Do More Difficult Tests Potentiate More New Learning?
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The Forward Effect of Testing
Retrieval practice has been shown to be more effective than restudy or no-interim practice to enhance subsequent learning of new information.¹

Taking a test enhances encourages participants to sustain effort and attention while encoding new information.²,³

The encoding effort hypothesis posits that experiencing retrieval difficulty enables participants to see that their previous encoding was insufficient and dedicate more effort to subsequent learning.²,³

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Sample Interim Review</th>
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<tbody>
<tr>
<td>Read Section 1</td>
<td>Restudy: Aristarchus was the first to propose that the sun was the center of the solar system (rather than the Earth)</td>
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<tr>
<td>Distractor</td>
<td>Difficult MC: Who was the first to propose that the sun was the center of the solar system (rather than the Earth)?</td>
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<tr>
<td>Read Section 2</td>
<td>a. Newton</td>
</tr>
<tr>
<td>Distractor</td>
<td>b. Aristarchus</td>
</tr>
<tr>
<td>Read Section 3</td>
<td>c. Kepler</td>
</tr>
<tr>
<td>Cued Recall for Section 3</td>
<td>Difficult MC</td>
</tr>
</tbody>
</table>

Research Question
Based on the encoding effort hypothesis, more difficult tests should produce greater subsequent learning of new material than easier tests. This hypothesis was supported in research with relatively simple materials (Swahili-English translations, unrelated word pairs).⁴

Do more difficult tests produce a greater forward effect of testing with educationally relevant materials?

Results

A. Retrieval difficulty was effectively manipulated t-test: p < .001; Cohen’s d = 1.145
B. No differences among interim review conditions on the section 3 cued recall test One-Way ANOVA: p = .94
C. No differences among interim review conditions on section 3 reading times, either One-Way ANOVA: p = .96

Discussion
The encoding effort hypothesis was not supported. Despite an effective manipulation of multiple-choice difficulty, no differences in subsequent effort or learning were observed.

Open Questions
• Can the lack of the FTE be attributed to a lack of differences in encoding effort (section 3 reading times)?
• Did experiences of difficulty not translate into more effort? Or, did our manipulation of difficulty not impact perceived difficulty?

Future Research
• Explore metacognitive and memory explanations why the forward effect of testing has been observed with text materials using interim free recall.⁵
• Use additional measures of subjective difficulty.
• Use additional measures of encoding effort.

References
⁴Hausman, H., Rhodes, M.G., Hahne, F., & Kubik, V. (2020, September 23). Does test difficulty moderate the forward testing effect? https://osf.io/6u23c/?view_only=5c4f9f3ec53b40e8684d6e352677f45d
Abstract

Several studies have shown that retrieval practice is more effective than restudy or no-interim practice to enhance subsequent learning of new information. We intended to test the encoding effort hypothesis of this forward effect of testing (FET) through an empirical study analyzing the effect of question difficulty, and therefore encoding effort, on subsequent retrieval. In our study, we presented participants with educationally-relevant reading materials split up into three sections. After each of the first two sections, an interim practice on the previous section was given depending on their randomly assigned group: restudy, easy multiple choice or difficult multiple choice. After the third section, all participants were given cued recall questions. If the encoding effort hypothesis is indeed true, we expect to find a significant difference in the cued recall scores with difficult multiple choice assigned participants scoring better than easy multiple-choice participants scoring better than restudy participants.