Cognitive load and spelling performance in a word dictation task: Contributions of the TBRS model

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Context

• Many variables have an impact on spelling performance
• Is the time variable a factor to be considered?
• Time as a cognitive resource
Spelling performance factors

• Type of practice (Ouellette, 2010; Pérez, Giraudo & Tricot, 2012)
• Frequency of word encounter (Bégin, Saint Laurent & Giasson, 2010)
• Spelling consistency (Fayol, Bonin & Collay, 2008)
• Graphical fluency (Fayol & Miret, 2005)
• Working memory capacity and cognitive load (Benton, Kraft, Glover & Plake, 1984; Fayol & Largy, 1992)
The Time-Based Resources Sharing model

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• We have tested the robustness of this model in school learning situations (Puma et al., 2018)
• We have shown its compatibility with cognitive load theory (Puma & Tricot, 2019)
Questions and hypotheses

• Is time having an effect on spelling performance?
• Does a better temporal management of the attentional resources:
  • reduce cognitive load?
  • increase performance?

• Hypotheses
  • Increasing the pause time between words increases performance by reducing cognitive load.
  • This effect is greater for novices than for experts.
Experiment 1

**Variables**
- Time to write: 18''/9''
- Dictation: A/B
- Grade: 3, 4, 5
- Order

**Participants**
- 28 grade 5
- 26 grade 4
- 19 grade 3

**Materials**
- Pre-recorded dictations
- Paas' scale
- Paper/pencil

**Mesures**
- Spelling performance
- Cognitive load

**Procedure**

<table>
<thead>
<tr>
<th></th>
<th>dictation A</th>
<th>dictation B</th>
</tr>
</thead>
<tbody>
<tr>
<td>day 1</td>
<td>18'' 9''</td>
<td>18'' 9''</td>
</tr>
<tr>
<td>day 2</td>
<td>9'' 18''</td>
<td>9'' 18''</td>
</tr>
</tbody>
</table>
Materials

Dictée pré-test
- suspendre
- raquette
- guirlande
- abricot
- confiture
- campagne
- accordéon
- photographe
- injustice
- grenouille

Dictée A
- apprendre
- recette
- fatigue
- abriter
- canapé
- champagne
- atlantique
- accorder
- visible
- téléphone
- aviatrice
- écureuil

Dictée B
- comprendre
- fillette
- guitare
- aborder
- caméra
- champignon
- pacifique
- accuser
- jetable
- pharmacie
- directrice
- feuillage

Echelle de Paas

Faire cette tâche m’a demandé un effort mental.

<table>
<thead>
<tr>
<th>Très très faible</th>
<th>très faible</th>
<th>plutôt faible</th>
<th>faible</th>
<th>moyen</th>
<th>élevé</th>
<th>plutôt élevé</th>
<th>très élevé</th>
<th>très très élevé</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>
Results

1. Significant grade main effect
2. No effect of time, nor expertise
Results

1. Significant grade main effect
2. No effect of time, nor expertise
Results

Significant interaction order/time to write

1st half

2nd half

18º  9º
Results

Significant interaction order/time to write

Significant cognitive load effect
Discussion

• Results are not compatibles with TBRS model
• Methodological issue? Repeated measures
• Theoretical issue? TBRS is not relevant because dictation is not a double task
Experiment 2

Variables
• Time to write: 18''/9''
• Grade: 4, 5

Participants
• 436

Materials
• Same
• Subjective questions

Measures
• Same
• Motivation, fatigue, difficulty, boredom

3 experimental conditions

<table>
<thead>
<tr>
<th></th>
<th>18''</th>
<th>9'</th>
<th>18''</th>
</tr>
</thead>
<tbody>
<tr>
<td>dictation A</td>
<td>227 participants</td>
<td>124 grade 5</td>
<td>103 grade 4</td>
</tr>
<tr>
<td>dictation A+B</td>
<td>209 participants</td>
<td>102 grade 5</td>
<td>107 grade 4</td>
</tr>
<tr>
<td>dictation B</td>
<td>164 participants</td>
<td>68 grade 5</td>
<td>96 grade 4</td>
</tr>
</tbody>
</table>

Independent measures
Results

1. No effect of grade (no difference in pre-test means)
2. No effect of time to write on performance
3. Significant effect on cognitive load
4. Effect on difficulty/fatigue $18'' < 9'$ and on boredom $18'' > 9'$
Results

1. No effect of grade (no difference in pre-test means)
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4. Effect on difficulty/fatigue $18'' < 9'$ and on boredom $18'' > 9'$
Experiment 3: replication + recall task
more « TBRS » compatible

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<th>Measures</th>
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<tr>
<td>• Time to write: 18&quot;/9&quot;</td>
<td>• 436</td>
<td>• Same +</td>
<td></td>
</tr>
<tr>
<td>• Grade: 4, 5</td>
<td></td>
<td>• Subjective questions</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• 4 word recall</td>
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<tr>
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</tr>
<tr>
<td>69 grade 4</td>
<td>46 grade 4</td>
</tr>
</tbody>
</table>

2 experimental conditions

Independantes measure
Results

pre-test means significantly different at pre-test!

1. Effect of grade level CM2 > CM1
2. Effect of time to write on performance 9’’ > 18’’ but not on recall
3. No effect on cognitive load and other measures
4. No effect on recall (comparison of experiments 2 and 3)
Conclusion

• Easy to implement, ecological experimental design, new.
• Surprising results, not compatible or partially compatible with the TBRS model?
• Boredom effect at 18" which could perhaps explain it?
• WM resource depletion?
Thank you!