Energizing Preschoolers and Pre-Service Educators: Reflections on Wind Day

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By: Amy Lindgren and Scott Boris
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Introduction

In June 2020, the co-researchers attended the Energizing Preschools Teacher Education Conference in Wisconsin Dells, WI. An outcome of that conference was the development of a comprehensive research study funded by the Wisconsin K-12 Energy Education Program (KEEP) and Wisconsin Society of Science Teachers (WSST). The purpose of the larger study designed for the 2020 conference was to explore how environmental education at the preschool level might contribute to Wisconsin'sK-12 curriculum, as well as effective ways energy education can be implemented in K-12 classrooms. Thus, this study is part of a larger action research study being conducted by K-12 educators and university professors throughout Wisconsin to explore effective and meaningful energy education strategies. Paired with the central research question in the summer 2019 workshop, the co-researchers were inspired by wind energy lessons developed by Wisconsin's K-12 Energy Education Program (p. 44-49 and pp. 171-214).

As both co-researchers serve within the field of early childhood education, there was strong motivation to consider how energy education experience might be developed and appropriate for preschoolers. Specifically, this study is important because it provides a group of preschool educators with an authentic opportunity to reflect upon their current knowledge related to energy education, as well as apply content knowledge to planning, implementing, and assessing unique environmental education activities for young children. These are key INTNSC standards areas of growth for pre-service educators. This study explored effective and meaningful environmental education learning opportunities for both preschoolers as well as future educators.

Purpose Statement

The purpose of this qualitative research study was to explore the characteristics of a learning experience that helped both preschoolers and pre-service educators learn about wind energy, effective ways energy education for young children, and the components of a meaningful environmental education experience for preschoolers. The study’s primary emphasis was on the most effective characteristics of the learning experience for the learners involved.

Research Questions

Central Research Question: What characteristics of a learning experience help students learn about energy effectively and long-term?

SRQ1: How do preschool students perceive wind energy?

SRQ2: How do pre-service educators perceive planning and implementing energy education for young children?

SRQ3: What characteristics of the learning experience most effectively facilitate preschoolers’ knowledge about wind energy?

Methodology

Two groups of participants participated in the Wind Day action research project during the spring and summer of 2020. In a pre-service educator, preschool and environmental education methods course, 15 participants, a research assistant, and a pre-service educator. Twelve preschoolers participated in the Wind Day event in June 2020. Data was gathered from the pre-service educator in the form of a Post-Reflection Tool, and from the pre-service educator using the Pre-Interview Drawing. The post-reflection interviews were completed the week following the Wind Day event. The post-reflection interviews were completed three times, first, second, and final interview. The pre-service educator’s reflections for the study were made available for qualitative analysis. The pre-service educator's reflections were transcribed, and then analyzed for themes using the constant comparative method. The themes were then compared and contrasted with the pre-service educators' reflections. The themes were then compared and contrasted with the pre-service educators' reflections.
Teacher Educators Network for Environmental Education (TENFEE)

The Teacher Educators Network for Environmental Education (TENFEE) performs several roles in the state of Wisconsin. TENFEE serves as a communication hub for environmental education in teacher education programs, an advocate for teacher education program inclusion of environmental education, and an umbrella for research in higher education related to environmental education and environmental literacy.

As part of this third role, KEEP co-sponsored the annual TENFEE workshop on June 10-11, 2019, “Energizing Pre-Service Teacher Education Programs and In-Service Teacher Collaborators.” (Group photo of 2019 workshop participants and facilitators.)

As a cooperative effort between K-12 teachers and higher education faculty, ten projects (see graphic below) were catalyzed at the workshop to address the overarching research question: What characteristics of a learning experience help students learn about energy efficiently, effectively, and long-term?

Four projects were completed before disruptions due to the pandemic occurred. A manuscript based on this research is underway from the following institutions of higher education and their K-12 education partners: Concordia University, UW-La Crosse, and UW-Stevens Point.
The purpose of this qualitative research study was to explore the characteristics of a learning experience that helps both preschoolers and pre-service educators learn about wind energy efficiently and effectively. Furthermore, this study intended to explore pre-service educators’ perceptions of planning and implementing a wind energy learning experience for preschoolers; with specific emphasis on the most effective characteristics of that learning experience for the learners involved.
Research Questions

Central Research Question:
What characteristics of a learning experience help students learn about energy efficiently, effectively, and long term?

SRQ1: How do preschool students perceive wind energy?
SRQ2: How do pre-service educators perceive planning and implementing energy education for young children?
SRQ3: What characteristics of the learning experience most effectively facilitate preschoolers’ schema about wind energy?
The co-researchers of the proposed study represented two organizations:

- Amy Lindgren (Concordia University Wisconsin). 10 pre-service educators enrolled in ED 357: Methods of Science and Environment in Early Childhood.

