AAPT Programs & Conferences Tools

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Paper Sort

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Sacramento - California (SM16) / Status: Inactive

Abstract List | Sort All | Sort All Collapsed View

Generic Abstracts

PER: Evaluating instructional strategies

Abstracts Submitted (# 23)

Abstract Title: An Activity-Based Model for Training Physics Teaching and Learning Assistants 5330

Paper Type: Contributed

Author: Monica K. Cook
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Preparing graduate teaching assistants (TAs) and undergraduate learning assistants (LAs) in Introductory Physics to facilitate discovery learning in labs and tutorials is a topic of intense interest in Physics Education Research. Our model for training TAs and LAs includes an overview of pedagogical theory, roleplays targeted at specific issues in active learning, and direct feedback from multiple teaching observations throughout the semester. The content of the roleplays and other activities emphasizes the importance of discourse, questioning, and eliciting student ideas by requiring the TAs and LAs to model those practices. We examine survey data from TAs and LAs and their students, and video data and field notes from training activities and teaching observations to consider the viability of our model as a method for preparing TAs and LAs to teach physics effectively. We also reflect on our training model for its potential to train future physics faculty members in student-centered learning.

You have submitted comments on this item

Change Session

No Yes

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Order

1

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Comparing factor analysis and network methods to cluster test questions 5489

Paper Type: Contributed

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When creating concept inventories, we usually write questions in clusters, each cluster corresponding to a particular concept. Do these clusters appear in the data generated when students take the concept inventories, and what does this tell us about student thinking? The physics education research community has often tackled this problem using factor analysis. Other recent work has modeled test result data as a bipartite network and applied community detection algorithms to identify clusters of questions. To better understand the differences between these methods, we hypothesize a model of how students answer questions inspired by the resource framework, use the model to simulate test results with known cluster structure, and compare the two methods' ability to recover the known cluster structure. Finally, we discuss implications of these results on how we should understand the way that students generate answers to test questions.

Footnotes: Sponsored by Edward Redish

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Research-based assessment instrument cluster

Update

Abstract Title: Comparison of Lecture/Laboratory Format with SCALE-UP Classes 5347

Paper Type: Contributed

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In this study, we have examined the differences of lab and lecture activities in Lecture/Laboratory format and SCALE-UP classes for algebra-based introductory physics. Also, we have investigated the effects of these differences on success and withdrawal rates, student conceptual learning as measured by the Force Concept Inventory (FCI), and student attitudes as measured by Colorado Learning Attitudes about Science Survey (CLASS). Even though SCALE-UP algebra-based physics classes show no significant increase in FCI gains over traditional classes, SCALE-UP intervention shows a significant improvement in CLASS favorable scores for both Conceptual Understanding and Problem Solving categories.

You have submitted comments on this item

Change Session

No Yes

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Order

9

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Effects of Animated Video Solutions on Learning and Metacognition 5172

Paper Type: Contributed

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Students preparing for Physics exams must make decisions on what material to study, how to best prepare, and estimate their preparedness. Previous research has demonstrated that low performing students tend to over predict their learning and preparedness. Research has shown that simplifying the reading level in texts leads to gains in comprehension as well as larger gains in confidence in comprehension. We present data where low performing students in an introductory mechanics course completed an animated video solution intervention. Participants completed a pre-test, viewed video solutions, then completed a post-test. Confidence judgements were made after attempting each problem and after viewing the video solutions. Data will show whether or not students are able to learn from viewing video solutions for previously solved problems. We also present data about students' prediction of their performance. We discuss the educational implications of our findings.

