In a physics communication course, reflection and instruction affected neither presentation quality nor retention of concepts.

**Background**

- Employer accounts suggest physics graduates are deficient in social and communicative skills [Sarkar et al., 2016].
- Despite widespread support for student development of science communication skills, implementation of relevant resources has been slow and highly localized.

**Methods**

### Senior Seminar

- (required course, one credit-hour)
- **High enrollment & limited class resources**
- **Students present once per semester, often having received no instruction.**
- Randomly assigned peer evaluations per presentation
- **Treatment:** critical reflection [Girard et al., 2011]
- **Control:** assess engagement; distract from reflection
- End-of-class quiz on concepts from that day’s presentations
- Presentations evaluated independently for research

**N=49** Presentations across two semesters  
**N=1033** Peer evaluations; quiz question submissions

**Results**

<table>
<thead>
<tr>
<th>Multimedia Design Principle</th>
<th>Treatment (n = 521)</th>
<th>Control (n = 509)</th>
<th>Established effect size [Mayer, 2020]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coherence (Co):</strong> Omit extraneous, seductive details.</td>
<td>0.86 ± 0.08</td>
<td>0.72 ± 0.06</td>
<td>0.08</td>
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<tr>
<td><strong>Signaling (Sg):</strong> Visually guide learners through content organization.</td>
<td>0.70 ± 0.07</td>
<td>0.72 ± 0.06</td>
<td>0.08</td>
</tr>
<tr>
<td><strong>Redundancy (Re):</strong> Avoid that which is redundant with narration or images.</td>
<td>0.86 ± 0.08</td>
<td>0.72 ± 0.06</td>
<td>0.08</td>
</tr>
<tr>
<td><strong>Spatial Contiguity (SpCt):</strong> Place corresponding slide contents near each other.</td>
<td>0.70 ± 0.07</td>
<td>0.72 ± 0.06</td>
<td>0.08</td>
</tr>
<tr>
<td><strong>Modality (Md):</strong> Complement graphics with narration, not blocks of text.</td>
<td>1.00 ± 0.00</td>
<td>1.00 ± 0.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Personalization (Pn):</strong> Use a conversational, informal style.</td>
<td>0.86 ± 0.08</td>
<td>0.72 ± 0.06</td>
<td>0.08</td>
</tr>
<tr>
<td><strong>Embodiment (Em):</strong> Augment instruction with dynamic, physical expression.</td>
<td>0.58 ± 0.06</td>
<td>0.58 ± 0.06</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Rubric:** Full credit = 1 pt / Partial credit = 0.5 pt / No credit = 0 pt

**Limitations & future work**

- Small sample size and restricted class continuity hinder generalization and detailed examination of confounders.
- Ongoing study of analogous two-credit-hour chemistry course may improve understanding of rigorous instruction and multiple presentation opportunities.

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**Sp24 students received four weeks of instruction while F23 students received none.** Still, a one-sided Mann-Whitney U test did not suggest improvement in usage of CTML principles.