Initial Research Methodology Plan:

- **End of January 2020**: Introduce Research and Teaching Project: “Wind Day”
- **Beginning of February 2020**: Pre-Service Educators will complete Pre-Reflection Tool. Co-researchers will generate preliminary analysis.
- **February 13, 2020**: Visit #1. Pre-service educators will visit host preschool and conduct site visit and observations. Each pre-service educator will complete the Pre-Interview Drawing with 2-3 preschoolers.
- **March/Early April 2020**: Pre-Service Educators will submit Pre-Interview Drawings for analysis. Co-researchers will generate preliminary analysis of wind energy knowledge. Pre-service students will generate lesson plans and materials for “Wind Day.” This will be a collaborative learning experience as the candidates refine their mini-lessons and informal, formative assessment tools.
- **April 30, 2020**: Visit #2 – “Wind Day.” Pre-school educators will be responsible to collaboratively facilitate the entire sequence of “Wind Day” mini lessons for a small group of preschoolers.
- **Beginning of May 2020**: Pre-Service Educators will complete Post-Reflection Tool for the wind energy teaching experience. Co-researchers will generate analysis. Pre-Service Educators will complete preschoolers’ Post-Interview Drawings and submit drawings for analysis.
- **May/June 2020**: Co-researchers will generate analysis, results, and conclusions related to the stated research questions.

Data Collection Tools

1. **Pre-Reflection and Post-Reflection Tools**: Wind Energy Teaching Experience
2. **Pre-Interview Drawing**: Preschool Wind Learning Experience
3. **Post-Interview Drawing**: Preschool Wind Learning Experience
4. **Early Childhood Lesson Plan Template** – Modified for ELS Wind Experience

**KEEP Activity Basis:**

**Theme 1: We Need Energy – Wind** – “Sun, Wind, and Water” pp. 47-49

Methodology Adjustments - COVID

Wind Day on April 30, 2020, was canceled because all pre-service educators and preschoolers transitioned to distance learning.

Pre-Service Educator COVID Modifications:
- Virtual Lessons using the Merged Plan
- Lessons Recorded on Zoom and Peer Review
- Post-Reflection Tool Completed

Preschool and Wind Day Event Modifications:
- Wind Day was Rescheduled for June 29, 2020
- Modified group of Preschool Participants
- Wind Day Event followed Merged Plan and was taught by the Co-Researchers
- Post-Interviews and Drawings were Completed
- Data Analysis, Findings, and Conclusions generated in Summer 2020
## Data Analysis Plan

### Central Research Question: What characteristics of a learning experience help students learn about energy efficiently, effectively, and long term?

<table>
<thead>
<tr>
<th>Sub-Research Question</th>
<th>Tools Analyzed to Address Question</th>
</tr>
</thead>
</table>
| SR1: How do preschool students perceive wind energy?                                  | • Pre-Interview Drawing and Dictation  
• Post-Interview Drawing and Dictation  
• Anecdotal Notes and Assessments “Wind Day”                                             |
| SR2: How do pre-service educators perceive planning and implementing energy education for young children? | • Pre-Reflection: Wind Day Teaching Experience  
• Post-Reflection: Wind Day Teaching Experience                                                  |
| SR3: What characteristics of the learning experience most effectively facilitate preschoolers’ schema about wind energy? | • Pre-Reflection: Wind Day Teaching Experience  
• Post-Reflection: Wind Day Teaching Experience  
• Anecdotal Notes and Assessments “Wind Day”                                                   |
Initial Research & Observation Visit

February 13, 2020
ED 357 Wind Day Planning and Brainstorming Session based on Initial Data
March 2020

**Rotations**

- 10 min each

**Bathroom & Snack**
- Make own wind
- Blow paint & small objects
- Talk about strength
- Describe wind

**Outside**
- Find wind
- Weather - Not always scary
- Find moving
- Goggles + mask/glasses etc.

**Topics**
- Tools
- Wind socks
- Pinwheels
- Streamers
- Types/strength of wind

**Wind Exploration**
- 30-40 min
- Goal oriented
- Finish line

- Come up with questions
- Create with loose parts

**Intro**
- Story
- Key vocab
- Wind - invisible
  - Described w/ fan

- "You will be wind scientist today"
- "Find the wind..."
**Key Concepts and Standards:**

<table>
<thead>
<tr>
<th>Math</th>
<th>Science</th>
<th>Environmental Literacy &amp; Sustainability</th>
<th>Social Studies (Intersection: People &amp; Planet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengths of Wind</td>
<td>Strengths of Wind</td>
<td>Strengths of Wind</td>
<td>Strengths of Wind</td>
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<tr>
<td>Use Senses and Tools to find Evidence of Wind</td>
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<td>Use Senses and Tools to find Evidence of Wind</td>
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<tr>
<td>Determine Wind Direction</td>
<td>Determine Wind Direction</td>
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<tr>
<td>Capture Wind Energy or Direct Wind to Produce Something</td>
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<tr>
<td>Use Wind to Make a Car Travel a certain Distance</td>
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**Dispositional STEM Skills Incorporated**

Collect Data, Observe, Communicate, Collaborate, Ask Questions, Investigate, Create, Discuss, Reflect, Design, Implement, Evaluate.

