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Implementation

Purpose of the MPEX

To probe some aspects of student expectations in physics courses and measure the distribution of student views at the beginning and end of the course.

Course Level: What kinds of courses is it appropriate for?

Upper-level, Intermediate, Intro college, and High school

Content: What does it assess?

Beliefs / Attitudes (epistemological beliefs)

Timing: How long should I give students to take it?

20-30 minutes

Example Questions

Sample questions from the MPEX:

A significant problem in this course is being able to memorize all the information I need to know.

Strongly Disagree 1 2 3 4 5 *Strongly Agree*

Knowledge in physics consists of many pieces of information each of which applies primarily to a specific situation.

Strongly Disagree 1 2 3 4 5 *Strongly Agree*

Access: Where do I get the assessment?

Download the assessment from physport at www.physport.org/assessments/MPEX.

Versions and Variations: Which version of the assessment should I use?

The latest version of the MPEX, released in 1997, is version 4.0.

Administering: How do I give the assessment?

- Give it as both a pre- and post-test. This measures how your class shifts student thinking.
 - Give the pre-test at the beginning of the term.
 - Give the post-test at the end of the term.
- Use the whole test, with the original wording and question order. This makes comparisons with other classes meaningful.
- Make the test required, and give credit for completing the test (but not correctness). This ensures maximum participation from your students.
- Tell your students that the test is designed to evaluate the course (not them), and that knowing how they think will help you teach better. Tell them that correctness will not affect their grades (only participation). This helps alleviate student anxiety.
- For more details, read the **PhysPort Guides** on implementation:
 - **PhysPort Expert Recommendation on Best Practices for Administering Belief Surveys**
(www.physport.org/expert/AdministeringBeliefSurveys/)

Scoring: How do I calculate my students' scores?

- Download the answer key from PhysPort (www.physport.org/key/MPEX)
- The "percent favorable score" is the percentage of questions where a student agrees with the expert response. (Dis)agree and strongly (dis)agree are counted as equivalent responses. For instructions on scoring the MPEX, see below
- See the **PhysPort Expert Recommendation on Best Practices for Administering Belief Surveys** for instructions on calculating shift and effect size (www.physport.org/expert/AdministeringBeliefSurveys/)
- Use the **PhysPort Assessment Data Explorer** for analysis and visualization of your students' responses (www.physport.org/explore/MPEX)

Detailed Instructions for Scoring the MPEX:

Organize survey data: Match pre- and post-course responses: Its important only to include students who completed the MPEX at the beginning and end of the course (“matched data”). This will ensure that the shifts in beliefs you calculate from pre to post are differences in the way students are thinking and not a difference in the students who took the survey. This matched data set typically includes about 65–70 % of the students enrolled in the course. Also, remove student responses from your data set where the students clearly didn't take the survey seriously (all the same answers, not answering many questions etc.).

Calculate Class Average Percent Favorable or Percent Unfavorable Score: Follow this same process for the pre- and post-test results.

1. Collapse all “strongly agree” and “agree” responses together. Do the same for “strongly disagree” and “disagree” responses. This is because students’ interpretations of agree vs. strongly agree are not consistent; the same conviction of belief may not result in the same selection such that one student may respond with strongly agree while another responds with agree.
2. For each student, determine the average number of questions (out of 34) that they answered in the same way as an expert physicist (“percent favorable responses”).
3. Average these individual average percent favorable scores to find the class average percent favorable.
4. You can repeat the same process to find the class average percent unfavorable score. For this measure, use the number of questions in which students do not answer in the same way as an expert physicist.

Calculate Shift in Percent Favorable Score From Pre- to Post-test:

Calculate the “shift” in percent favorable responses by subtracting the pretest class average percent favorable from the posttest class average percent favorable. This metric tells you how students’ favorable beliefs about physics changed from the start to end of their physics course. We hope that this shift would be positive, indicating students’ beliefs improved over the course of their physics class.

Clusters: Does this assessment include clusters of questions by topic?

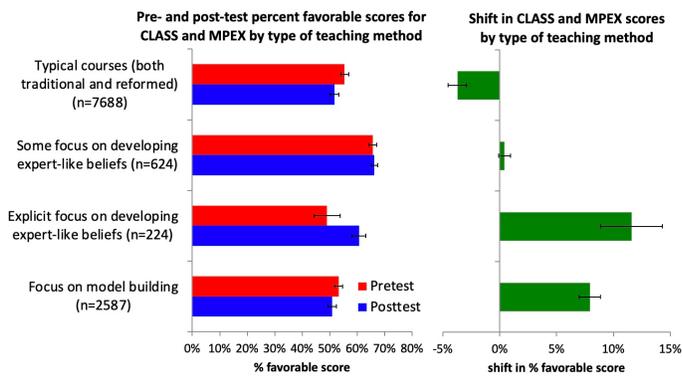
Clusters of MPEX questions defined by [Saul, Steinberg, and Redish, 1998](#):

