Connecting Epistemology to Students' Religious Beliefs

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Introduction:

It is quite possible that students' epistemologies may be influenced by their beliefs on other subjects, e.g. religion. For example, students may be reluctant to adopt expert-like epistemology if their religious community is skeptical of science. In this study, we examine students' epistemologies at a faith-based university during two "faith integration" interventions in which both epistemological and religious viewpoints were discussed.

Design of study:

EBAPS pre- and post-surveys administered in 6 courses/sections:

- PHY151: Physics for Life Sciences I
- PHY152: Physics for Life Sciences II
- PHY161: Physics for Science & Engineering I

Two "faith integration" interventions consisted of

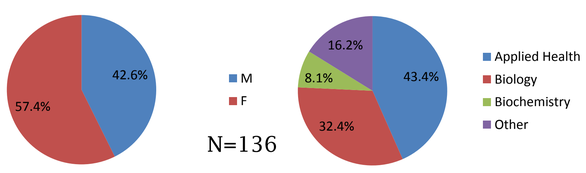
- Short (~5 min.) daily discussions on selected topics
- Outside of class online threaded discussions
- Grading for participation

Topics varied in each intervention.

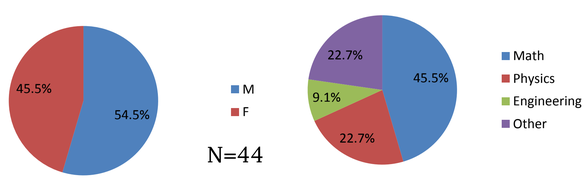
Intervention 0 (PHY151 F12 Sec. 1,PHY152 S12 Sec.1, PHY161 F12) : No topics
Intervention 1 (PHY152 F12 Sec. 2, PHY161 F11): Characteristics and habits of scientists
Intervention 2 (PHY152 S12 Sec. 2): Nature and methods of science

Hypothesis: Epistemological content of Ints. 1 & 2 (particularly Int. 2) will result in better epistemological gains

Physics for Life Sciences I/II demographics



Physics for Science & Engineering I demographics



Intervention #1 example topics:

- Of the personality traits and habits of good scientists that the class identified in the last topic, which are also good traits or habits for Christians to have? Why do you think it is that many of the traits of good scientists and good Christians are similar?
- We have agreed that one has to be highly motivated in order to be successful as a scientist. Brainstorm what things might motivate people to study science. In other words, what do people hope to gain by studying science?

Intervention #2 example topics:

- One basic assumption of science is that physics is controlled by a fairly small number of general principles. We use scientific methods to determine what the general principles are and then we use the general principles to try to explain everything. For a principle to be considered general, i.e. a law, what properties does it need to have? Why do general principles have those properties?
- One striking feature of science is that scientific explanations or theories are provisional, i.e. scientific explanations can and do change. Why is it important that scientists remain open-minded to change? If theories were accepted and not expected to change afterwards, would science still function?

One-sample t-tests

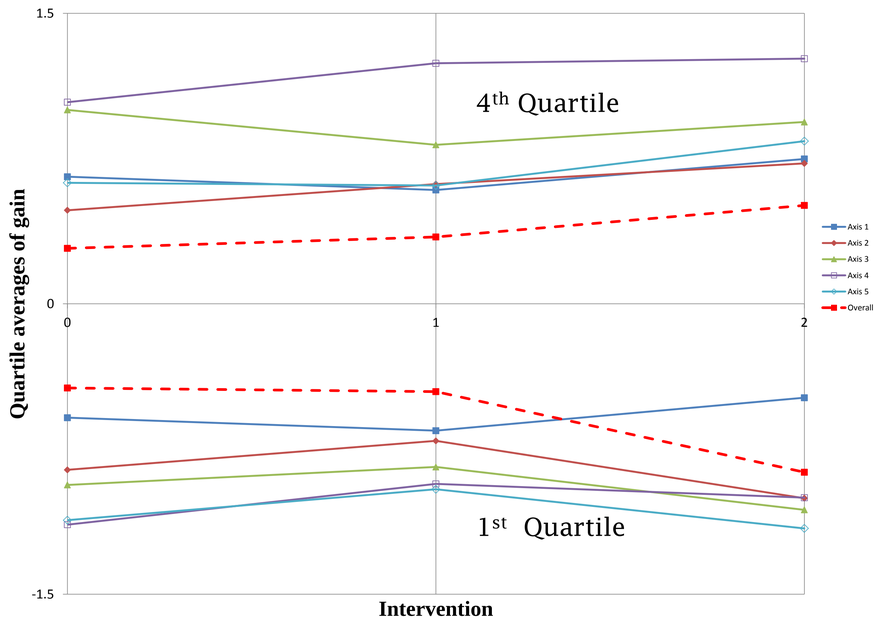
Int.	Test var.	Mean	Std. Dev.	p
0	Overall gain	-0.09	0.30	0.02
	Axis 1 gain	0.04	0.50	0.49
	Axis 2 gain	-0.14	0.54	0.04
	Axis 3 gain	0.05	0.78	0.63
	Axis 4 gain	-0.13	0.87	0.24
N=65	Axis 5 gain	-0.22	0.74	0.02
1	Overall gain	-0.04	0.33	0.28
	Axis 1 gain	-0.03	0.49	0.57
	Axis 2 gain	-0.03	0.53	0.57
	Axis 3 gain	-0.01	0.67	0.93
	Axis 4 gain	0.15	0.87	0.15
N=75	Axis 5 gain	-0.17	0.67	0.03
2	Overall gain	-0.03	0.43	0.67
	Axis 1 gain	0.10	0.52	0.24
	Axis 2 gain	-0.10	0.71	0.35
	Axis 3 gain	-0.09	0.79	0.48
	Axis 4 gain	0.12	0.91	0.39
N=40	Axis 5 gain	-0.15	0.78	0.23

- Int. 0 - significant losses or no significant change on all axes
- Int. 1 – no significant change on any axis except axis 5
- Int. 2 – no significant change on any axis

- Int. 1 – modest effect size>0 on axes 2 & 4
- Int. 2 – modest effect size >0 on axis 4
- Effect sizes of Ints. 1 & 2 small but positive on most axes

Independent-samples t-tests

Comparison groupings	Test Var.	Diff. of means	Effect size	p
Int. 0 to Int. 1	Overall gain	0.05	0.16	0.37
	Axis 1 gain	-0.08	-0.16	0.37
	Axis 2 gain	0.11	0.21	0.25
	Axis 3 gain	-0.05	-0.07	0.66
	Axis 4 gain	0.27	0.31	0.07
	Axis 5 gain	0.05	0.07	0.67
Int. 0 to Int. 2	Overall gain	0.06	0.16	0.40
	Axis 1 gain	0.06	0.12	0.59
	Axis 2 gain	0.04	0.06	0.77
	Axis 3 gain	-0.14	-0.18	0.39
	Axis 4 gain	0.25	0.28	0.16
	Axis 5 gain	0.07	0.09	0.62



EBAPS axes:

1. Structure of scientific knowledge
2. Nature of knowing and learning
3. Real-life applicability
4. Evolving knowledge
5. Source of ability to learn

Conclusions:

- Intervention 0 has negative epistemological gains, typical of intro physics courses
- Interventions 1 & 2 showed approximately 0 epistemological gains (though not statistically significant due to small sample)
- Effect sizes of interventions 1 & 2 were typically positive, though small to modest
- Interventions 1 & 2 had particularly positive effects on axis 4Individual student scores in intervention 2 showed a wider range of gains; discussion of epistemological topics may facilitate epistemological change though more is needed to ensure positive changes