Web-Based Intelligent Tutoring System Delivers Powerful Reading Comprehension Strategy to Children

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Puiwa Lei Ph.D.
Outline

• The Structure Strategy
• Web-Based Tutoring
• Efficacy Studies Grades 4, 5, 7, and 8
• Results
• Lessons learned
Models of Comprehension

• Construction Integration (Kintsch & van Dijk)
• Landscape (van den Broek)
• Text Structure Model (Meyer)
  – Top-Down
  – Integration with Prior Knowledge
  – Reader-Text-Task
The Text Structure Strategy

• Selection, Encoding, Strategic Memory, Comprehension Monitoring, and Application (Meyer, 1975 …)
• Five Text Structures and Nested Structures
• 4 Steps to Application
  – Signals/Linking Words
  – Identify Text Structure
  – Summarize Using a Main Idea Pattern
  – Recall/apply/monitor
4 Steps – Comparison Structure

1. Determine the text structure by finding the linking signaling words for the comparison text structure e.g., compared, different, in contrast, similarly, but, however, the same as, ...

2. Write a main idea using the main idea pattern for the comparison text structure
_____ and _____ were compared on ________, ________, and ________.

3. Recall information by using the main idea as a guide

4. Monitor comprehension by checking your main idea pattern to organize and review the parallel components of the compared entities
Example 1 – Comparison Structure

Differences Between Favorite Presidents of the U.S.A.

George Washington was a farmer and military commander. He was the first President of the United States. George Washington raised two stepchildren.

On the other hand, Abraham Lincoln was a lawyer. He was the 16th President of the United States. In contrast to George Washington, Abraham Lincoln had four sons, Robert, Edward, William, and Thomas.
Abraham Lincoln and George Washington were compared on jobs, order of presidency, and children.
Structure Strategy and Reading Comprehension

• Text Structure – Comparison, Problem and Solution, Cause and Effect, Sequence, and Description
• Expanding access to the structure strategy
• Consistent delivery, modeling, assessment, scaffolding, and feedback
• Multiple domains
• Wide range of reading levels and prior knowledge
• Designing for learners
• Integrating with current practices
Elephants

Two different kinds of elephants exist today; these two types are the African elephant and the Indian elephant. These interesting creatures differ dramatically in ears, backs, and how long they live. African elephants have very large ears. Their backs arch down in the middle. African elephants live 50 to 60 years.

Indian elephants have small ears. The backs of the Indian elephants arch up in the middle. They live 70 to 80 years.

Important Table for the Comparison Structure

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Signaling Words used in Comparison Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relations on the basis of differences and similarities. The main idea is organized in parts that provide comparison between differences and similarities.</td>
<td>instead; but; however; or; alternatively; whereas; on the other hand; while; compare; in comparison; in contrast; in opposition; not everyone; all but; have in common; similarities; share; resemble; the same as; just as; more than; longer than; less than; act like; look like; despite; although; just; options; difference; differentiate; different; (plus others you can find)</td>
</tr>
</tbody>
</table>

For example: Comparing Killer whales and Blue whales on size, color, and life span.

Click the signaling words in the passage and they will appear below.

1).

2).
Now we see clearly that the author has used the comparison structure to write this article because we have found the signaling words and see that Blue and Beaked whales are being compared. Next, I want you to fill in the main idea pattern.

There are enormous differences between Blue and Beaked whales. Blue whales are the largest animals that have ever lived. They may grow up to 100 feet long and can weigh more than 220 tons. They are dull blue. They have no teeth. Blue whales live in all the oceans. They feed almost entirely on krill, which are part of plankton.

Unlike the huge Blue whales, Beaked whales are smaller; some kinds of Beaked whales grow only about 15 feet long and others reach 40 feet. Beaked whales have a beaklike snout and two or four teeth in the lower jaw. They have no upper teeth. The Beaked whales feed mainly on squid and fish. The same as the Blue whales, the Beaked whales live in all the oceans.

Please click on a box below, then click on the details in the passage on the left. Do not type in the boxes below.