You have submitted comments on this item

Change Session

No Yes

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Order

10

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Evaluating JiTT and Peer Instruction using Clickers in a Quantum Mechanics Course 5055

Paper Type: Contributed

Author: Ryan T. Sayer

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Just-in-Time Teaching (JiTT) is an instructional strategy involving feedback from students on pre-lecture activities in order to design in-class activities to build on the continuing feedback from students. We investigate the effectiveness of a JiTT approach, which included in-class concept tests using clickers in an upper-division quantum mechanics course. We analyze student performance on pre-lecture reading quizzes, in-class clicker questions answered individually, and clicker questions answered after group discussion, and compare those performances with open-ended retention quizzes administered after all instructional activities on the same concepts. In general, compared to the reading quizzes, student performance improved in individual concept tests administered using clickers after lecture focusing on student difficulties found via electronic feedback. The performance on the group concept tests administered after the individual concept tests and on retention quizzes also showed improvement. We discuss possible reasons for the improvement in performance from pre-lecture quizzes to post-lecture concept tests and from individual to group concept tests and retention quizzes.

You have submitted comments on this item

Change Session

No Yes

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Order

11

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Examining the necessity of problem diagrams using MOOC AB experiments 5538

Paper Type: Contributed

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Creating high quality problem diagrams consumes significant resources from both instructor and publisher, yet the benefit of problem diagrams has not been confirmed by research. Using the AB experiment functionality of the edX MOOC platform, we selected 12 problems where the diagram adds no critical information for problem solving, and studied the impact of adding/removing a diagram on both student' correctness and problem solving behavior. We found that providing a diagram improved 1st attempt correct rate by merely 3% overall, but reduced the fraction of students drawing their own diagram by ~10% on half of the problems. On the other half, providing a diagram have no detectable impact on either correctness or behavior. Further analysis confirmed that except for the most spatially challenging problems, MOOC students are able to compensate for the loss of a diagram by drawing their own.

You have submitted comments on this item

Change Session

No Yes

PER: Problem Solving--G

Order

Comment:

Representations cluster

Update

Abstract Title: Inquiry vs. Traditional: Student perceptions and learning gains 5389

Paper Type: Contributed

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This PER study investigates the order in which conceptual topics and laboratory exercises are presented in a high school physics classroom. By varying the order of presentation of conceptual material and labs, the researchers aimed to identify if student scores and growth on conceptual measures differed in the two contexts. We hypothesized that students learning with the guided inquiry model, in which laboratory exercises preceded conceptual lessons, would demonstrate higher scores and greater growth on objective measures of learning. We further hypothesized that these students would indicate a preference for learning via the

guided inquiry model. We will discuss significant differences in group means in the two learning contexts. Results of student preference surveys will also be reported in order to evaluate student perceptions of the two instructional paradigms.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Large-scale Assessment Yields Evidence of Minimal Use of Reasoning Skills 5646

Paper Type: Contributed

Author: Beth Thacker
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Large-scale assessment data from Texas Tech University yielded evidence that most students taught traditionally in large lecture classes with online homework and predominantly multiple choice question exams, when asked to answer free-response questions, did not support their answers with logical arguments grounded in physics concepts. Their answers indicated not only their lack of conceptual understanding, but their inability to apply even lower order thinking skills to solve a problem. While correct answers indicated evidence of lower level thinking skills, when coded by a rubric based on Bloom's taxonomy, incorrect and partially correct answers indicated little or no evidence of the use of thinking skills at all. The free-response format, unlike other assessment formats, allowed assessment of both their conceptual understanding and their application of thinking skills, clearly pointing out weaknesses not revealed by other assessment instruments.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Research-based assessment instrument cluster

Update

Abstract Title: Learning introductory E&M: a 22k+ students meta-analysis 5586

Paper Type: Contributed

Author: Ulas Ustun
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In this talk, I present the results of a meta-analysis of students learning in introductory electricity and magnetism, which is conducted as a part of DEAR-Faculty project. We selected 34 studies presenting the data on the two most popular assessment instruments: the Conceptual Survey of Electricity and Magnetism (CSEM), and the Brief Electricity and Magnetism Assessment (BEMA). Our data includes more than 22,000 students in 353 introductory level physics classes. We augmented information in the papers with published information on institutional websites to infer average class sizes for both lecture and lab courses and compare student learning in different courses as a function of teaching method, class size, institution type, and nation. We also compare the results of CSEM and BEMA assessment instruments.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Research-based assessment instrument cluster

