Do Future Teachers' Views & Epistemic Beliefs About Science Change After a Single Course?

N. Sanjay Rebello
&
Charles B. Mamolo
Kansas State University

Research Participants & Context

- **Elementary Education Majors**
  - *N* = 108
  - 95% Women

- **Conceptual Physics Course**
  - Almost no students have High School Physics

- **Pedagogy: Learning Cycle**
  - Exploration: 1st half of week in Activities Center.
  - Concept Introduction: Lecture with Peer Instruction.
  - Application: 2nd half of week in Activities Center

Data Sources

Pre-Post Comparisons of scores on...

- **Epistemic Beliefs in the Physical Sciences** (EBAPS)
  - A 30-question multiple-choice questionnaire

- **Views about Nature of Science** (VNOS)
  - A seven-question open-ended questionnaire

EBAPS Dimensions

- **Structure of Knowledge**
  - Coherent vs. Pieces

- **Nature of Learning**
  - Propagated from authority vs. Self constructed

- **Real-Life Applicability**
  - Applicable vs. Non-applicable to the real world

- **Evolving Knowledge**
  - Knowledge changes with time

- **Source of Ability to Learn**
  - Innate vs. Acquired

EBAPS Results

VNOS Dimensions

- **Empirical Nature of Scientific Knowledge**
  - Observations are used in making scientific claims.

- **Inference & Theoretical Entities in Science**
  - Scientific models are inferential in nature.

- **Nature of Scientific Theories & Laws**
  - Theories provide a framework for examining evidence.
  - Laws may change.

- **Creativity & Subjectivity in Science**
  - Creativity permeates science, no single scientific process.
  - Science is a mixture of objective & subjective components.

- **Social & Cultural Influences**
  - Science is a culture in itself and is influenced by society.
**VNOS Results**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>PRE</th>
<th>POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empirical Nature of Science</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inferential Nature of Models</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientific Theories &amp; Laws</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity &amp; Subjectivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social &amp; Cultural Influences</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% Respondents Showing Evidence of Understanding

**Conclusions**

Future elementary teachers’...

- Epistemic beliefs (as measured by EBAPS) do not change significantly after this course.
  - Only change in “Real-Life Applicability” dimension

- Views of Nature of Science (as measured by VNOS) do not change significantly after this course.
  - Only change in “Inferential Nature of Models” dimension

**Limitations of Study**

Inherent limitations in the instruments

- **EBAPS:**
  - Teasing Epistemology vs. Expectations
  - Teasing Beliefs vs. Goals
  - Inferring students’ sophistication
  - Inviting stock responses from students

- **VNOS:**
  - Validity of interpreting open-ended responses
  - Inter-rater reliability (low ~70%)

---

**Implications**

A single reformed science course, even one that uses research-based pedagogy, may not significantly alter students’ views or epistemic beliefs about science.

These issues may need to be explicitly addressed over the long term in a students’ educational experience.

---

**THANK YOU**

For information please contact

**cbmamolo@phys.ksu.edu**

OR

**srebello@phys.ksu.edu**