<table>
<thead>
<tr>
<th>Size/Length</th>
<th>Blue whales</th>
<th>Beaked whales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>220 tons</td>
<td>15 feet long and others reach 40 feet</td>
</tr>
<tr>
<td>Teeth</td>
<td>no teeth</td>
<td>upper</td>
</tr>
<tr>
<td>What they eat</td>
<td>plankton</td>
<td>squid and fish</td>
</tr>
<tr>
<td>Where they live</td>
<td>Blue whales</td>
<td>live in all the oceans</td>
</tr>
</tbody>
</table>
Comparison Structure

Relates ideas on the basis of differences and similarities.

Main Idea Pattern - Comparison

Mary-Kate and Ashley
(two or more ideas)
were compared on ________, ________, and ________.

Example: Comparing Killer whales and Blue whales on size, color, and life span.

Click the signaling words in the passage and they will appear below.

1)

5)

6)

Your Key to Success!

Click the key to flip it over. Double-click the key to close it.
Remember to use one signaling word in your first sentence when you start paragraph 1 about the Blue whales and another signaling word in your first sentence when you start paragraph 2 about the Beaked whales. Use your main idea to help you remember the details for your paragraphs.

Here are the signaling words that you found in the passage.
1.) differences
2.) unlike
3.) the same as

Structure: Comparison

Main Idea: (two or more ideas)

- blue and beaked whales

were compared on
- teeth, size, weight, what they eat
Trouble with Loring's Work

Structure: Comparison

Main idea: Comparing Families in Southern and New England colonies

Recall: The Americans lived to be 69 years old.

All I can remember because it was not interesting.

Loring blames his poor recall on the fact that the article wasn't interesting. However, one reason to use the Structure Strategy is that it can help you remember even when you read an uninteresting article. Loring needs to think about how he will fill in the main idea pattern for the Comparison Structure when he reads the article so he will write a good main idea and remember more of the ideas. Lots of times in school and life you have to learn things that are uninteresting. The Structure Strategy can help you do this. In fact, the more you know about something, the more interesting it usually gets.
ITSS Efficacy Studies

• 3 States
• Over 60 schools
• Over 14,000 total users on the system
• Approximately 130 teachers at each grade level
• Tools
  – Study Management
  – Data management


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The following tables are from recent publications cited below:


<table>
<thead>
<tr>
<th>Measures</th>
<th>Coefficient for ITSS (standard error) from HLM</th>
<th>Pooled student-level standard deviation</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray Silent Reading Test</td>
<td>2.34*** (.44)</td>
<td>11.45</td>
<td>.20</td>
</tr>
<tr>
<td>Comparison text</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signaling test</td>
<td>2.93*** (.39)</td>
<td>7.05</td>
<td>.42</td>
</tr>
<tr>
<td>Main idea quality</td>
<td>.82*** (.08)</td>
<td>1.54</td>
<td>.53</td>
</tr>
<tr>
<td>Total recall</td>
<td>5.57*** (1.07)</td>
<td>17.49</td>
<td>.32</td>
</tr>
<tr>
<td>Comparison competence</td>
<td>.64*** (.14)</td>
<td>2.42</td>
<td>.26</td>
</tr>
<tr>
<td>Problem and solution text</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total recall</td>
<td>2.38*** (.64)</td>
<td>12.20</td>
<td>.20</td>
</tr>
<tr>
<td>Problem and solution competence</td>
<td>.37** (.12)</td>
<td>2.45</td>
<td>.15</td>
</tr>
</tbody>
</table>

Note. Effect size = Adjusted difference between ITSS (coded ½) and Control (coded -½) groups divided by the student-level pooled standard deviation.