Update

Abstract Title: Measuring the impact of mastery inspired activities in introductory physics 5267

Paper Type: Contributed

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We have introduced mastery inspired activities into our introductory electricity and magnetism course. These activities provide students an opportunity to develop basic skills through repeated practice and feedback. In this talk we will present results on the impact these activities had on student learning in a large introductory electricity and magnetism class at the University of Illinois

You have submitted comments on this item

Change Session

No Yes

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Order

12

Comment:

Teaching method evaluation cluster

Update

Abstract Title: National assessment of the impact of Learning Assistants on physics students' learning 4996

Paper Type: Contributed

Author: Ben Van Dusen
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This study investigates the effects of various uses of Learning Assistants (LAs) on student outcomes across over 20 LA Alliance member institutions. Over 5,000 physics students and 29 instructors participated in the study using the LA Supported Student Outcomes (LASSO) online student evaluation system. The Force and Motion Concept Evaluation (FMCE), Force Concept Inventory (FCI), Brief Electricity and Magnetism Assessment (BEMA), and Conceptual Survey of Electricity and Magnetism (CSEM) were used by over 40 different classes across the U.S. Our analysis links course-level information (e.g. how LAs are utilized) and average LA-student interaction time to course learning gains. We will report results from various institutional settings and discuss contextual effects on student outcomes.

You have submitted comments on this item

Change Session

No Yes

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Order

4

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Natural language vs. multiple choice format in computer-based practice 5328

Paper Type: Contributed

Author: Ryan C. Badeau
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In order to evaluate the relative effectiveness of different question formats and levels of interaction during computer-based practice, students from two introductory-level mechanics classes were trained on the concepts of force and motion as part of one of four different

training conditions. The training conditions varied the format of student responses (short answer, natural language versus multiple choice format) and the level of interaction in the feedback provided (a single, provided explanation versus constructive follow-up questions). Overall, the natural language format with follow-up dialog provided the largest gains over control, with retention over a month after training. In addition, we see some evidence that the effectiveness of the different formats varies based on initial student knowledge.

You have submitted comments on this item

Change Session

(•) No ( ) Yes

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Order

13

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Pathways through Introductory Physics: Effects of Switching Between Course Formats 5492

Paper Type: Contributed

Author: Jacquelyn J. Chini
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As part of a project to explore the varying success of studio-mode courses, we are investigating institutional barriers that may lead to different student outcomes. As institutions adopt new instructional models, some may embrace the change more slowly, such that students have the option to take courses in multiple formats. We explore the pathways of students through the introductory physics sequence at two universities that have transformed some of their sections into studios, such that students may take the first semester course in either lecture-mode or studio-mode and then choose to stay with that mode or switch for the second semester. We report on correlations between first semester student outcomes on their choice to "switch" or "stay" and subsequent outcomes in the second semester as measured by conceptual and attitudinal surveys.

Footnotes: This work was funded by the National Science Foundation (Grant No. DUE-1347515).

You have submitted comments on this item

Change Session

No Yes

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Order

14

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Physics Teachers' Questioning Patterns and the Reasoning Behind Them 5514

Paper Type: Contributed

Author: Brianna Santangelo
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One of teachers' greatest tools in the classroom is questioning. It has long been theorized that higher level questioning leads to students developing a better understanding of the material but no one has examined the types of questions asked in physics classrooms in great detail. We used Bloom's revised taxonomy to classify the questions asked by high school physics instructors and surveyed them on what they believe their questioning patterns to be. By analyzing the distribution of question types and the teachers' self-perceived questioning patterns we take a first step to better understanding the use of questioning in physics classrooms.

