Schema Strategies and Reading Comprehension

Rebeka C. Gutkind, PhD
What to Expect

This study:

- Various types of comprehenders based on the concept of schema theory.
- Know how students think
- Opened our eyes (as teachers) what are students doing as they are reading?
What to Expect

Visible learning......

- The teacher could see and hear how the students were learning

- The children’s thinking became visible:
  - *Think-alouds*
  - *Analysis of responses*

*(John Hattie, 2009)*
Outline of Presentation

1. Schema Theory
2. Schema Strategies
   - Comprehension
   - Inferences
   - Reading Comprehension
   - Learning
3. Previous Research
4. Current Research- Results
5. Examples of Varied Comprehenders
6. And so what....?
7. Implications for Instruction
Schema Theory

In Essence:

Schema Theory is a theory about

KNOWLEDGE

Representation of knowledge
The use of this knowledge within the structure of the mind.

(Anderson & Pearson, 1984)
Schema Theory

Totality of Experiences, Knowledge, Emotions, and Understanding, which effects What and How we learn

(Anderson & Pearson, 1984)
Schema Theory

- A framework for interpreting one’s world
- A continuous process that occurs in several domains
- Acquisition of learning
Schema Theory

Formative Research

Bartlett/Kant 1929, 1932:
Interpretation of the world occurs within organized structures or schemas. Schemata mediated between external world and internal mental structures.

Piaget & Inhelder, 1969
Cognitive Structures that underlie intelligence and change/adapt to the environment: assimilation and accommodation

Bruner, 1979
Constructing new meaning and knowledge from authentic experiences
Rumelhart, 1980, pp. 33-34

“... building blocks of cognition. They are the fundamental elements upon which all information processing depends. Schemata are employed in the process of interpreting sensory data (both linguistic and non-linguistic). . .”
Schema Theory

Rumelhart, 1980, pp. 33-34

in RETRIEVING information from memory,
in ORGANIZING actions,
in DETERMINING goals and sub goals,
in ALLOCATING resources, and
generally,
in guiding the FLOW OF PROCESSING in the system".
What are Schema Strategies?
What are Schema Strategies?

SCHEMATA:

- have . . . . . VARIABLES
- can . . . . . EMBED ONE WITHIN ANOTHER
- represent . . . . KNOWLEDGE ENCYCLOPEDIA

(Rumelhart & Ortony, 1977)
What are Schema Strategies?

Schema and Comprehension

Schema and Inference

Schema and Reading Comprehension

Schema and Learning
Schema and Comprehension

Information Processing System

Schema Selection                        Schema Interpretation
Schema and Inference

Unobserved Input

Notion of Parts to Whole

Assigning default values
Schema and Reading Comprehension

Equation of Schema and Reading Comprehension

Accesses Appropriate Schema = Good Comprehension

Accesses Appropriate Schema – insufficient clues = Inadequate Comprehension

Accesses Schema (inconsistent with author’s intent) = Understanding of Passage + Misunderstanding of Author’s Intent

(Rumelhart, 1980)
Schema and Learning

Three Modes of Learning

Accretion
Schema and Learning

Three Modes of Learning

Tuning
Schema and Learning

Three Modes of Learning

Restructuring
PREVIOUS RESEARCH
Previous Research

Activation and Construction of Schema
Rumelhart (1984)

After reading 2-3 sentences in a paragraph.....
Presented adults with the following questions:

WHO . . . were the characters
WHAT . . . they perceived was happening
WHY . . . characters acted as they did
WHEN . . . the event occurred
WHERE . . . the story took place
Previous Research

Business had been slow since the oil crisis

Nobody seemed to want anything really elegant anymore

Suddenly the door opened and a well-dressed man entered the showroom floor. John put on his friendliest and most sincere expression and walked toward the man.

