Why RCT evidence often failed to predict classroom successes?
Research methods Pitfalls

Cause

- Waiving Extrinsic Constraints
- EdTech as Independent variable
- Controlling the teacher role

Consequence
Logistics assistants (warehouse employees)
Tinker
No sign. effect in understanding

mean = 7.84 vs. mean = 7.43
F(1,14) = .25; p > .05

No sign. effect in problem-solving

mean = 5.16 vs. mean = 5.15
F(1,14) = .06, p > .05

Son DoLenh, Patrick Jermann
Worst group

Best group

<table>
<thead>
<tr>
<th>Group</th>
<th>Collaboration quality</th>
<th>Manipulation discussion</th>
<th>Reflection discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 6</td>
<td>1.4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Group 5</td>
<td>1.6</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>Group 8</td>
<td>1.4</td>
<td>1.25</td>
<td>1.00</td>
</tr>
<tr>
<td>Group 1</td>
<td>1.4</td>
<td>1.75</td>
<td>1.75</td>
</tr>
</tbody>
</table>
SIMULATE

GROUP

- Run a simulation of the current layout.
- Ask the students to predict before running.
### Significant effect in understanding

![Box plot for understanding score across conditions](image)

### Significant effect in problem-solving

![Box plot for problem-solving score across conditions](image)

<table>
<thead>
<tr>
<th>Measures</th>
<th>Warehouse study’s conditions</th>
<th>Evaluation of TinkerLamp 2.0 conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Paper/pen</td>
<td>TinkerLamp 1.0</td>
</tr>
<tr>
<td><strong>Understanding score</strong></td>
<td>7.84(2.85)</td>
<td>7.43(2.82)</td>
</tr>
<tr>
<td><strong>Problem-solving score</strong></td>
<td>5.16(1.70)</td>
<td>5.15(1.78)</td>
</tr>
</tbody>
</table>
Tool-A, Teacher-Role X < Tool-A, Teacher-Role Y
Cause

- Waiving Extrinsic Constraints
  - EdTech as Independent variable
  - Controlling the teacher variable

Consequence
**EdTech as Independent variable**

<table>
<thead>
<tr>
<th>Pre</th>
<th>EdTech activity</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>Non-tech activity</td>
<td>Post</td>
</tr>
</tbody>
</table>

**Teacher role as Independent variable**

<table>
<thead>
<tr>
<th>Pre</th>
<th>Teacher’s Role A</th>
<th>EdTech activity</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>Teacher’s Role B</td>
<td>EdTech activity</td>
<td>Post</td>
</tr>
</tbody>
</table>
Does the teacher has a role in your edTech solution?

From a sage on the stage
To a guide on the side
25% of K12 children have difficulties

10 months
Average waiting time
Asselborn et al., Extending the spectrum of dysgraphia, a data driven strategy to estimate handwriting quality, 2020, *scientific reports*
Describing handwriting with more than 100 features

Objectively describing invisible characteristics of the handwriting sample

Static Kinematic Pressure

Static: moment of handwriting
Kinematic: median of power spectral of speed frequencies
Pressure: median of power spectral of speed of pressure change frequencies

Asselborn et al., Automated human-level diagnosis of dysgraphia using a consumer tablet, 2019
Patrick
5 years old

"Il fait très beau.
Je suis bien.
Je veux l'eau.
Mai je ne sais pas où elle va."

Julie
6 years old

"Il fait très chaud.
Je suis bien.
Je sais pas où.
"
Personalized handwriting improvement games
Il fait très doux,
je suis très bien.
Je bois de l'eau
mais je ne sais pas
où elle va.
L'eau venait sur
les côtés.

L'eau venait sur la côte, un grand
homme se tenait près de moi, il a
plu, il a plu.
Can you prove it is effective?

<table>
<thead>
<tr>
<th>Learning activities</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>NoTech activity</td>
</tr>
<tr>
<td>Pre</td>
<td>Tech activity</td>
</tr>
<tr>
<td>Pre</td>
<td>Tech activity</td>
</tr>
</tbody>
</table>
Research methods Pitfalls

Cause:
- Waiving Extrinsic Constraints
- EdTech as Independent variable
- Controlling the teacher variable

Consequence:
Does your edTech solution integrate non-tech activities?
Training gardeners
\{a_1(\text{GardenVR}), a_2(\text{paper})\} < \{a_1(\text{paper}), a_2(\text{gardenVR})\}
Research methods Pitfalls

Cause

Waiving Extrinsic Contraints

EdTech as Independent variable

Controlling the teacher role

Consequence
Physics 101

H. Alavi, Olivier Guédat
“While Waiting Productivity” LOSS : 62% → 6%
Success Story?
Our experiments often waive extrinsic (micro) constraints

Intrinsic constraints:
- Who
- What
- How

Extrinsic constraints:
- Teacher’s time
- Learners’ time
- Motivation
- Grades
- Disciplines
- Absences
- ...
Does your EdTech solution consider extrinsic-constraints?

- Keeping control
- Producing grades
- Leaving traces
- Handling late comers
- ...
Do you accept to run this experiment in your class?
Research methods Pitfalls

Cause

Waiving Extrinsic Constraints

EdTech as Independent variable

Controlling the teacher variable

Consequence

No More login!
Research methods Pitfalls

- Cause
  - The myth of intrinsic technology effects
  - Classroom-ignorant Design

- Waiving Extrinsic Constraints
  - EdTech as Independent variable

- Controlling the teacher variable

- Consequence
The ‘Context’

2 more independent variables:
- the teacher role
- the sequence