



# Incorporating Philosophy of Science in Physics for Non-science Majors

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# PHY 101

## Introduction to the Physical World

- General education lab science course for non-science majors.
- ~ 24 students in a section.
- Topics: Mechanics, Energy & Entropy, Electricity & Magnetism, Quantum Mechanics
- 23 activities, 10 labs, discussions, etc.
- Main goal: help students understand the nature of science and scientific knowledge



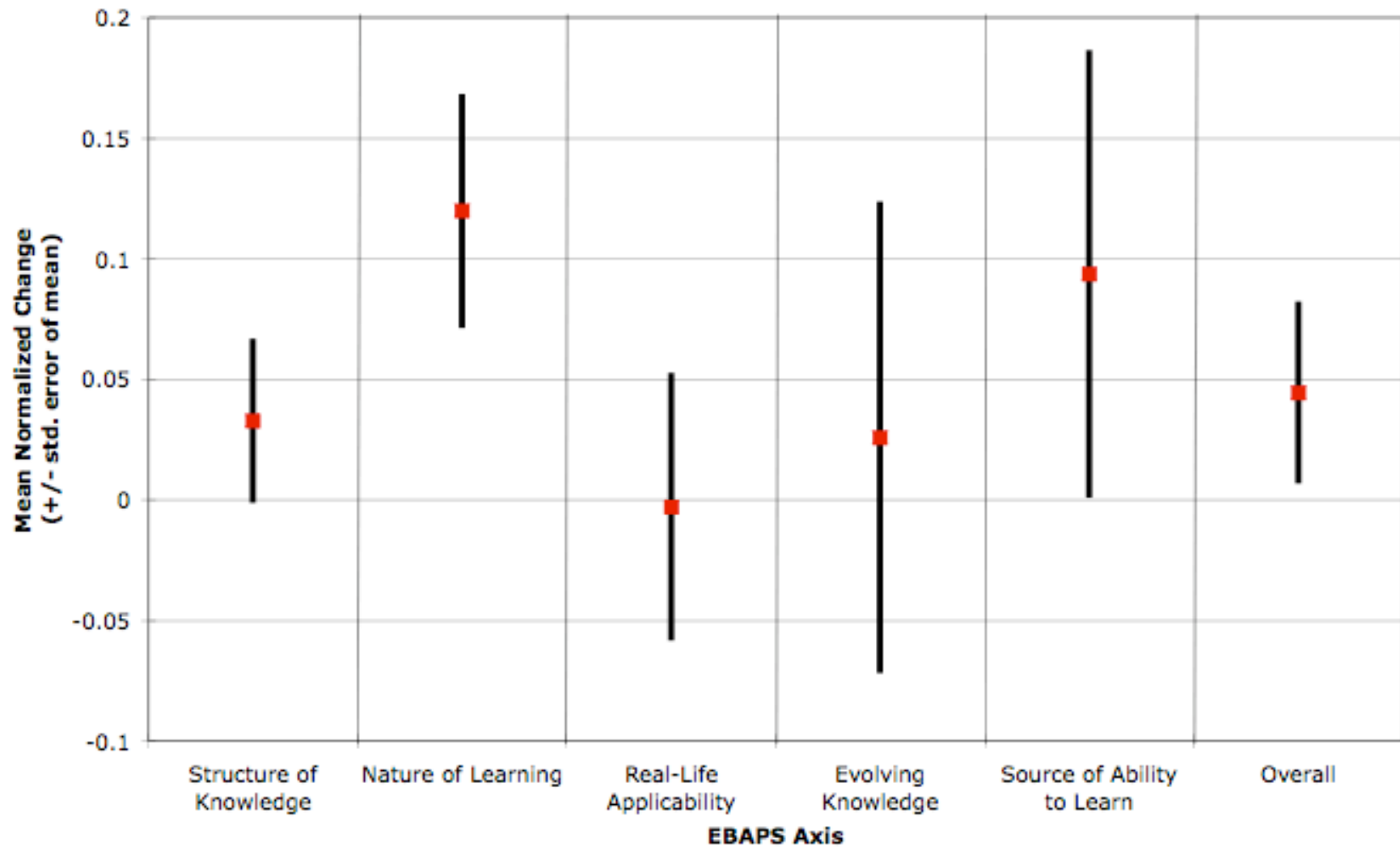
## EBAPS

- Epistemological Beliefs Assessment for Physical Science
- Axis 1: Structure of Knowledge (SK)
- Axis 2: Nature of Learning (NL)
- Axis 3: Real-life Applicability (RA)
- Axis 4: Evolving Knowledge (EK)
- Axis 5: Source of Ability to Learn (SA)
- Overall Score (OS)