Rumelhart, 1984, p. 6
Previous Research

Activation and Construction of Schema
Rumelhart (1984)

Agreement among participants:
- inherent outline of the story
- participants activated, evaluated, refined, discarded
- consistent patterns of hypothesis generating
Previous Research

Wade (1990)

**Investigated** children’s use of varied schema strategies in reading comprehension

**Results** indicated varied types of comprehenders
Previous Research

Wade (1990)

Children reported their insights by responding to two questions:

what do you think this is about
what clues in the story helped you

Responses: categorized according to similarities in cognitive processing
**Good Comprehender** – generates hypotheses, tunes, monitors incoming information

**Non-risk taker** – lacks the ability to select appropriate schema

**Non-integrator** – new schema is generated for every sentence read

**Schema imposer** – keeps same schema (no “fix-up” strategies)

**Storyteller** – relates prior knowledge that does not relate to the text  

(Wade, 1990)
CURRENT RESEARCH
## Current Research

### Sample

81 Fourth-graders  
32 Third-graders

<table>
<thead>
<tr>
<th>Fourth Grade</th>
<th>Below-Average below 25%*</th>
<th>Average 25 – 75%*</th>
<th>Above-Average Above 75%*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third Grade</td>
<td>Average 25 – 75%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* *performance level based on the ITBS Reading Comprehension subtest*
Current Research

Think-alouds: read three short story passages out-loud. After every one or two sentences in each passage, ask the probing questions.

Code according to Wade’s (1990) five types of comprehenders plus three more types of comprehenders (Descriptors of Comprehender Types)

Record data on the Schema Coding Form
**Current Research**

**Probing Questions and Procedure**

- **Stage One: Initial Questions**
  What do you think this is about?  
  What clues in the story helped you? or What information led you to think that?

- **Stage Two: Probing Questions**
  - Participant Response in Stage One: “I don’t know”
    Can you give me any guesses?  
    Can you describe what is happening?  
    Can you tell me anything else?
  - Participant Response in Stage One: Change and/or Tuning of Schema  
    What made you change your mind?  
    What information in the story made you change your mind?

- **Retelling**
Current Research

Additional Types of Comprehenders

**Schema omitter** – tuning and relates text content with background knowledge, but does not activate a particular schema

**Non–integrator: limited tuning** – new schema is generated for every segment read with minimal use of tuning

**Restater** – paraphrases, no activation of schema
## Current Research

### Wade (1990) vs. Gutkind (2012)

<table>
<thead>
<tr>
<th>Good Comprehender</th>
<th>Non-risk Taker</th>
<th>Non-Integrator</th>
<th>Schema Imposer</th>
<th>Storyteller</th>
<th>Schema Omitter</th>
<th>Non-Integrator: Limited Tuning</th>
<th>Restater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesizes Monitors</td>
<td>“I don’t Know”</td>
<td>Non-connective clues</td>
<td>Keeps initial schema</td>
<td>Exclusive prior knowledge</td>
<td>Uses tuning No hypothesis</td>
<td>Some use of tuning New schema for every segment of text</td>
<td>Paraphrases</td>
</tr>
</tbody>
</table>

### Good Comprehender
- Use of tuning and/or restructuring

### Medium Comprehender
- Beginning to retune away from inefficient strategizing

### Inefficient Comprehender
- Multiple inefficient strategizing
  - • Schema Omitter
  - • Non-integrator: Limited Tuning
  - • Non-integrator
  - • Restater
  - • Schema Imposer
  - • Non-risk Taker
  - • Story teller
Results

**Percentage of Comprehender Types for Group 1 across three Stories**

<table>
<thead>
<tr>
<th>Type of Comprehenders</th>
<th>Story 1</th>
<th>Story 2</th>
<th>Story 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Good Comprehender</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Medium Comprehender</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Inefficient Comprehender</td>
<td>9</td>
<td>69.2</td>
<td>9</td>
</tr>
<tr>
<td>Mixed (Inefficient Comprehender/Good Comprehender)</td>
<td>4</td>
<td>30.8</td>
<td>4</td>
</tr>
</tbody>
</table>

\[n = 13\]