You have submitted comments on this item

Change Session

No Yes

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Order

6

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Principles for research-based physics activities 5463

Paper Type: Contributed

Author: Joshua S. Von Korff
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Physics instructors obtain their educational activities from a variety of sources. They may invent the activities themselves, use activities that have been designed for them by other faculty in their department, or use published materials that can be purchased or downloaded. Over the last few decades, many published materials have been tested and shown to benefit students' conceptual understanding. We have analyzed some of these published physics activities and interviewed their designers in order to better understand the principles behind them. These principles are valuable for understanding the impact that physics activities have on students and for understanding non-published activities developed by individual instructors.

You have submitted comments on this item

Change Session

No Yes

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Order

7

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Promoting high school students' physics identity through performed

recognition 5285

Paper Type: Contributed

Author: Jianlan Wang
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Recognition has been found to be a significant component for the construction of identity. Recognition in physics education is how people perceive a student with respect to physics. Such perceptions are normally conveyed to students through words. Alternative to the explicit way of verbal recognition, recognition can be implicitly performed. The major objective of this study is to explore the efficacy of performed recognition in promoting students' physics identity. We enacted our performed-recognition interventions in multiple high school physics classes, tracked the development of the students' physics identity, and made both longitudinal and parallel comparisons of the patterns of identity development. The data is drawn from a series of surveys and student interviews. Our results indicate that performed recognition has a significantly positive effect in promoting or maintaining students' physics identity. We also make suggestions about how performed recognition should be conducted in high school.

You have submitted comments on this item

Change Session

○ No ◉ Yes

PER: Topical Understanding and Attitudes--G

Order

Comment:

Identity cluster

Update

Abstract Title: Reform Introductory Quantum Mechanics: Three Years In 5535

Paper Type: Contributed

Author: R. Daryl Pedigo
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During the 2012-13 academic year, a small team at the University of Washington began development of a thoroughly revamped sophomore level introduction to quantum mechanics course for physics majors. The course was first taught in the summer of 2013, and has been revised continuously since that time. Over 400 students have taken this course to date. An outline of the course structure and materials will be presented, along with one set of pre/post test results plus commentary on what seems to work and what does not.

Footnotes: with contributions from several graduate TAs, most notably Michelle Storms and Tong Wan.

Conflicts: Need to leave Tuesday late afternoon if at all possible to avoid missing two summer class sessions. But of course I know that everyone asks to be early rather than late.

You have submitted comments on this item

Change Session

(•) No ( ) Yes

--Select here if you would like to change the session --

Order

15

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Social Network Analysis of Support Groups in Introductory Physics 5408

Paper Type: Contributed

Author: Christopher A. Oakley
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Research suggests that students benefit from peer interaction and active engagement. The quality and nature of these interactions is currently being explored. Students have been surveyed at regular intervals during the second semester of trigonometry-based introductory physics to determine the frequency and self-reported quality of interactions. These interactions can be with current or past students, tutors, and instructors. Our current research focuses on the metrics of Social Network Research in an effort to refine deeper research questions regarding success in the introductory sequence and the support system that student create during the 2 semester physics sequence. These metrics include centrality

of students as well as segmentation of groups.

You have submitted comments on this item

Change Session

No Yes

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Order

22

Comment:

Update

Abstract Title: Specifications grading in a large-enrollment ISLE physics class 5621

Paper Type: Contributed

Author: David T. Brookes
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I will report on an experiment to implement a specifications grading* approach to assessment in a large-enrollment (130 students) introductory algebra-based physics course at California State University, Chico. In specifications grading, criteria for adequate performance need to be clearly specified, and all criteria are graded pass/fail. In adapting this assessment approach to the Investigative Science Learning Environment (ISLE) philosophy, I created homework and exam questions that that tested different (sometimes overlapping) clusters of scientific abilities. Students needed to perform adequately on all the specified scientific abilities in order to pass that particular question. This allowed for a more process-focused approach to assessment while still emphasizing key physics content. I will report on the effectiveness of this approach to assessment as gauged by quantitative shifts in students' attitudes and gains in conceptual understanding as well as qualitative data from student interviews.

