

IMPACT OF A PHENOMENON-BASED SCIENCE WORKSHOP ON PROSPECTIVE ELEMENTARY TEACHERS' SCIENCE CONTENT KNOWLEDGE

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PROBLEM

- Elementary teachers' science content knowledge may be incomplete in relation to the content they are expected to teach (Abell, 2007; Van Driel, Berry, & Meirink, 2014)
- Subject matter knowledge...
 - **impacts development of teachers' pedagogical content knowledge (Van Driel et al., 2014)**
 - **is a key requirement for effective science teaching in the context of the instructional shifts required by the Next Generation Science Standards (Bybee, 2014)**
 - **is an important part of being able to facilitate student learning in science (Banilower, 2019)**

PURPOSE

- Investigate the impact of a science content workshop that used the Ambitious Science Teaching (Windschitl, Thompson, & Braaten, 2018) model of teaching on prospective elementary teachers' science content knowledge
- Research Questions:
 - **What is the impact of a phenomenon-based science content workshop on prospective elementary teachers' science content knowledge in the area of structure and properties of matter?**
 - **How do prospective elementary teachers make sense of science content ideas in a phenomenon-based science content workshop?**

METHODS – CONTEXT AND PARTICIPANTS

- 14 prospective elementary teachers
 - 1st year students through student teachers
- 14-hour workshop on two consecutive Saturdays
- Anchoring Phenomenon – Time-lapse video of candle

Day 1	Day 2
Science Content Pre-test Initial Explanatory Model Properties of solids, liquids, and gases (2-PS-1-1) Changes of state (5-PS-1-2) Midpoint Explanatory Model	Physical properties of matter (5-PS-1-3) Chemical properties of matter (5-PS-1-3) Physical and chemical changes (MS-PS-1-2; MS-PS-1-4) Final Explanatory Model Science Content Post-test

METHODS – DATA COLLECTION AND ANALYSIS

Data Sources

- Science Content Test
 - 30 items from AAAS Test Bank
 - Pre, Post, Delayed Post (2 months)
 - Complete data for 9 participants
- Science Notebooks
- Explanatory Model Posters
 - Initial, Mid-point, Final
- Field Notes

Data Analysis

- Science Content Test*
 - Paired sample t-tests
- Science Notebooks
 - Open-coded → Consensus Themes
 - Thematic Coding
- Explanatory Model Posters*
 - Key scientific ideas and vocabulary
- Field Notes

*Data included in this presentation

FINDINGS – CONTENT KNOWLEDGE

	Mean Score (% Correct)	N	t-value	Significance (2-tailed)
Pair 1				
Pre-test	.6939	11	-3.348	.007
Post-test	.7636	11		
Pair 2				
Pre-test	.7133	10	-4.243	.002
Delayed Post-test	.8467	10		
Pair 3				
Post-test	.7852	9	-2.485	.038
Delayed Post-test	.8370	9		

Varying Ns due to number of participants who completed each assessment.

FINDINGS – EXPLANATORY MODEL POSTERS

Key Idea	Group 1	Group 2	Group 3	Group 4
States of matter	I	I	I	I
Change of state	I	I	I	I
Heat transfer	I	I		I
Molecule movement	I	I		M
Molecule spacing		M		M
Physical change	F	F		
Chemical change	F	F	F	F
Chemical reaction	F			

I = Initial Model; M = Mid-point Model; F = Final Model

DISCUSSION

- Prospective elementary teachers who participated in the two-day content workshop demonstrated increased science content knowledge as well as more sophisticated explanatory models that required the application of this knowledge to a novel phenomenon.
- Supports what has been found in previous research that indicated targeted science content courses improved the content knowledge of prospective teachers.
- This type of phenomenon-based science instruction although designed for use in K- 12 classrooms is also an effective approach for supporting the development of prospective elementary teachers' science content knowledge.

IMPLICATIONS

- Future Research:
 - **How/if science content courses for prospective elementary teachers have an impact on their ability to plan and implement Ambitious Science Teaching style lessons**
 - **Investigate the increase in delayed post-test scores with larger sample size**
- Science Teacher Education:
 - **Provide more opportunities like this for prospective elementary teachers**
 - **Provide these types of opportunities for practicing elementary teachers**
 - **Work with science faculty to integrate Ambitious Science Teaching ideas in general science courses taken by prospective elementary teachers**

QUESTIONS?

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Sorry for the text heavy slides – it's not my normal style, but seemed better for sharing rather than be able to give the presentation 😊