**Frequency Table of Schema Strategy Use of Group 1 across three Stories**

<table>
<thead>
<tr>
<th>Categories</th>
<th>Story 1</th>
<th>Story 2</th>
<th>Story 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Good Comprehender</td>
<td>10</td>
<td>19.2</td>
<td>10</td>
</tr>
<tr>
<td>Schema Omitter</td>
<td>1</td>
<td>1.9</td>
<td>0</td>
</tr>
<tr>
<td>Non-Integrator: Limited Tuning</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Restater</td>
<td>14</td>
<td>26.9</td>
<td>10</td>
</tr>
<tr>
<td>Non-Risk Taker</td>
<td>3</td>
<td>5.8</td>
<td>7</td>
</tr>
<tr>
<td>Schema Imposer</td>
<td>8</td>
<td>15.4</td>
<td>0</td>
</tr>
<tr>
<td>Non-Integrator</td>
<td>14</td>
<td>26.9</td>
<td>22</td>
</tr>
<tr>
<td>Storyteller</td>
<td>2</td>
<td>3.8</td>
<td>3</td>
</tr>
<tr>
<td>Total ( n )</td>
<td>52</td>
<td></td>
<td>52</td>
</tr>
</tbody>
</table>
## Results

**Percentage of Comprehender Types for Groups 2, 3 and Third Grade across Three Stories**

<table>
<thead>
<tr>
<th>Type of Comprehenders</th>
<th>Story 1</th>
<th>Story 2</th>
<th>Story 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Good Comprehender</td>
<td>14</td>
<td>34.1</td>
<td>14</td>
</tr>
<tr>
<td>Medium Comprehender</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Inefficient Comprehender</td>
<td>19</td>
<td>46.3</td>
<td>7</td>
</tr>
<tr>
<td>Mixed (Inefficient Comprehender/Good Comprehender)</td>
<td>8</td>
<td>19.5</td>
<td>6</td>
</tr>
</tbody>
</table>
# Results

*Frequency Table of Schema Strategy Use of Groups 2, 3 and Third-Graders across Three Stories*

<table>
<thead>
<tr>
<th>Categories</th>
<th>Group 2</th>
<th>Group 3</th>
<th>3rd Grade</th>
<th>Group 2</th>
<th>Group 3</th>
<th>3rd Grade</th>
<th>Group 2</th>
<th>Group 3</th>
<th>3rd Grade</th>
<th>Group 2</th>
<th>Group 3</th>
<th>3rd Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Good Comprehender</td>
<td>70</td>
<td>42.7</td>
<td>67</td>
<td>62.0</td>
<td>25</td>
<td>32.9</td>
<td>74</td>
<td>45.1</td>
<td>69</td>
<td>63.9</td>
<td>21</td>
<td>27.6</td>
</tr>
<tr>
<td>Schema Omitter</td>
<td>2</td>
<td>1.2</td>
<td>4</td>
<td>3.7</td>
<td>0</td>
<td>0.0</td>
<td>2</td>
<td>1.2</td>
<td>5</td>
<td>4.6</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Non-Integrator: Limited Tuning</td>
<td>4</td>
<td>2.4</td>
<td>1</td>
<td>.9</td>
<td>3</td>
<td>3.9</td>
<td>5</td>
<td>3.0</td>
<td>1</td>
<td>.9</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td>Restater</td>
<td>26</td>
<td>15.9</td>
<td>7</td>
<td>6.5</td>
<td>20</td>
<td>26.3</td>
<td>6</td>
<td>3.7</td>
<td>2</td>
<td>1.9</td>
<td>7</td>
<td>9.2</td>
</tr>
<tr>
<td>Non-Risk Taker</td>
<td>2</td>
<td>1.2</td>
<td>2</td>
<td>1.9</td>
<td>0</td>
<td>0.0</td>
<td>8</td>
<td>4.9</td>
<td>2</td>
<td>1.9</td>
<td>3</td>
<td>3.9</td>
</tr>
<tr>
<td>Schema Imposer</td>
<td>20</td>
<td>12.2</td>
<td>8</td>
<td>7.4</td>
<td>11</td>
<td>14.5</td>
<td>10</td>
<td>6.1</td>
<td>5</td>
<td>4.6</td>
<td>7</td>
<td>9.2</td>
</tr>
<tr>
<td>Non- Integrator</td>
<td>33</td>
<td>20.3</td>
<td>18</td>
<td>16.6</td>
<td>11</td>
<td>14.5</td>
<td>57</td>
<td>34.8</td>
<td>23</td>
<td>21.1</td>
<td>25</td>
<td>32.9</td>
</tr>
<tr>
<td>Storyteller</td>
<td>7</td>
<td>4.3</td>
<td>1</td>
<td>.9</td>
<td>6</td>
<td>7.9</td>
<td>2</td>
<td>1.2</td>
<td>1</td>
<td>.9</td>
<td>10</td>
<td>13.2</td>
</tr>
<tr>
<td>Total n</td>
<td>164</td>
<td>108</td>
<td>76</td>
<td>164</td>
<td>109</td>
<td>76</td>
<td>246</td>
<td>162</td>
<td>111</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results
## Current Study - Restructuring Strategies