Footnotes: * Nilson, L. B. (2015). Specifications Grading. Sterling, Virginia: Stylus Publishing, LLC.

You have submitted comments on this item

Change Session

No Yes

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Order

16

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Students' investigation of thermal radiation with infrared cameras 5136

Paper Type: Contributed

Author: Jesper Haglund
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First-year university physics students (N = 42) were engaged in an open-ended laboratory module of a thermodynamics course, with a focus on understanding a chosen phenomenon or the principle of laboratory apparatus, such as thermal radiation or a heat pump. In the practical investigation, students had at their disposal handheld infrared (IR) cameras. Students' interaction with the laboratory exercises and oral presentations were video recorded, and three episodes were selected for qualitative analysis. Students used IR cameras in the investigation of interaction of thermal radiation with matter, e.g. metals, glass or whiteboard surfaces. For instance, the function of a glass window is to let through visible light, but reflect radiation in the IR range for insulation purposes. Students were intrigued to find black- and white-painted surfaces to have similar thermal emissivity. As an implication, IR cameras were found to be useful tools in open practical thermodynamics exercises.

Footnotes: Bor Gregorcic

You have submitted comments on this item

Change Session

No Yes

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Order

17

Comment:

Teaching method evaluation cluster

Update

Abstract Title: The effects of group structure in an introductory studio classroom 5551

Paper Type: Contributed

Author: Kristine E. Callan
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At Colorado School of Mines, we teach introductory physics using a hybrid lecture-studio model. In studio, students are split into groups of three to work through scaffolded problems and experiments. We want to know whether heterogeneous or homogenous group structures yield the most effective learning in our particular context. Each group structure has its own set of advantages (e.g., diversity of understandings and skills vs. ease of communication) and disadvantages (e.g., difficulty of communication vs. potential lack of understandings and skills). To explore the answer to this question, we assigned half of each studio class to groups with mixed physics proficiency and gender, and the other half to groups with matched physics proficiency and gender. We evaluate the performance of each group type according to the students' scores and responses on the FMCE, common course exams, the CLASS, and an internal survey about their studio groups.

You have submitted comments on this item

Change Session

No Yes

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Order

18

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Toward instructional design principles: Inducing Faraday's Law with Contrasting Cases 5376

Paper Type: Contributed

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In discussion sections of a large, introductory physics course, a pair of studies compare two instructional strategies for teaching Faraday's law: having students (i) explain a set of contrasting cases or (ii) apply and build on previously learned concepts. We show that contrasting cases not only lead to better performance on subsequent Faraday's law questions, but also prepare students to better learn related topics, such as Lenz's law. We argue that early exposure to contrasting cases better focuses student attention on a key feature: change in magnetic flux. Importantly, the benefits of contrasting cases are enhanced for students who did not first attend a Faraday's law lecture, suggesting that being told the answer can circumvent the benefits of its discovery. These studies illustrate an experimental approach for understanding how the structure of classroom activities affects learning and performance outcomes, a first step toward design principles for effective instructional materials.

You have submitted comments on this item

Change Session

No Yes

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Order

19

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Using and Improving Mastery-Style Online Homework in a Large Introductory Course 5283

Paper Type: Contributed

Author: Brianne N. Gutmann
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The successful implementation of mastery-style online homework into our preparatory mechanics course has been a long term project, currently in its second year. By requiring students to perfect a single unit of defined competencies before moving on to its successive unit (with intervening narrated animated solutions for instructional support), this homework delivery method replaced traditional immediate feedback online homework for the class of about 500 students. After the first year of data collection and analysis, significant revisions were made to the system's delivery, content, and messaging. The impact of these changes and second year data will be presented.

You have submitted comments on this item

Change Session

No Yes

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Order

20

Comment:

Teaching method evaluation cluster

Update

Date Last Updated: February 4, 2011