# 2006 Results



## 2006 EBAPS Results





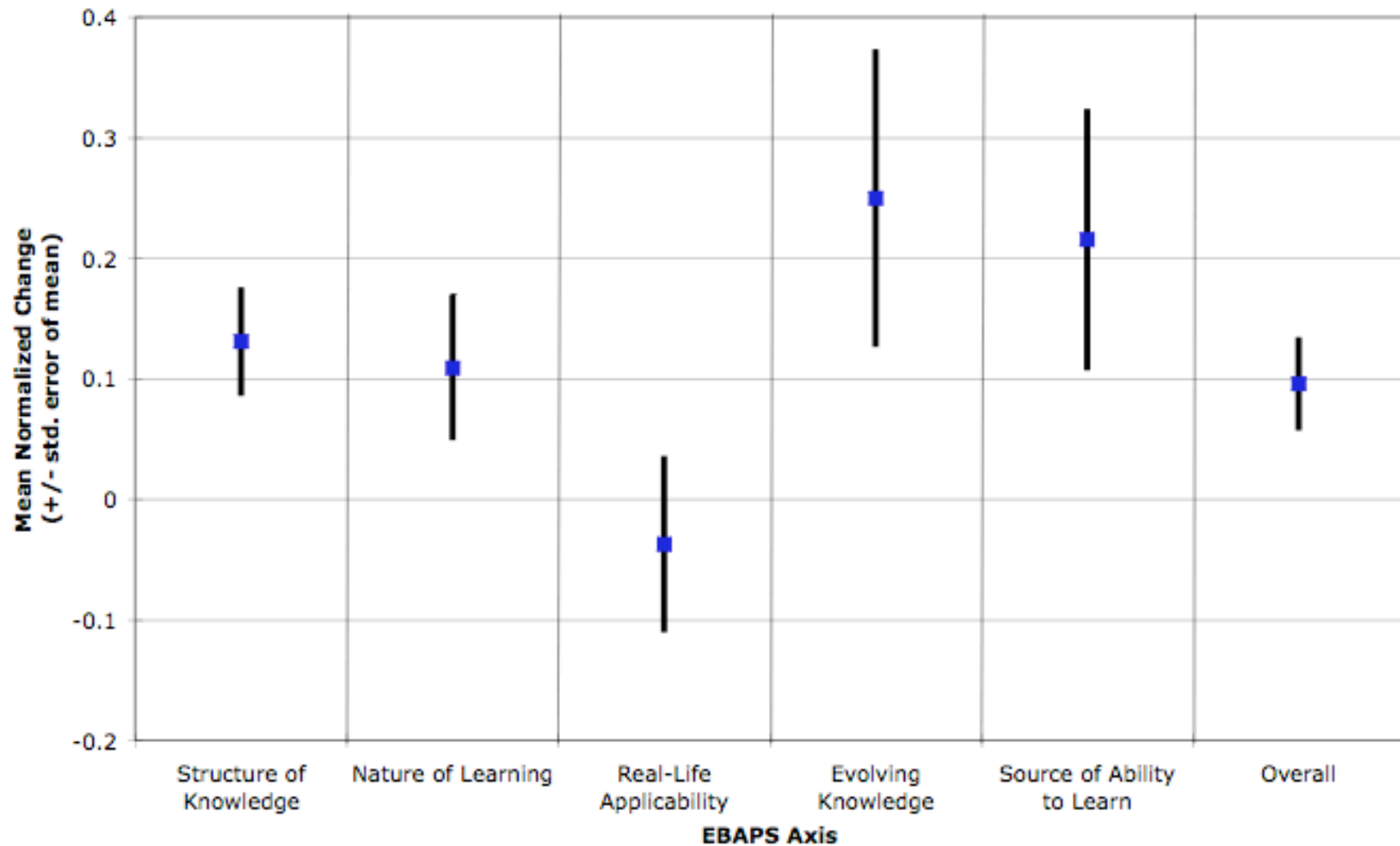
## Philosophy of Science

- Two introductory lectures on topics in the philosophy of science (details on web).
- Questions in the activities related these topics to the material in the activity.
- Class discussions/lectures
  - Newtonian worldview (mechanism)
  - Science vs. pseudoscience
  - Quantum mechanics and reality
- Two group projects