**p<.01, ***p<.001. Source: Wijekumar et al., 2013
## ITSS Efficacy 7th Grade Effect Sizes

<table>
<thead>
<tr>
<th>Measures</th>
<th>Coefficient for ITSS (standard error) from HLM (^a)</th>
<th>Pooled student-level pretest standard deviation</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray Silent Reading Test</td>
<td>2.06** (.48)</td>
<td>11.52</td>
<td>.18</td>
</tr>
<tr>
<td>Comparison text (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signaling test</td>
<td>1.59*** (.41)</td>
<td>8.32</td>
<td>.19</td>
</tr>
<tr>
<td>Top level structure</td>
<td>.68*** (.12)</td>
<td>1.94</td>
<td>.35</td>
</tr>
<tr>
<td># issues</td>
<td>.27* (.12)</td>
<td>1.48</td>
<td>.18</td>
</tr>
<tr>
<td>Competence</td>
<td>.29* (.12)</td>
<td>2.37</td>
<td>.12</td>
</tr>
<tr>
<td>Comparison text (2) Advanced</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top level structure</td>
<td>.49*** (.13)</td>
<td>1.58</td>
<td>.31</td>
</tr>
<tr>
<td># issues</td>
<td>.14* (.06)</td>
<td>.54</td>
<td>.26</td>
</tr>
<tr>
<td>Competence</td>
<td>.27** (.10)</td>
<td>1.09</td>
<td>.25</td>
</tr>
<tr>
<td>Main Idea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top level structure</td>
<td>.70*** (.10)</td>
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\(^*\) p<.05, **p<.01, ***p<.001.
Lessons Learned

• Teacher roles in technology use
• Teacher knowledge and efficacy in text structure and teaching with text structure
• Misconceptions about text structure
• School technology infrastructure and support variability
Related findings and New Developments

• Writing* (collaboration with Drs. Karen R. Harris and Steve Graham, Arizona State University)

• Strategy Instruction on the Web for Spanish speaking English Language Learners (SWELL)

• Changing profiles of learners

• Teacher and intelligent tutor roles

Wijekumar, Harris, Meyer, Graham, Lei (2013-2016) U.S. Department of Education
When Linking Signals are Not Present

Favorite Presidents of the U.S.A.

George Washington was a farmer and military commander. He was the first President of the United States. George Washington raised two stepchildren.

Abraham Lincoln was a lawyer. He was the 16th President of the United States. George Washington, Abraham Lincoln had four sons, Robert, Edward, William, and Thomas.

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**Tabla Importante para la Estructura de Comparación**

<table>
<thead>
<tr>
<th>Comparación</th>
<th>Las palabras señaladas que se usan en la estructura de comparación.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaciona ideas en la base de las diferencias y las semejanzas. La idea principal está organizada en partes que proveen comparación entre las diferencia y las semejanzas.</td>
<td>en vez de; pero; sin embargo; no obstante; o; o bien; como alternativo; mientras que; en tanto que; por el otro lado; mientras; compara; en comparación; por el contrario; a diferencia de; en oposición; no todos; todos excepto; tener en común; semejanzas; comparte; parecerse; el mismo como; así como; más que; más largo que; menos que; comportarse como; parece que; a pesar de; aunque; justo; opciones; diferencia; distinguir; diferente; ...(más otras que puede encontrar)...</td>
</tr>
</tbody>
</table>

Por ejemplo: La comparación de las orcas y las ballenas azules en el tamaño, el color, y el periodo...
Elephants

Two different kinds of elephants exist today. These two types are African and Indian elephants. These creatures differ in their ears, backs, and how long they live. African elephants have large ears. Their backs arch down in the middle. They live 50 to 60 years.

Indian elephants have small ears. Their backs arch up in the middle. They live 70 to 80 years.

Structure: Comparison

Main Idea: (two or more ideas)

african and indian elephants are compared on

were compared on

ears, backs, and how long they live

In contrast to the African elephant has...
I strongly believe all students should go outside for recess, and I will tell you why. **One reason why everyone should go outside is because children need to move their bodies.** When kids are outside for recess, they are doing a lot of running, jumping, and climbing. Another reason for going outside is to get out of the classroom. It is super hard to sit in one place all day. When kids get up and go outside they will be ready to learn when they come back inside. Finally, when students go outside for recess, they get to meet kids from different grades. They can teach you games that you don't know. Now you know what I believe. Kids should go outside for recess so that they can move their bodies, get out of the classroom for a break, and meet other students.
Email: K_Wijekumar@tamu.edu

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