Do research findings on schema-based instruction translate to the classroom?

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I do not have an affiliation (financial or otherwise) with a pharmaceutical, medical device or communications organization.

Je n’ai aucune affiliation (financière ou autre) avec une entreprise pharmaceutique, un fabricant d’appareils médicaux ou un cabinet de communication.
Cognitive Load Theory

• Cognitive load “how hard you are thinking”

• New information requires use of working memory

• Working memory is limited

• Overwhelming working memory may impair transformation into long-term memory
Cognitive Load Theory

Sorva, 2012, p.45
Cognitive Load Theory

- **Intrinsic**
  - Inherent difficulty of the task
- **Number of elements**
- **Element complexity**

Sorva, 2012, p.45
Cognitive Load Theory

- **Extraneous**

- Any load that doesn’t contribute to learning

Sorva, 2012, p.45
Cognitive Load Theory

- **Germane**
- Processing that helps learning

Sorva, 2012, p.45
## Traditional Approach

- **Focused on diagnosis**
- **Comprehensive**
- **Not all facts are important**

<table>
<thead>
<tr>
<th></th>
<th>Aortic Stenosis</th>
<th>Aortic Sclerosis</th>
<th>Mitral Regurgitation</th>
<th>Mitral Valve Prolapse</th>
<th>Ventricular Septal Defect</th>
<th>Hypertrophic Cardiomyopathy</th>
<th>Tricuspid Regurgitation</th>
<th>Aortic Regurgitation</th>
<th>Mitral Stenosis</th>
<th>Pericardial Rub</th>
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<tr>
<td><strong>Timing</strong></td>
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<td>Systolic</td>
<td>Systolic</td>
<td>Systolic</td>
<td>Systolic</td>
<td>Systolic</td>
<td>Diastolic</td>
<td>Diastolic</td>
<td>Diastolic</td>
<td>Systolic &amp; Diastolic</td>
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<tr>
<td><strong>Shape</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Location</strong></td>
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<td>Apex</td>
<td>Apex</td>
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<td>Base &amp; Apex</td>
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<tr>
<td><strong>Radiation</strong></td>
<td>Carotid</td>
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<td>Axilla</td>
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<td>Blowing</td>
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<td>Blowing</td>
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<td>High pitch, hollow</td>
<td>Low pitch, rumble</td>
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<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Double pulsation</td>
<td>Normal</td>
<td>Bounding</td>
<td>Difficult to palpate</td>
<td>Normal</td>
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<tr>
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<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>CY wave</td>
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<td>Normal</td>
</tr>
<tr>
<td><strong>Palpation</strong></td>
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<td>Normal</td>
<td>Displaced Apex</td>
<td>Normal</td>
<td>Parasternal thrill</td>
<td>Triple apex</td>
<td>RV heave</td>
<td>Displaced apex</td>
<td>Difficult to palpate</td>
<td>Normal</td>
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<td><strong>Extra heart sounds</strong></td>
<td>+/- S4</td>
<td>None</td>
<td>+/- S3</td>
<td>Mid-systolic click</td>
<td>Loud P2</td>
<td>+/- S3 or S4</td>
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</table>
Schemas

Blissett S et al, Medical Education 2012: 46: 815-822
Schemas and cognitive load

• Reduced intrinsic cognitive load

• Reduced extraneous load

• Enhance germane processing
Background

- Schemas are effective in research settings
  - Improved diagnostic performance
  - Reduced reported intrinsic cognitive load

Blissett S et al, Medical Education 2012: 46: 815-822
Pelaccia et al. Med Educ online 2011;16
McLaughlin et al. Teach Learn Med. 2007;19:35-41
How are classrooms different?

• Increased extraneous load
  » More distractions

• Increased extraneous load may offset optimizations of intrinsic or germane load
Research Question

Will schema-based instruction maintain its beneficial effects on diagnostic performance and cognitive load in a classroom setting?
101 first year Western University medical students

- Schema lecture (n=53)
- Traditional lecture (n=48)

Completion of Cognitive Load assessment

Completion of Diagnostic Performance Questions

Complementary Lecture

Follow up questionnaire
  Rating of Lecturers
  Rating of content of lectures
## Cognitive Load Assessment

<table>
<thead>
<tr>
<th>Completely Disagree</th>
<th>Completely Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

### Relating to the topic:
1. The topic covered in the lecture was very complex.
2. Using the topic of the lecture in a practical way (i.e., with a patient) is a very complex activity.
3. The lecture covered concepts and definitions that I perceived as very complex.

### Relating to the instruction and explanations:
4. The instructions and/or explanations during the lecture were very unclear.
5. The instructions and/or explanations were, in terms of learning, very ineffective.
6. The instructions and/or explanations were full of unclear language.

### Relating to my learning:
7. The lecture really enhanced my understanding of the topic(s) covered.
8. The lecture really enhanced my knowledge of the topic covered.
9. The lecture really enhanced my ability to apply the information practically (i.e., with a patient).
10. The lecture really enhanced my understanding of concepts and definitions.

Diagnostic performance questions

1) You examine a patient with a murmur and find that it is a systolic murmur, at the base of the heart, and it radiates to the carotids. The apex beat is sustained. What is the cause of the murmur?

   a. Atrial septal defect
   b. Aortic stenosis
   c. Hypertrophic cardiomyopathy
   d. Mitral stenosis
Results
Diagnostic performance higher with schema-based lecture

- Percentage Correct
  - Schema: 64
  - Traditional: 44

p<0.001
Intrinsic load lower with schema-based lecture

\[ p < 0.001 \]

\[ p = 0.36 \]
Lecturers and content were similar

• No difference in rating of lecturers (p=0.114)

• Majority of students agreed lectures:
  – Covered same topic
  – Covered same amount of content
Discussion

- Reduced intrinsic load correlates with improved diagnostic performance in schema-based lecture

- Similar effect sizes in classroom (20%) and research settings (30%)

- Similar reported extraneous load was expected
Limitations

• Lecturers were different

• Single medical domain

• Single centre study

• Distractions not directly measured
Conclusion

Schema-based instruction in a classroom maintained its beneficial effects on diagnostic performance and cognitive load.
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Questions
References


