AAPT Programs & Conferences Tools

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Sacramento - California (SM16) / Status: Inactive

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Approved Topics' Abstracts

Adaptaton of Physics Activities to Three Major Components of NGSS

Committee on Physics in High Schools | **Type:** Inv/Con | **Organizer:** Trina Cannon

Description:

Call for Papers: NGSS is taking hold and we have many physics lessons that have stood the test of time. Now is the time to wed the two and update the the concepts we have taught in many forms. Share the new products that are clearly designed for the NGSS curriculum plan. Since many teachers are being directed to the NGSS, this is the time to share your work and understanding of the NGSS directives.

Abstracts Submitted (# 2) | Abstracts You Have Reviewed: 0

Abstract Title: Integrating NGSS Physics Concepts with Common Core Mathematics and English

Paper Type: Invited

Author: Jan Mader
Great Falls High School
1900 2nd Ave S
Great Falls, MT 59404
406-268-6388 (p)
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Jan_Mader@gfps.k12.mt.us

Speaker order: 01

With the push for literacy in all core areas, high school physics and middle school physical science instructors are encouraged to demonstrate the integration of NGSS performance expectations to other science disciplines, engineering and the Common Core State Standards in Mathematics and English Language Arts. Using the concept of energy, this session will focus on the development of a learning cycle and the integration of mathematics and literacy strategies.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: NGSSifying Exploratorium Snacks (Activities)

Paper Type: Contributed

Author: Marc 'Zeke' Kossover
Exploratorium
17 Pier, Suite 100
San Francisco, CA 94111
4156949337 (p)
zkossover@exploratorium.edu

An Exploratorium Snack is a hands-on science activity. They are tabletop exhibits or explorations of natural phenomena that teachers or students can make using common, inexpensive, readily available materials. Some of them can be found at www.exploratorium.edu/snacks. Snacks are ideal candidates for NGSS activities because they support teachers in bringing phenomena into the classroom to be explored by students. However, Snacks alone won't ensure that your students engage in the science practices successfully. See how we have retrofitted Snacks from decades ago to make them better. We are also investigating how we can help new teachers NGSSify our Snacks. We have a planning tool that you might find useful too.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

CIRTL: A Network Model to Transform STEM Education and Prepare Future Faculty

Committee on Graduate Education in Physics | **Type:** Inv/Con | **Organizer:** Manher Jariwala

Description:

Call for Papers: The CIRTL (Center for the Integration of Research, Teaching, and Learning) Network of 22 leading U.S. research universities uses graduate education as the leverage point to develop a national STEM faculty committed to implementing and advancing effective, evidence-based teaching practices. In this session, we will discuss the impact of CIRTL, both network-wide and in individual member institutions across the country.

Abstracts Submitted (# 4) | Abstracts You Have Reviewed: 0

Abstract Title: New doorways to physics instruction: Blending a MOOC and classroom discussion to train graduate students and postdocs in evidence-based teaching

Paper Type: Invited

Author: Bennett Goldberg
Boston University
8 Saint Mary's St, Photonics Center
Boston, MA 02215
617-353-5789 (p)
goldberg@bu.edu

Speaker order: 02

A challenge facing physics education is how to encourage and support the adoption of evidence-based instructional practices that years of physics education research has shown to be effective. Like many STEM departments, our community struggles to overcome the barriers of faculty knowledge, motivation and time; institutional cultures and reward systems; and disciplinary traditions. Research has demonstrated successful transformation of department-level approaches to instruction through critical components of local learning communities, in-house expertise, and department administrative support. In this presentation, I will discuss how physics and other STEM departments can use a MOOC on evidence-based instruction together with in-person seminar discussions to create a learning

community of graduate students and postdocs, and how such communities can affect departmental change in teaching and learning. Four university members of the 21-university network working to prepare future faculty to be both excellent researchers and excellent teachers collaborated on an NSF WIDER project to develop and deliver two massive open online courses (MOOCs) in evidence-based STEM instruction. A key innovation is a new blended mode of delivery where groups of participants engaged with the online content and then meet weekly in local learning communities to discuss, convey current experiences, and delve deeper into particular techniques of local interest. The MOOC team supported these so-called MOOC-Centered Learning Communities, or MCLCs, with detailed facilitator guides complete with synopses of online content, learning goals and suggested activities for in-person meetings, as well as virtual MCLC communities for sharing and feedback. In the initial run of the first MOOC, 40 MCLCs were created; in the second run this past fall, more than 80 MCLCs formed. Further, target audiences of STEM graduate students and postdocs completed at a 40-50% rate, indicating the value they place in building their knowledge in evidence-based instruction. We will present data on the impact of being in an MCLC on completion and learning outcomes, as well as data on departmental change in physics supported by MCLCs.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Teaching and Research Training: A Graduate Student Perspective

