WHAT
The WWC reviews evidence of effectiveness of programs, policies, or practices by using a consistent and transparent set of standards. The WWC doesn't rank, evaluate, or endorse interventions.

WHO
Hundreds of trained and certified reviewers rate whether studies meet standards and then summarize results that do meet standards.

HOW
The WWC creates products that present findings on what works in education, including:

- INTERVENTION REPORTS
- SINGLE STUDY REVIEWS
- QUICK REVIEWS
- PRACTICE GUIDES

WHERE
Summaries of the available research interventions are available at whatworks.ed.gov

EFFECTIVENESS STUDIES
RANDOMIZED CONTROLLED TRIALS
QUASI-EXPERIMENTAL DESIGN

MEETS WITHOUT RESERVATIONS
MEETS WITH RESERVATIONS
DOES NOT MEET WWC STANDARDS

10,000+ STUDIES

ies INSTITUTE OF EDUCATION SCIENCES **WHAT WORKS CLEARINGHOUSE™**

Features of Comparison Group Designs

Randomized Controlled Trials (RCTs)	Quasi-Experimental Designs (QEDs)
<ul style="list-style-type: none"> ▶ Randomly assigned to treatment or comparison group ▶ Created similar on observables and unobservables ▶ Outcome differences due only to intervention ▶ Can receive highest rating, <i>Meets Group Design Standards Without Reservations</i> 	<ul style="list-style-type: none"> ▶ Assignment not random – some receive treatment and some do not ▶ Can demonstrate similar only on observables ▶ Outcome differences possibly due to intervention and other factors ▶ Can <i>Meet Group Design Standards With Reservations</i>, but cannot receive highest rating

WWC Webinar, March 2015. Designing Quasi-Experiments: Meeting What Works Clearinghouse Standards Without Random Assignment

OTHER SOLUTIONS?

Within-Subjects designs

EXAMPLES



EXAMPLES



Levesque-Bristol et al.
Coordinated by J. Moss

Research project designed to evaluate the success of the IMPACT program at Purdue.

IMPACT is a faculty development initiative that empowers faculty to foster student centered learning environments. It is evidence-based and the ultimate goal is to improve student motivation and performance.



First in the World Program



***WWC standards**

EXAMPLES: STEAM

Levesque-Bristol et al.
Coordinated by J. Moss

Procedure

1. Identify Treatment (IMPACT) vs. Control (no-IMPACT) sections – two distinct groups
2. Apply a Knowledge exam (Pre-test) and a Student perceptions survey
3. “Intervention” – student-centered environment vs. traditional; usually one semester long
4. Reapply the Knowledge exam (Post-test) and the Student perceptions survey

Measures

Sections can be used if there are no significant differences in the the Pre-test – *Baseline Equivalence*

- Performance on the Knowledge Exam
- Student Perceptions (motivation; control check for the success of the intervention)
- *Grades, Performance in pre-established course learning outcomes

EXAMPLES: Self-Regulated Learning in the Classroom

(Ariel et al., in prep)

Questions:

1. Can students learn to regulate their learning and implement retrieval practice strategies by themselves?
2. Does the type of regulation students do correlate with their performance in class?

HOW TO ANSWER THESE QUESTIONS IN A CLASSROOM SETTING?

EXAMPLES: Self-Regulated Learning in the Classroom

(Ariel et al., in prep)

Method

Within-subjects design

- avoid ethical concerns
- *easier to implement*

Large sample – more power, even with data losses

- PSYC 200 Introduction to Cognitive Psychology, Purdue
- 200 students

Iteration	N
1	128
2	95
3	66
4	89

EXAMPLES: Self-Regulated Learning in the Classroom

(Ariel et al., in prep)

Procedure

- A computer program was created to review information studied in the class
- This program was available 1 week before each exam (4 in total) and students were instructed to use it to study for the upcoming exam
- To incentivize students, the program completion counted as a homework assignment (points!)
- They were also instructed not to use notes or textbooks when performing the homework assignments
- 20 Facts were used for each assignment
- ~1/3 of the content covered on each assignment appeared in some form on the corresponding exam

EXAMPLES: Self-Regulated Learning in the Classroom

(Ariel et al., in prep)

Procedure

- A computer program was created to review information studied in the class – **TECHNOLOGY HELPS**
- This program was available 1 week before each exam (4 in total) and students were instructed to **use it to study for the upcoming exam – PERCEIVED VALUE FOR THE STUDENT**
- To **incentivize students**, the program completion counted as a homework assignment (points!)
- They were also instructed not to use notes or textbooks when performing the homework assignments – **INSTRUCTIONS (might or might not be followed...)**
- 20 Facts were used for each assignment – **not everything can be covered**
- ~1/3 of the content covered on each assignment appeared in some form on the corresponding exam – **PERCEIVED VALUE**

EXAMPLES: Self-Regulated Learning in the Classroom

(Ariel et al., in prep)

Measures

- Who used the program?
- How the program was used? (i.e., what type of strategy was being used?)
- Performance in the program
- Performance in each exam topic – covered by the program and not covered
- Performance in each exam
- Final grade

We could get more ambitious and use GPA, and even track students' trajectories in the future. We didn't do this for this project (for now!)

EXAMPLES: Self-Regulated Learning in the Classroom

(Ariel et al., in prep)

POSSIBLE ISSUES

- N drops
 - Technology sometimes fails (e.g., Mac vs. Windows)
 - Students simply don't do it (which can lead to problematic "selection" effects)

Iteration	N
1	128
2	95
3	66
4	89

- Time-consuming
 - Prepare the program and test it
 - Instructor willing to implement it (it makes it easier when the instructor is also the researcher but that isn't always the case)
- Impossible to do without good communication between research team and instructor

EXAMPLES: Self-Regulated Learning in the Classroom

(Ariel et al., in prep)

PERCEIVED VALUE – STUDENTS' COMMENTS (COURSE EVALS)

- 1 the exam review assignments were fantastic loved those. Also the study guides really helped with effective studying.
- 4 examples during lectures always helped in understanding, assignments also helped in learning and related to the topics, the hotseat questions helped review and learn material,
- 10 The assignments really enhances learning
- 36 know, Assignments and test solution prepared before each exam were especially helpful organizing concepts in the material. Demonstration were effective at learning too. Numerous office hour is great on clarifying the materials. I too
- 40 The homework assignments before the exams are very helpful and a good studying tool.

TAKE-HOME MESSAGE

- Unfortunately, there is **no recipe** to do research in the classroom.
- But there are a **set of procedures** that one can keep in mind:
 - use equivalence at baseline or within designs (don't forget the importance of counterbalance)
 - be prepared for substantial decreases in your N
 - ethical treatment of students – the research cannot become more important than teaching
 - try to use interventions with high perceived value for the student
 - plan ahead, keeping good communication with the instructor

THANK YOU!

Ludmila D. Nunes
nunes@purdue.edu