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Third-Graders</th>
</tr>
</thead>
<tbody>
<tr>
<td>below-average</td>
<td>average</td>
<td>above-average</td>
<td>average</td>
</tr>
<tr>
<td>0 participants</td>
<td>3 participants</td>
<td>5 participants</td>
<td>2 participants</td>
</tr>
</tbody>
</table>
Results

*Statistically Significance*

Groups 1, 2, and 3 across all three stories in comprehender types and patterning types
Results

Fourth-Graders with Reading Difficulties

- Difficulty with making coherent representation of text
- Difficulty with making cross-sentence connections
- Selected partial information from the text
- Did not always assimilate new information to modify existing schema
- Missing the intent of the segment or sentence
- Overall difficulty with efficient strategy processing
**Results**

*Average and Above Average Fourth-Graders*

- Demonstrated more efficient strategy use than the below average fourth-graders

- Difficulty with making cross-sentence connections for coherent representation of text (*about one-half of average fourth-graders and approximately one-quarter of the above-average fourth-graders*)
Results

Third-Graders

- Demonstrated more efficient strategy use than the below-average fourth-graders.

- Difficulty with making cross-sentence connections for coherent representation of text
Results

- Good Comprehender
- Inefficient Comprehender

Mixed Comprehender
<table>
<thead>
<tr>
<th>Types of Comprehenders</th>
<th>Hypothesis</th>
<th>Text Information</th>
<th>Understanding Meaning</th>
</tr>
</thead>
</table>
| **Good Comprehender**  | -Generates hypothesis  
- Supports hypothesis  
- Uses information from text  
- Relates text content with background knowledge  
- Integrates new activated schema  
- Monitors info that conflicts with generated schema by tuning or creating a new schema  
- Monitors info that conflicts with the schema of the moment by tuning or creating a new schema  
- Recognizes point of story | -Uses information from text  
- Relates text content with background knowledge  
- Integrates new activated schema  
- Monitors info that conflicts with generated schema by tuning or creating a new schema  
- Monitors info that conflicts with the schema of the moment by tuning or creating a new schema  
- Recognizes point of story | -Recognizes point of story |
| **Schema Omitter**     | -Does not generate hypothesis  
- Uses information from the text  
- Relates text content with background knowledge  
- Integrated new information with activated schema  
- Monitors info that conflicts with generated schema but does not create a new schema  
- Monitors info that conflicts with the schema of the moment by tuning or creating a new schema  
- Sometimes recognizes the point of the story | -Uses information from the text  
- Relates text content with background knowledge  
- Integrated new information with activated schema  
- Monitors info that conflicts with generated schema but does not create a new schema  
- Monitors info that conflicts with the schema of the moment by tuning or creating a new schema  
- Sometimes recognizes the point of the story | -Sometimes recognizes the point of the story |
| **Non-integrator**     | -Generates new hypothesis for every segment of the text  
- Never relates new hypothesis to previous hypothesis  
- Uses selected info from the text  
- Fragmented/disconnected relation of text content with background knowledge  