Paper Type: Contributed

Author: Alexander P. Becker
Boston University
590 Commonwealth Ave
Boston, MA 02215
6179875485 (p)
apbecker@bu.edu

CIRTL seeks to improve the teaching and research training of graduate students. At Boston University, two major initiatives are the "Teaching Fellow Peer Mentoring" program (TFPM) and the "Teaching as Research" fellowship (TAR). I will offer a graduate student's perspective on these efforts to train future educators. Having been first mentee and then

mentor within the TFPM, I will present experiences, data and activities which sustain and expand this student-run program. The TAR fellowship comprises a seminar and research project, for which graduate students and professors team up to investigate one aspect of undergraduate or graduate education. Getting graduate students involved is one goal, another one being the further improvement of teaching at BU. I will present challenges and opportunities, by example of my own TAR research project.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: The CIRTL Network and Graduate Professional Development at Texas A&M University

Paper Type: Contributed

Author: Robert C. Webb
Texas A&M University
Department of Physics and Astronomy
College Station, TX 77843-4242
979-845-4012 (p)
979-845-2590 (f)
webb@physics.tamu.edu

The CIRTL mission is to improve undergraduate education in the STEM disciplines through providing future faculty (a.k.a. grad students and post doctorals) with various forms of professional development using the three CIRTL pillars: teaching as research (TAR); learning communities; and learning through diversity. Texas A&M has been a member of the CIRTL Network for nearly ten years and during that time we have developed a number of programs aimed at addressing this mission. In this presentation we will give an overview of the primary TAMU CIRTL activities at Texas A&M and then spend a few minutes discussing how these activities have begun to impact physics education research in our department.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: The Integration of Research, Teaching and Learning: Preparation of the Future STEM Faculty

Paper Type: Invited

Author: Robert D Mathieu
University of Wisconsin - Madison
Department of Astronomy
Madison, WI 53706-1380
608-239-0380 (p)
mathieu@astro.wisc.edu

Speaker order: 01

Graduate students at research universities shape the future of STEM undergraduate education in the United States. These future faculty flow into the STEM faculties of several thousand research universities, comprehensive universities, liberal arts colleges, and community and tribal colleges. The Center for the Integration of Research, Teaching, and Learning (CIRTL) uses graduate education as the leverage point to develop STEM faculty with the capability and commitment to implement and improve effective teaching and learning practices. CIRTL has developed, implemented, and evaluated successful strategies based on three core ideas - teaching-as-research, learning communities, and learning-through-diversity. A decade of research demonstrates that STEM future faculty in CIRTL learning communities understand, use, and advance high-impact teaching practices. Today the CIRTL Network includes 46 research universities. Ultimately, CIRTL seeks a national STEM faculty who enable all students to learn effectively and achieve STEM literacy, whose teaching enhances recruitment into STEM careers, and whose leadership ensures continued advancement of STEM education.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Climate Change

Committee on Physics in Two-Year Colleges | **Type:** Inv/Con | **Organizer:** Tom Carter

Description:

Call for Papers: This session will review current research in climate change along with innovative techniques used in the teaching of the physics of climate change.

Abstracts Submitted (# 7) | Abstracts You Have Reviewed: 0

Abstract Title: A selection of climate myths from AAPT posters

Paper Type: Contributed

Author: Gordon J. Aubrecht
Ohio State University Marion Campus
193 N. Washington St.
Delaware, OH 43015-1609 United States
7403690992 (p)
aubrecht.1@osu.edu

Posters outlining climate myths arising almost exclusively from letters to the editor of my small-town newspaper have been a feature of previous and the current meeting. I present a selection of "greatest hit" myths in this short talk.

