

ASSESSING ADAPTATIONS OF PHYSICS BY INQUIRY: STUDENT BELIEFS

PST2-15

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This work was supported by NSF DUE 0410804

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Question:

Students' beliefs about physics and learning physics typically do not change or become less expert-like after a standard introductory physics course, even one using a research-based/reform curriculum. Does the same hold true for an inquiry-based physics course?

Physics by Inquiry

Physics by Inquiry is a guided-inquiry, lab-based introductory physics curriculum developed by the Physics Education Group at the University of Washington. Students perform experiments and use their observations to develop explanatory models with predictive power. Students also practice skills such as proportional reasoning, use multiple representations, and engage in evidence-based reasoning.

Physics by Inquiry is used to educate pre- and in-service K-12 teachers, students underprepared in science, and liberal arts non-science majors.

We have adapted this curriculum for use at our institutions where, unlike the University of Washington, we have larger student:staff ratios and do not have graduate student teaching assistants.

Colorado Learning Attitudes about Science Survey

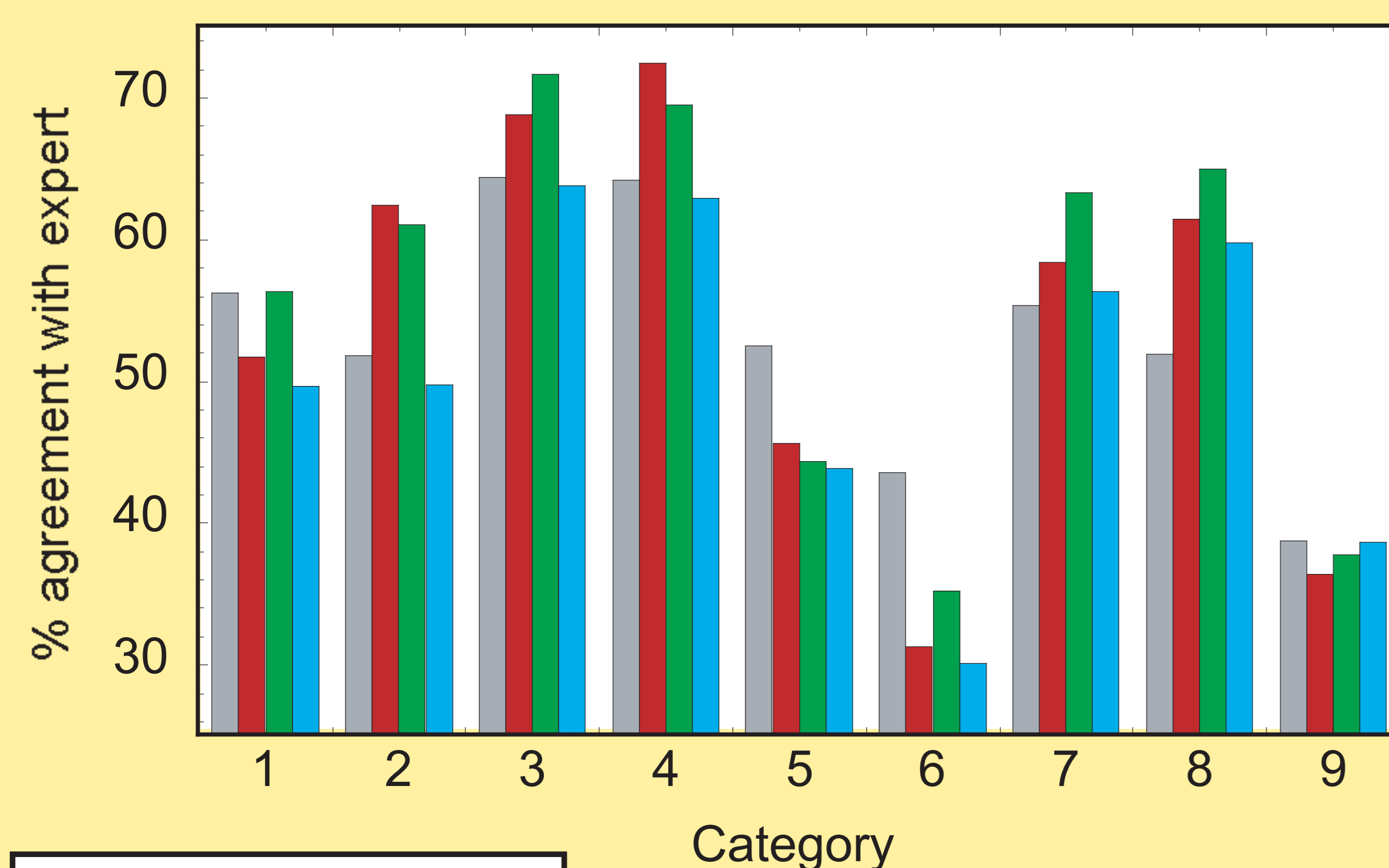
The CLASS is a 42-question Likert-scale survey developed at the University of Colorado. It is given as a pre- and post-test and is designed to measure students' beliefs about physics and learning physics. The questions are grouped into 8 categories (listed below).