- Disregards info that conflicts with the schema of the moment | -Uses selected info from the text  
- Fragmented/disconnected relation of text content with background knowledge  
- Disregards info that conflicts with the schema of the moment | -Does not recognize point of the story |
<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Characteristics</th>
<th>Storytelling Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-integrator: Limited Tuning</td>
<td>Generates new hypothesis for every segment of the text</td>
<td>Uses selected information from the text</td>
<td>Does not recognize point of the story</td>
</tr>
<tr>
<td></td>
<td>Relates new hypothesis to selected segments of previous hypothesis</td>
<td>Fragmented/disconnected relation of text content with background knowledge</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disregards information that conflicts with the schema of the moments</td>
<td></td>
</tr>
<tr>
<td>Restater</td>
<td>Does not generate hypothesis</td>
<td>Restates and/or paraphrases information from the text</td>
<td>Does not recognize point of the story</td>
</tr>
<tr>
<td>Schema Imposer</td>
<td>Generates initial hypothesis without option for alternative hypothesis</td>
<td>Uses selected information from text that matches the initial hypothesis</td>
<td>Does not recognize point of the story</td>
</tr>
<tr>
<td></td>
<td>Supports only the initial hypothesis</td>
<td>Partial relation of text content with background knowledge</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disregards information that conflicts with initial activated schema</td>
<td></td>
</tr>
<tr>
<td>Non-risk taker</td>
<td>Does not generate hypothesis</td>
<td>Uses minimal information from the text</td>
<td>Does not recognize point of the story</td>
</tr>
<tr>
<td>Storyteller</td>
<td>Generates hypothesis non-related to text</td>
<td>Does not use information from text</td>
<td>Does not recognize point of the story</td>
</tr>
</tbody>
</table>
EXAMPLES OF VARIED COMPREHENDERS
<table>
<thead>
<tr>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am large and very heavy</td>
</tr>
<tr>
<td>- bulldozer</td>
</tr>
<tr>
<td>I am gray</td>
</tr>
<tr>
<td>- bulldozer, ‘cause some bulldozers can be gray</td>
</tr>
<tr>
<td>I have a trunk that you can’t pack</td>
</tr>
<tr>
<td>- a bulldozer has a digger, so that can be a trunk</td>
</tr>
<tr>
<td>You can see me at the circus</td>
</tr>
<tr>
<td>- there are bulldozers in the circus</td>
</tr>
</tbody>
</table>
Examples
Varied Types of Comprehenders

I am the color of a carrot
- *tangerine*

Find seeds inside of me
- *tangerine*

I am the size and shape of a baseball
- *well, a tangerine is smaller than a baseball, so I think it is an orange*

Squeeze me to make juice
- *an orange*
Examples
Varied Types of Comprehenders

I am round
- *ball*

I am many colors, but mostly blue
- *the ocean or sea*

Use me at home or at school
- *a notebook*

Spin me to see the whole world
- *playing pin the donkey on the tail*
Examples
Varied Types of Comprehenders

I have doors, but rarely have windows.
- office building

Several people can ride in me at once
- Well, you can’t ride in an office building, so I will say a van

Call for me by pushing a button
- Well you don’t call for someone in a van, but you need to push a button when you ring a doorbell and it says it has doors in the first clue, so it’s a door bell.