Conflicts: Not to conflict with PERC, International Ed, Teacher Prep, SI Units, my poster session, or my invited session, please.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Climate Change and California: Potential Impacts and Solutions

Paper Type: Invited

Author: Guido Franco
Research Division, California Energy Commission
1516 Ninth Street, MS-29
Sacramento, CA 95814-5512
916-654-4989 (p)
Guido.Franco@energy.ca.gov

Speaker order: 02

California's climate is changing and will continue to evolve in the foreseeable feature at a rapid rate driven mostly by the increased concentration of greenhouse gases in our atmosphere. This talk will describe how our climate is changing in California and how these changes are just a prelude to what is expected to occur in the rest of this century. The presentation will also describe what is known about the potential impacts of climate change on the different sectors of our economy and on the energy sector in particular. Finally, the presenter will describe the actions that California is taking to both reduce greenhouse gas emissions and to prepare for the impacts that are no longer avoidable.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Climate Change Films for the Physics Classroom

Paper Type: Contributed

Author: Jeffrey R. Groff
Shepherd University
PO Box 5000
Shepherdstown, WV 25443-5000
3048765143 (p)
jgroff@shepherd.edu

Film can be a powerful medium for engaging, informing, and inspiring students. This talk will highlight climate-change-themed films suitable for screening in a physics class. The showcased films have all been official selections of the American Conservation Film Festival in Shepherdstown West Virginia and are accompanied by an online resource kit for instructors. This resource kit includes film summaries, suggested topics for discussion, and a mapping between the content of each film and specific units encountered in the physics curriculum.

Conflicts: I am a committee chair (Ed. Tech.) and am also presiding over the session titled "Educational Hacking: Repurposing Technology for Teaching."

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Climate Physics in the Classroom

Paper Type: Invited

Author: Michael Wiescher
University of Notre Dame
225 Nieuwland Hall
Notre Dame, IN 46556
574 631 6788 (p)
mwiesche@nd.edu

Speaker order: 01

The question of climate and climate change is dominated by emotional discussion and by ideological agendas. A new course was developed to investigate the science conditions that determine climate and that instigate climate change. The presentation will provide an overview on motivation and content of the course that includes topics such as energy physics of climate, the microphysics of climate, the atmospheric and hydrospheric physics of climate,

climate history, climate proxies and signatures, closing with possible methods for climate stabilization.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Physics of Climate

Paper Type: Contributed

Author: Celia Chung Chow
(CSU)
9 Andrew Drive
Weatogue, CT 06089 USA
8608888209 (p)
cchungchow@comcast.net

Speaker order: 5

While the global climate pattern is changing drastically, we physics teachers need to update our knowledge constantly in order to understand the Nature and to cope with her. Above all, we will share our understanding with students. Some concepts and models of climate will be presented.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: The effect of place attachment on Learning Sustainable Energy at the undergraduate level

Paper Type: Contributed

Author: Elon E. Langbeheim
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6980 E Sahuaro Dr. Apt 2029
Tempe, AZ 85287-2803 United States
6023843688 (p)
6023843688 (f)
elon.langbeheim@asu.edu

Speaker order: 6

A realistic picture of the challenges of developing cleaner energy production and use that will reduce greenhouse gas emissions, has to include quantitative analyses of alternatives and to explain the limitations posed by the laws of physics. The recent Paris climate summit (Dec. 2015) has defined guidelines for a global effort to reduce greenhouse gas emissions. It also acknowledges that although the implications of burning fossil fuels are global, promoting sustainable energy production and use has to be tailored to the location, culture and development of the country. Thus, teaching people about sustainable energy requires applying the scientific to local opportunities and challenges. We outline the essential components a course on sustainable energy, and its impact on learners. Specifically, we explore whether fitting the course content to include local examples makes it more meaningful and comprehensible for students native to the area than for students from out of state.

Conflicts: Please schedule the presentation before July 20th (i.e. July 16-19 is ok)

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Worldwide Climate Change: Darkest Just before the Dawn

Paper Type: Invited

Author: William Collins
Lawrence Berkeley National Laboratory
One Cyclotron Road
Berkeley, CA 94720 United States
510-495-2407 (p)
wdcollins@lbl.gov

Global climate change is becoming increasingly obvious, and unavoidable, as the 21st century unfolds. Scientists are also seeing many signs in their observations that the pace of this change is both unprecedented relative to last several thousand years and is poised to accelerate in the near future. This presentation describes recent advances in detecting global change, quantifying the rate of that change, and attributing that change to natural and human causes. The talk will then turn to the likely impacts of that change over the next several decades on global society and the environment. We conclude by discussing the windows of opportunity to slow or perhaps even halt climate change, the urgent actions required to take advantage of these opportunities, and the critical role of enhancing education among those actions.