# 2007 EBAPS Results



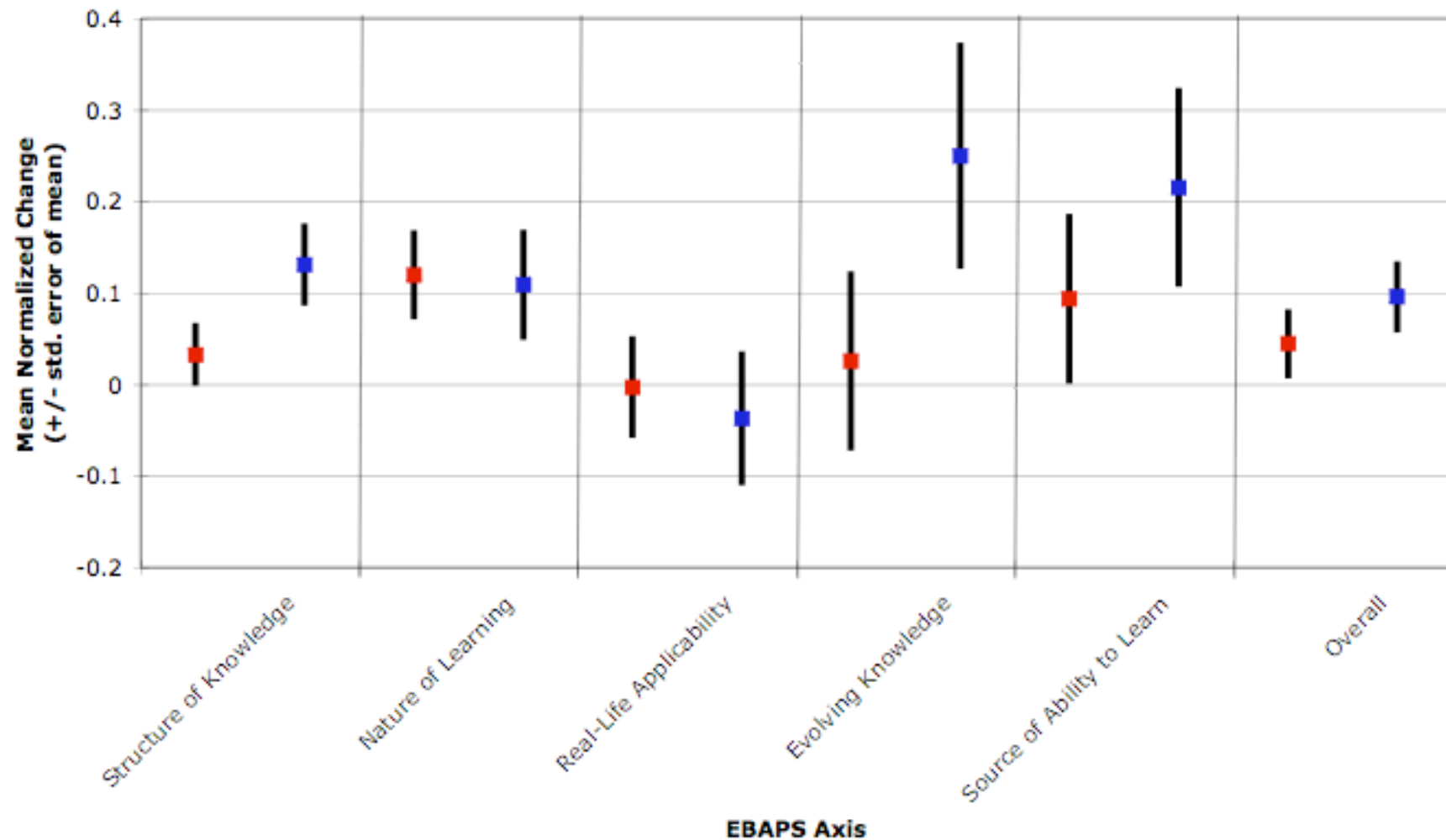
## 2007 EBAPS Results



# Comparison of 2006 & 2007



**EBAPS Result Comparison**  
**(2006 & 2007)**





## Conclusions

- Active-learning pedagogy alone may not improve student understanding of the nature of science and scientific knowledge.
- Explicit instruction in the philosophy of science and incorporation of philosophical questions into hands-on activities leads to some improvement of student understanding in this area.
- Would this type of instruction be useful for science majors, perhaps **before** they begin their college courses (i.e. in high school)?

## References



- For more details:  
[fsweb.berry.edu/academic/mans/ttimberlake/phy101\\_ps](http://fsweb.berry.edu/academic/mans/ttimberlake/phy101_ps)
- EBAPS:  
[www2.physics.umd.edu/~elby/EBAPS/home.htm](http://www2.physics.umd.edu/~elby/EBAPS/home.htm)
- Andrew Elby, “Helping physics students learn how to learn,” *American Journal of Physics* **69**, S54-64 (2001).
- Jeffrey D. Marx and Karen Cummings, “Normalized Change,” *American Journal of Physics* **75**, 87-91 (2007).
- A good starting point for learning about the philosophy of science is Alan Chalmers, *What is this thing called science?* (Open University Press, 1999).