I go up and down in tall buildings.
- It says tall buildings, so I guess it is an office building
Examples

Varied Types of Comprehenders

I have a large head
- Well, it could be an animal or a person, or an insect; not sure

I live in an ocean
- Well it is something that lives in the ocean and has a large head –maybe some kind of fish or maybe a plant

I have eight legs.
- I know it is some kind of fish, but I don’t know which kind
I have keys, but no locks.
- *It doesn't have any locks*

I have pedals, but don’t move
- *It can’t move because it has pedals*

I make noise when you touch me.
- *It can make noise*

Touch my keys to make music
- *It makes music when you touch it*
Examples
Varied Types of Comprehenders

You can see me, but can’t hold me
- *It’s about when a baby feels you can’t hold him, but the baby still sees the mommy.*

I follow you everywhere
- *The baby follows the mommy everywhere because he wants mommy*  

See me when the sun shines
- *One day, the mommy took the baby outside to see the sun shining*

I am long in the morning and evening, but short at noon
- *Mommy takes the baby for long walks*
Examples
Varied Types of Comprehenders

We are white and yellow.
- a balloon, no...I don’t know
We are only kernels- not generals
- I don’t know
We burst out of our shells when we get how.
- ..don’t know
Eat us by the handful at the movies
- Oh..., maybe it is ?....., no.....I don’t know
Practice with a Partner

1. CHOOSE ONE STORY

2. ROLE PLAY WITH A PARTNER

3. CODE YOUR RESULTS
When you gain speed, the grown-up will run alongside of you and still hold on.

**Researcher:** “So now tell me what do you think this story is about?”

- **Schema Omitter Response:** “A motorcycle, or a car...it can’t be a motorcycle, it can’t because you can’t run that fast. (It’s) about a guy who is on something, I can’t figure out what, but he’s on something and he has to be helped by a grown up.”

- **Non–integrator Response:** “The story is about when a car is about to hit him so he holds onto his hand.”

- **Restater Response:** “Gaining Speed.”

- **Schema Imposer Response:** (Previous responses were about rollerblading) “That a person who is saying that a grown up helps him and that like he’s on rollerblades and when he gains speeds, he runs.”
The first thing you will want to do is find a grown-up to help you out. Have the grown-up hold on tight so that everything is steady while you climb on.

Researcher: “What do you think this story is about?”
  - Good Comprehender Response: “A boy who wants to climb a tree.”
  - Researcher: “What clues made you think climb a tree?”
  - Good Comprehender Response: “It said to hold on tight so maybe he can climb.”
  - Storyteller Response: “A babysitter, the children - that the children’s parents are going out.”

Researcher: “What clues in this story made you think it’s a babysitter?”
  - Storyteller Response: “Getting into trouble.”
Responses from Story 2

Text: It seems to be dead, but inside something wonderful is happening. After a brief struggle, a body with folded wings breaks out of the silken shell.

- **Researcher:** “What do you think it’s talking about?”
- **Good Comprehender Response:** “Now it became a butterfly....well actually it might be a caterpillar. I’ll say a caterpillar because caterpillars have big long cocoon and becomes butterflies.” (Explanation: the student is using the information to tune or change his current activated schema).
- **Non–integrator Response:** “An animal is having a baby”
- **Researcher:** “What clues made you think that?”
- **Non–integrator Response:** “Breaking out.” (Explanation: the student generated a schema based on one clue in the story).
- **Schema Imposer Response:** “A bat.” (Explanation: participant’s first activated schema was about a bat. He maintained this schema for half of the story).
- **Restater Response:** “You think that something is bad, but really it’s good.”
- **Researcher:** “What clues made you think that?”
- **Restater Response:** “Because it seems to be dead, but something wonderful is happening.”
Text: Sometimes it can turn black or brown when it mixes with mud and dirt. Sometimes it looks light and delicate.