Consistent with results from previous studies using similar surveys (e.g., MPEX), students' responses to the CLASS become less expert-like or at best, do not change after a standard introductory physics course, even when the use of research-based curricula leads to large gains on conceptual surveys such as the FCI, FMCE, BEMA, CSEM, etc.

We have used the CLASS to examine the beliefs and changes in beliefs of students after working through the *Physics by Inquiry* curriculum.

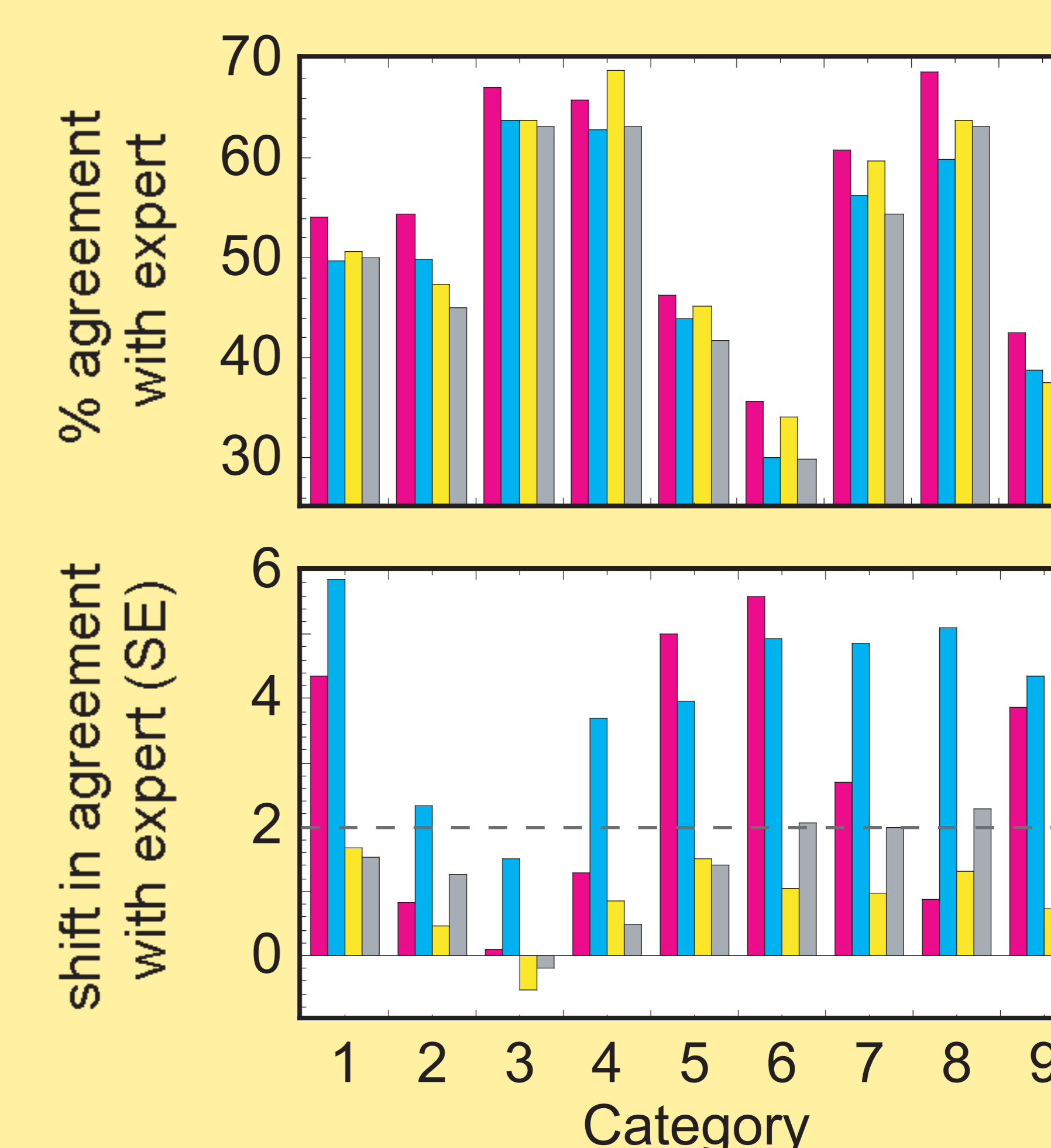
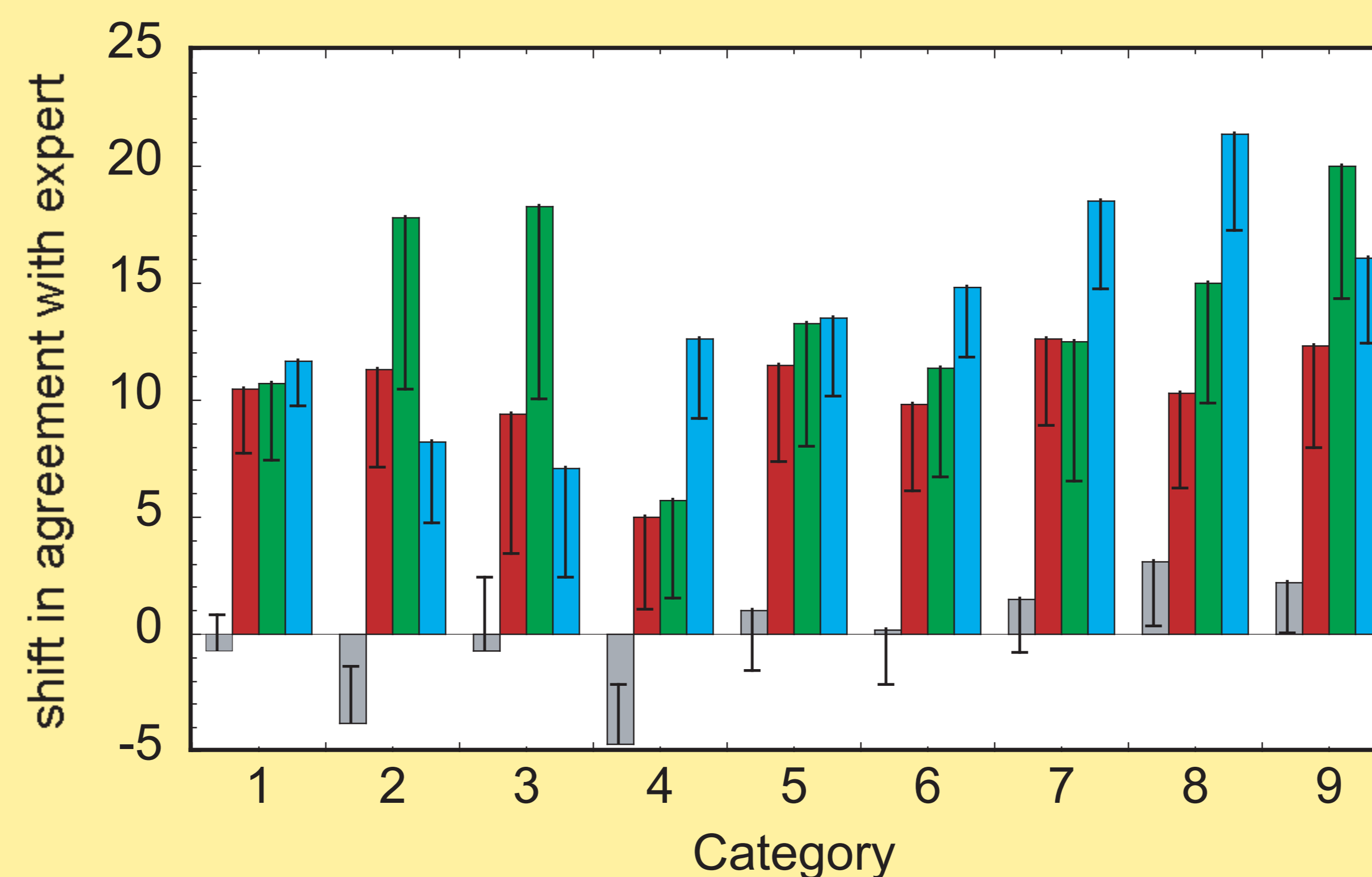
Results

Pre-instruction CLASS results



Categories
 1 Overall
 2 Personal interest
 3 Real world connection
 4 Sense making/Effort
 5 Conceptual connections
 6 Applied conceptual understanding
 7 Problem solving (General)
 8 Problem solving (Confidence)
 9 Problem solving (Sophistication)

Shifts in CLASS results



Summary

An inquiry-based curriculum such as *Physics by Inquiry* can produce significant positive shifts in student beliefs about physics and learning physics (as measured by the CLASS). However, it does not always do so.

Pre-test scores and shifts in scores were not found to be correlated with class grade or with each other.

The relationship between scores on the CLASS and other instruments such as EBAPS is not clear.

Further questions

Why was there such a difference in the magnitude of the CLASS shifts in different semesters?

What factors were responsible for positive shifts when they occurred?