Wind Car STEM Trials will include a dispositional cycle such as ENGAGE: Students are engaged in a challenging situation, prior knowledge is activated, and questions are provoked. EXPLORE: Students investigate phenomena, prior knowledge is generated, and applied. ELABORATE: Students apply their knowledge towards new situations, knowledge is deepened, and extended. EVALUATE: Students reflect on their knowledge and the learning process. Students apply the new knowledge to begin the cycle again with a new engagement. Dispositional Cycle Adapted From: Northern, S., (2019). The 5 F’s of inquiry-based learning. Retrieved from: https://kewlresearch.org/three-fives-of-inquiry-based-learning/

**Standards**

- **WISLES Mathematical Thinking**
  - WI 1: Understands the concept of measurement.
- **WISLES Scientific Thinking**
  - C.I. 3: Use observation to gather information.
- **WISLES Environmental & Sustainable Literacy Standards**
  - ELS.EK.5 Investigates and analyzes how change and adaptation impact natural and cultural systems.
- **WISLES Social Studies Standards**
  - SS Inq. 3.a.c: With prompting and support, state a claim to answer a question that the class is considering.

**Health and Education**

- **WISLES**
  - C.I. 2: Engages in social interactions and plays with others.
ED 357
Wind Day: Pictures of Virtual Teaching on Zoom
April 30, 2020

Measure how far your car travels!
Activities that are multimodal and multisensory, such as searching for the wind and discovering evidences of wind. This is especially important since wind is invisible and abstract for young children.

Developmentally appropriate exploration and hands-on activities at stations; in which the teacher can flexibly facilitate, discuss, observe, and model the content with a small group of learners.

Authentic and hands-on experiences that intentionally consider and build on the children’s prior schema.

Fun and creative opportunities to use simple tools and play with the concept; in this case capes, pinwheels, bubbles, wind painting, and wind cars.

When learning builds from foundational to complex, starting with a basic definition of wind and culminating with the problem solving and critical thinking required to participate in a STEM activity using wind cars.

Activities that are transferable and can be repeated at home or another day to increase the child’s depth of knowledge.

The use of developmentally appropriate and kid-friendly language to teach vocabulary and to facilitate the development of key content.
Initial Findings: Preschoolers’ Understanding of Wind

February 13, 2020

Wind is scary or strong like a windstorm or monster. Recognition of wind when it is strong, but lacking full understanding of different strengths of wind.

Lacking understanding that there is always some wind and that wind is related to weather, that is changing all the time.

Confusion about the definition of wind. Wind is abstract because it is invisible and the children struggle to recognize it.

Wind moves things. Children need chances to find the wind outside by noticing how things move and to make their own wind that moves things.

Children need to explore capturing the wind to make things move; catching the wind to experience its strength and how it moves things; and attempting to use the wind to produce energy or make things move.
Comparative Findings: Preschoolers’ Increased Understanding of Wind

Can state a definition of wind as air that blows. There is some recognition of the origin of wind and how wind relates to weather or clouds.
Recognition that wind is all around, not just high up in the sky.
Less fear of wind, although the connection between wind and storms lingers. Wind can be unpredictable but rather than fear, it is fun to play with wind.
Wind moves or blows things and people. You can use your senses to see and feel wind.
Recognition that wind is invisible. Drawings demonstrate the impact of wind on objects rather than an attempt to draw invisible wind. Students recognize that wind is depicted in books but that it is not seen in real life.
More recognition of types of wind such as a cold wind or a strong wind. Children used a variety of descriptors and attempted to draw various strengths of wind, although an emphasis on strong wind remains.
Beginning knowledge of measuring the strength of the wind using tools. Wind can be measured by how fast a pinwheel is spinning. The pinwheels on our Wind Day spun very fast which equaled strong wind.
A recognition of how wind can become energy that is useful. Bird use wind to fly, wind can move a kite, a car, or a ship. People can blow things and move them like wind. People can use the energy from wind or wind machines to make things move. More wind equals more energy or more impact on the object.
Still lacking understanding about design principles for effectively capturing wind energy and using it effectively to do work. While the children did understand that the wind could move the car, they were not yet able to figure out ways to use or capture the wind energy most effectively.

SRQ1: How do preschool students perceive wind energy?
Conclusions:
SRQ2: How do pre-service educators perceive planning and implementing energy education for young children?

• Pre-service educators have had personal and even educational experiences related to the concept of wind. However, they learned through this process, that it is very important to have an appropriate breadth and depth of content knowledge in order to facilitate effective learning experiences for young children.
• Having the opportunity to plan and implement lessons in authentic situations increases a pre-service educator’s application of content knowledge.
• Relationships are vital when planning, implementing, and assessing young children.
• It is very important to assess young children using multiple forms of representation. Lessons must be planned based on children’s prior knowledge and existing schema, not on assumptions about what young children know. Sometimes, children’s prior knowledge, experiences, and conceptions can be surprising such as the idea that wind is scary.
• Brainstorming, collaboration, and a revision process with peers can generate developmentally appropriate, innovative, and impactful lesson planning and implementation. Although care must be taken to ensure that foundational content is covered and lessons flow from basic to complex.
• Flexibility is a vital disposition for educators of young children, both in planning and implementation.
References:


