PhysPort Implementation Guide:
Attitudes and Approaches to Problem Solving Survey (AAPS)

Version 1

Supporting physics teaching with research-based resources

Implementation Guide by Adrian Madsen

Table of Contents

Implementation

Purpose of the AAPS

To measure students' attitudes and approaches to problem-solving at the introductory and graduate level.

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

Graduate, Upper-level, Intermediate, and Intro college

Content: What does it assess?

Beliefs / Attitudes (problem-solving)

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

15 minutes

Example Questions

Sample questions from the AAPS:

I usually draw pictures and/or diagrams even if there is no partial credit for drawing them.
A) Strongly Agree
B) Agree Somewhat
C) Neutral or Don't Know
D) Disagree Somewhat
E) Strongly Disagree

Suppose you are given two problems. One problem is about a block sliding down an inclined plane with no friction present. The other problem is about a person swinging on a rope. Air resistance is negligible. You are told that both problems can be solved using the concept of conservation of mechanical energy of the system. Which one of the following statements do you MOST agree with? (Choose only one answer.)
A) The two problems can be solved using very similar methods.
B) The two problems can be solved using somewhat similar methods.
C) The two problems must be solved using somewhat different methods.
D) The two problems must be solved using very different methods.
E) There is not enough information given to know how the problems will be solved.

Access: Where do I get the assessment?

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

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

The latest version of the AAPS, released in 2009, is Version 1.

Administering: How do I give the assessment?

- Give it as both a pre- and post-test. This measures how your class shifts student attitudes and approaches to problem-solving.
  - 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/AAPS)
- To calculate the average score for a question, give +1 for each favorable response (student's response matches the expert-like response), a −1 is assigned to each unfavorable response (student's response does not match expert-like response), and give 0 for neutral responses. Agree (or disagree) are scored the same as strongly agree (or disagree).
- Find the average score for each student on the pre- and post-test, and use these to find the class average for the pre- and post-test.
- 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/AAPS)

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

There are no clusters of questions on the AAPS.

Typical Results: What scores are usually achieved?

Table 1 from Mason and Singh 2010. "Intro" and "Self" with Graduate students implies problem solving in "introductory physics" and "graduate-level physics courses" respectively.

Group	**Average AAPS Score**
Faculty-intro	0.88
Faculty-grad	0.92
Graduate students-intro	0.73
Graduate students-self	0.62
Astronomy students	0.49
All introductory students	0.33

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

Your AAPS results are especially useful for comparing shifts in students' beliefs (favorable/expert-like) before and after you have made a change to your teaching, for example, trying teaching methods that explicitly focus improving your students' attitudes and approaches to problem solving. You can compare the shifts in percent favorable before and after you try new teaching techniques as one measure to gauge the effectiveness of the techniques.

There are no published AAPS results on students' shifts in beliefs between pre- and post-test for you to compare your results to. There are AAPS post-test results for varying levels of students shown in Typical Scores.

Resources

Where can I learn more about this assessment?

A. Mason and C. Singh, Surveying graduate students' attitudes and approaches to problem solving, Phys. Rev. ST Phys. Educ. Res. **6** (2), 020124 (2010).

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**
- **French** translated by Olivier Alibart and Frédéric Blanc
- **Indonesian** translated by Tria Wury Anjani
- **Portuguese** translated by Raúl Montagne

- **Turkish** translated by Nuri Balta and Muharrem Duran

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 topics covered, questions and format of the AAPS and APSS are quite similar. Fourteen of the questions are the same or very similar between the tests. The AAPS has more questions, so it covers a few more aspects of problem-solving than the APSS, including how students feel about problem-solving, how they learn from the problem-solving process, use of pictures/diagrams and what students actually do while solving a problem. The AAPS also covers similar topics to the APSS, but in more depth.

The CLASS, MPEX, EBAPS and VASS also contain questions about students' attitudes and beliefs about problem solving, similar to those on the APSS and AAPS. The AAPS and APSS can be used to specifically target problem-solving beliefs, while the CLASS, MPEX, EBAPS and VASS ask about a wider range of beliefs and attitudes.

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

Sixteen of the agree/disagree 5-point Likert scale AAPS questions were taken from the APSS, while the other 17 questions were created by the test developers, tested in student interviews and reviewed by experts. The AAPS questions were then tested with 16 graduate students, who also gave verbal feedback on the questions. The AAPS was modified and tested with 24 additional graduate students, of whom some gave verbal and written feedback. The APSS was subsequently tested with over 200 first-semester algebra-based physics students, over 150 second-semester algebra-based physics students, over 100 first semester calculus-based physics students and over 40 second-semester calculus-based course physics students. In addition, the AAPS was given to over 30 students in an introductory astronomy course. Finally, the survey was given to 12 physics faculty who had taught introductory physics recently. Overall, the AAPS has been given to over 600 students and the results published in two peer-reviewed papers.

Developer: Who developed this assessment?

Andrew Mason and Chandralekha Singh

References

- N. Balta and M. Asikainen, Introductory students' attitudes and approaches to Physics problem solving: Major, achievement level and gender differences, J. Technol. Sci. Educ. **9** (3), 378 (2019).
- N. Balta, A. Mason, and C. Singh, Surveying Turkish high school and university students' attitudes and approaches to physics problem solving , Phys. Rev. Phys. Educ. Res. **12** (010129), (2016).
- M. Good, A. Maries, and C. Singh, Impact of traditional or evidence-based active-engagement instruction on introductory female and male students' attitudes and approaches to physics problem solving, Phys. Rev. Phys. Educ. Res. **15** (2), 020129 (2019).
- A. Mason and C. Singh, Surveying college introductory physics students' attitudes and approaches to problem solving, Eur. J. Phys. **37** (5), 055704 (2016).

- A. Mason and C. Singh, Surveying graduate students' attitudes and approaches to problem solving, Phys. Rev. ST Phys. Educ. Res. **6** (2), 020124 (2010).
- S. Rakkapao and S. Prasitpong, Use of model analysis to analyse Thai students' attitudes and approaches to physics problem solving, Eur. J. Phys. **39** (2), 025707 (2017).
- C. Singh and A. Mason, Physics Graduate Students' Attitudes and Approaches to Problem Solving, presented at the Physics Education Research Conference 2009, Ann Arbor, Michigan, 2009.