Teaching Science with an Interactive Whiteboard:
Examining an Elementary Teacher’s Pedagogical Strategies

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Science Education

• Canada ranked 6/65 countries (PISA Report, 2009)

• Scientific literacy is best-supported when teachers engage students in active inquiry, problem solving, and decision making

• Promoting sense of discovery and the science to students’ lives

• Students can relate to technology
The Interactive Whiteboard (IWB) and Science Teaching

• A useful tool for teaching science
• Creates opportunities for interaction
• Promotes critical thinking and inquiry-based learning
IWB-Integrated Science Pedagogical Strategies

- Student Participation and Collaboration
- Immediate Feedback
- Integrate IWB with Other Resources
- Informal Learning and Assessment
- “Active” Learning Opportunities
- Learning Needs
- Interactivity
- Dynamic Visual Presentation
Research Question

What pedagogical strategies emerged when using the IWB to teach science?

Method

• Single Case Study: elementary teacher “Julie”
• Twelve supportive PD sessions over three months
• Focus: Grade 5 science
Supportive PD Design

1. Basic IWB Skills Acquisition
2. Incorporation of IWB Tools for Lesson Design
3. Classroom Implementation

- 3 in-class observations and 3 lesson debriefs
- Observational and transcriptional data were thematically-analyzed as part of a larger study
Three Grade 5 Science Lessons

1. Renewable Energy
   - Solar Energy
   - Hydroelectric Energy
   - Geothermal Energy
   - Energy: The Fuel of Life
   - Biomas Energy
   - Wind Energy

2. Non-Renewable Energy
   - Fossil Fuel Oil
   - Coal
   - Nuclear
   - Natural Gas

3. Examples of Reusable and Non-Reusable Items

<table>
<thead>
<tr>
<th>Reusable Items</th>
<th>Non-Reusable Items</th>
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</thead>
<tbody>
<tr>
<td>Juice with straw</td>
<td>Juice box with straw</td>
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<tr>
<td>Juice box</td>
<td>Milk carton</td>
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<tr>
<td>Battery</td>
<td>Newspaper</td>
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<tr>
<td>Newspaper</td>
<td>Water bottle</td>
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<tr>
<td>Bottle tops</td>
<td>Pop bottle</td>
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<tr>
<td>Water bottle</td>
<td>Cup with straw</td>
</tr>
<tr>
<td>Tuna can</td>
<td>Paper bag</td>
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<tr>
<td>Bottle</td>
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A visual display of important scientific concepts and processes

“a modern bigger and brighter overhead projector [that’s easier for students to see and relate to technology-wise], “kind of like comparing an HD TV to an older TV […] a better picture […] it’s very colourful too!”

“When I’d tell the students we’re going to do a Smart board activity today, they are excited and they say alright! (…) because it’s not something they usually do with me and is something new [for them].”
Strategic questioning using IWB resources

Use the pen to write your answers. The word bank will help you.

<table>
<thead>
<tr>
<th>3 sources of renewable energy</th>
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</thead>
<tbody>
<tr>
<td>2 harvested resources</td>
<td></td>
</tr>
<tr>
<td>3 products made from oil</td>
<td></td>
</tr>
<tr>
<td>another word for oil</td>
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<tr>
<td>conserve</td>
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<td>renewable</td>
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<td>extract</td>
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trees  water  sun  petroleum  asphalt  makeup  plastics  to store up or save  resources taken from earth  a natural energy source that can be replaced  corn
Step-by-step discussion
Promoting an (inter)active learning environment

• Creating opportunities for student participation and manipulation

Combining technologies with other resources

• Activity stations, flipchart, online lessons, videos

Obtaining immediate student feedback

• Assessment options, students relate to the technology
Key Considerations

• The role of the teacher: facilitator

• **Technology Use vs Technology Integration**: the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools (Lawless & Pellegrino, 2007)
The IWB and Interactivity in the Science Classroom

Using the IWB to foster student participation and interactivity in science

• “Active” learning environment: where learners are encouraged to actively engage in the learning process, rather than passively absorb instruction (Hennessy et al., 2007a)

• A “hands-on, minds-on” student-centered approach to science teaching (Knox & Schmidt, 2006; Hennessy et al., 2007a)
Explaining and Scaffolding Knowledge

Illustrating and explaining science

• Provides access to a variety of resources, while helping students to visualize abstract knowledge (Hennessy et al., 2007b; Murcia, 2008)

• Lesson planning: preparation and organization (Schuck & Kearney, 2007)

Creating a scientific story

• The sequence of IWB screens can provide information that acts as a stimulus for classroom discussion, leading to the production of new information that can be stored and ready for use during the next phase of the lesson (Hennessy et al., 2007a)
Using IWB Tools to Support Science Teaching

• Julie used IWB features that capture, emphasize, store, annotate, modify and link information

• Conducive to interactive science teaching (Beauchamp & Parkinson, 2005)

• IWB tools + sound pedagogical strategies can lead to successful instruction = positive effect on student learning (Gage, 2005; Glover & Miller, 2009; Türel & Johnson, 2012)
Pedagogical Interactivity

• Increased student-teacher and student-student participation – surface vs deep (Kennewell & Beauchamp, 2007)

• Cognitive, social, and physical participation in science learning (Hennessy et al., 2007a)

• Interactivity progression (Beauchamp & Parkinson, 2005)
Conclusions

• A changed classroom dynamic
• A didactic (teacher-centered) approach to teaching (e.g., discussion prompts)
• Surface interactivity
• Use of digital resources/access to science resources (up-to-date, accommodates learning styles)
• Lesson planning with scaffolding in mind
• Use of IWB tools (capturing, emphasizing, storing, annotating, modifying and linking information)
Next Steps

• More details to learning to use (and eventually integrate the IWB in the (science) classroom)

• The learning community approach; Longer term/revisits
• Achieving higher levels of interactivity

• Other technologies (e.g., iPad) as science teaching tools

• The use of the IWB in supporting “traditional” vs innovative pedagogical strategies in other subjects

• The student perspective – To what extent does the IWB influence student learning in science?
Thank You

- Thesis Supervisor: Dr. L. Dionne, University of Ottawa

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