- **Researcher:** “What do you think it’s about?”
- **Good Comprehender Response:** “Snow being mixed with mud and dirt, and then it gets all black.”
- **Non–integrator Response:** “I think it’s a pig.”
- **Researcher:** “What made you think it was a pig?”
- **Non–integrator Response:** “Turning black and brown when it plays in mud and pigs like to play in the mud.” (Explanation: did not include previous clues about color).
- **Restater Response:** “When it mixes, when mud and dirt mix up and then it becomes very delicate.”
- **Schema Imposer Response:** “... maybe it’s still a firefly”. (Explanation: participant’s first activated schema was about a firefly).
Restructuring Responses from Story 3

**Researcher:** “Okay, now tell me in your own words what this whole story is about.”

- **Participant #32:** “It’s talking about snow.”

**Researcher:** “What clues made you think that it was snow?”

- **Participant #32:** “Because it can turn black or brown when it mixes with mud and dirt. Sometimes it looks light and delicate ... and a cubic foot of it can weigh only six pounds, but when it is compressed, it can weigh 30 pounds, when it is squished together.

- **Participant #45:** “Snow”

**Researcher:** “What clues made you think it’s about snow?”

- **Participant #45:** “Colorless...it can turn black or brown...it can weigh six pounds when it’s less and ten pounds when its more. It’s an insulator. When you put a thermometer in it, it gets colder (warmer).”

- **Participant #62:** “Snow and what it could turn into and it could get very big and powerful and it’s one of nature’s best insulators and that’s it’s kind of a science experiment of it.”

**Explanation:** During the think-aloud, each of the above participants demonstrated a lack of knowledge regarding certain facts pertaining to snow. At the retelling, they were able to reconstruct a new “snow” schema that incorporated these additional facts (insulator, weight, etc.).
Validation

*Importance* of using schema strategizing

Regardless of students’ reading comprehension levels . . . *Need for teaching*...

Schema Strategizing . . .
Metacognitive Strategies

Relevant vs. Irrelevant
Cross-Sentence Connections
Schema Self-Awareness \((\text{accretion})\)
Verbalizing Students’ Schemata \((\text{tuning & restructuring})\)
Implications for Instruction
Implications for Instruction

Pictorial Presentation

Concretizes changes in schema

(based on Visualizing/Verbalizing Bell, 1991)
Implications for Instruction

Changes in Vocabulary

Teaches relevant vs. irrelevant

*It was the best of times.......*

- what schemata are activated?

*It was the worst of times.....*

-what schemata are activated now

-how are these two schemata different?

-how are these two schemata the same?
Implications for Instruction

Relevant vs. Irrelevant Information

- *The house was* dark, and eerie.
  what schemata are activated?
- *The house was* bright and cheery.
  what schemata are activated?
  how did my schema change (tuning)
Implications for Instruction

- The wind howled through the cracks in the windows.
  what schemata are activated?
- A soft breeze flowed through the open windows
  what schemata are activated?
  how did my schema change (tuning)
Implications for Instruction

Cross-Sentence Connections

Which sentences create a theme or a cohesive picture in your mind’s eye (cohesive representation of printed text)
Implications for Instruction

Riddles

*We are white and yellow*

- *what schemata are activated?*  
  (accretion)
- *what are the key clues?*  
  (relevant vs. irrelevant)
Implications for Instruction

We are only kernels

- does our schema change?
  (tuning)
- what clues changed our previous schema?
  (relevant vs. irrelevant)
- what clues maintained our previous schema?
  (relevant vs. irrelevant)
- are all the clues connected?
  (cohesive representation of text)
Implications for Instruction

We **burst out of our shells**

*when we get hot*

does our schema change?

(tuning)

what clues changed our previous schema?

(tuning; relevant vs. irrelevant)

what clues maintained our previous schema?

(relevant vs. irrelevant)

are all the clues connected?

(cohesive representation of printed text)
We need to make learning . . .
Visible !