These clusters were intended to give you a way of interpreting the results in terms of student response to instruction. That does not mean that the clusters represent the way the students associate the issues associated with the items.

| Category Name | Questions Included | Favorable Response | Unfavorable Response |
|---------------|----------------------|--|---|
| Independence | 1, 8, 13, 14, 17, 27 | Takes responsibility for constructing own understanding | Takes what is given by authorities (teacher, text) without evaluation |
| Coherence | 12, 15, 16, 21, 29 | Believes physics needs to be considered as a connected, consistent framework | Believes physics can be treated as unrelated facts or “pieces” |
| Concepts | 4, 19, 26, 27, 32 | Stresses understanding of the underlying ideas and concepts | Focuses on memorizing and using formulas |
| Reality link | 10, 18, 22, 25 | Believes ideas learned in physics are relevant and useful in a wide variety of real contexts | Believes ideas learned in physics have little relation to experiences outside the classroom |
| Math link | 2, 6, 8, 16, 20 | Considers mathematics as a convenient way of representing physical phenomena | Views the physics and the math as independent with little relationship between them |
| Effort | 3, 6, 7, 24, 31 | Makes the effort to use information available and tries to make sense of it | Does not attempt to use available information effectively |

Typical Results: What scores are usually achieved?

In typical physics classes, students’ beliefs usually deteriorate or at best stay the same. There are a few types of interventions, including an explicit focus on model-building and/or developing expert-like beliefs that appear to lead to significant improvements in beliefs. Small courses and those for elementary education and non-science majors also result in improved beliefs. However, because the available data oversamples certain types of classes, it is unclear what leads to these improvements. This figure from [Madsen et. al 2015](#) shows CLASS (n=9296) and MPEX (n=1316) pre- and post-test scores and shifts for a variety of teaching methods. The CLASS and MPEX are similar in the way they measure students’ beliefs about physics and learning physics, so the scores for these tests have been combined.



Interpretation: How do I interpret my students' scores in light of typical results?

Look at the shift between pre- and post-test

Your MPEX results are especially useful for comparing shifts in students' expert-like beliefs before and after you have made a change to your teaching, for example, trying teaching methods that explicitly focus on model- building and/or developing expert-like beliefs. You can compare the shifts in expert-like beliefs before and after you try new teaching techniques as one measure to gauge the effectiveness of the techniques.

Look at the effect size of the change

This tells you how substantially your pre- and post-test scores differ. Compare your effect size to the ranges given below to find out how substantial the change from pre- to post-test was. For more details, read the **PhysPort Expert Recommendation on Effect Size** (www.physport.org/expert/effectsize)

| Effect Size | Cohen's d |
|-------------|-----------|
| Large | ~0.8 |
| Medium | ~0.5 |
| Small | 0.2-0.3 |

Look at clusters of questions

You can also gain insight into what areas of your students' beliefs are being improved through your course by looking at their shifts in favorable or unfavorable beliefs by cluster.

Resources

Where can I learn more about this assessment?

E. Redish, J. Saul, and R. Steinberg, [Student expectations in introductory physics](#), Am. J. Phys. **66** (3), 212 (1998).

Translations: Where can I find translations of this assessment in other languages?

You can download translations of this assessment in the following languages from [PhysPort](#):

- English
- Spanish translated by José Luis Santana Fajardo

If you know of a translation that we don't have yet, or if you would like to translate this assessment, please [contact us!](#)

Background

Similar Assessments

The MPEX is most similar to the [CLASS](#). The MPEX asks more questions about students beliefs about the physics course whereas the CLASS focuses more on beliefs about the discipline of physics. Several items are the same on both tests. The MPEX is also similar to the [EBAPS](#), though less so than the CLASS.

The MPEX-II is variation of the MPEX with less emphasis on math and more questions that present scenarios, e.g., a discussion between students which asks test takers who they agree with.

Research: What research has been done to create and validate the assessment?

Research Validation: Gold Star ★

This is the highest level of research validation, corresponding to all seven of the validation categories below.

- ✔ Based on research into **student thinking**
- ✔ Studied using **student interviews**
- ✔ Studied using **expert review**
- ✔ Studied using **appropriate statistical analysis**
- ✔ Research conducted **at multiple institutions**
- ✔ Research conducted **by multiple research groups**
- ✔ **Peer-reviewed publication**

Research Overview

The questions on the MPEX were chosen through literature review, discussion with faculty and the researchers' personal experiences. Over 100 hours of student interviews were conducted to validate that students read and interpreted the questions in the way intended. MPEX data was collected from calibration groups with varying expertise in physics to confirm that MPEX scores increased with increasing experience in physics. Appropriate statistical analyses were conducted and the MPEX was found to be reliable and have good internal consistency. The MPEX has been administered at over 10 institutions with over 1500 students at varying course levels and teaching methods.

Developer: Who developed this assessment?

E. F. Redish, J. M. Saul, & R. N. Steinberg

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