Footnotes: Sponsored by Tom Carter

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Course Program Assessments

Committee on Physics in Two-Year Colleges | **Type:** Con | **Organizer:** Tom Herring

Description:

Call for Papers: Ideas concerning course and program assessment in physics at all levels. Best practices, avoiding problems, and communicating results of assessments are welcome topics.

Abstracts Submitted (# 0)

Developing Experimental Skills at all Levels

Committee on Laboratories | **Type:** Inv/Con | **Organizer:** Mary Ann Klassen

Description:

Call for Papers: One of the principal goals of the physics laboratory is the development of experimental and analytical skills. We expect our students to acquire this expertise in the laboratory, yet often we give no explicit framework in which to do so. This invited/contributed session is a forum to share ways of structuring the physics lab curriculum at all levels to teach these valuable skills to majors and non-majors alike.

Abstracts Submitted (# 17) | Abstracts You Have Reviewed: 0

Abstract Title: A Pedagogical Method for Advanced Laboratory Writing: Letters Home Project

Paper Type: Contributed

Author: Charles L. Ramey II
Texas Tech University
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Lubbock, TX 79409-4349 United States
4344202048 (p)
charles.ramey@ttu.edu

The Modern Physics course at Texas Tech University (TTU) serves as a bridge to other upper-level courses. In the lab segment, students expand their conceptual understanding while learning experimental and observational skills which are fundamental for advanced labs and research experience. This presentation will focus on a research project we call Letters Home (LH). LH are an informal means of practicing scientific writing skills to various levels of audience while engaging the writer in gathering, critically analyzing, and reporting data. In Fall 2015 we conducted 4 sets of LH with 28 students. Currently, we are analyzing the results from the previous semester and report our results. We also used a survey, the Colorado Learning about Science Survey for Experimental Physics (E-CLASS), to assess students' attitudes about physics, communication, and experimentation. We are continuing this research to increase our understanding of students learning and attitudes.

Change Session

(●) No ( ) Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: AP Chemistry Content Knowledge and Guided Inquiry Lab Instructional Strategies

Paper Type: Contributed

Author: Emily A. Knapp
University of Colorado Boulder/Longmont High School
1040 Sunset Street
Longmont, CO 80504
303-746-0017 (p)
knapp_emily@svvsd.org

With the extensive content requirements for Advanced Placement Science courses, teachers may find it challenging to teach adequate content without compromising time for laboratory data analysis during lessons. The College Board published a series of guided inquiry experiments for AP Chemistry with the goal that students have the opportunity to engage in science practices while learning the necessary content. This study examines how instructional strategies, such as small group presentations and whole-class consensus discussions about these guided inquiry labs, may influence student assessment performance on nationally normed AP Chemistry released questions.

Conflicts: I'd like to present as late as possible during AAPT so that I can also attend PERC. If I could have a spot late on Tuesday or Wednesday it would be helpful. Thank you.

Change Session

(●) No ( ) Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Assessing students' laboratory skills in introductory and intermediate physics courses

Paper Type: Contributed

Author: Duane L. Deardorff
The University of North Carolina at Chapel Hill
Campus Box 3255
Chapel Hill, NC 27599-3255
919-962-3013 (p)
duane.deardorff@unc.edu

For the past 15 years at UNC-Chapel Hill, we have been assessing students' laboratory skills in the introductory physics courses, and this past year we added a practicum to the intermediate physics lab course. The purpose of these exams is to evaluate how well our students are meeting our learning goals that include making accurate measurements with typical laboratory instruments, analyzing and interpreting empirical data, evaluating results, analyzing measurement uncertainties, and properly communicating findings. Trends in student performance and lessons learned will be shared in this talk. Sample lab exam questions and answers with explanations are provided for students to help them prepare for their exams; these can be found on our department website: www.physics.unc.edu/labs

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Assignment Sequences for Experimental Skill Development in Physics

Advanced Lab

Paper Type: Contributed

Author: Sean P. Robinson
MIT
77 Massachusetts Avenue, Room 4-362
Cambridge, MA 02139-4307
617-253-5082 (p)
spatrick@mit.edu

I will describe how the concept of assignment sequences --- preparatory online work, followed by a hands-on in-lab exercise, followed by a detailed homework exercise --- is applied in the MIT Physics Junior Lab course to help develop various professional skills both horizontally and vertically. Examples of skill domains include data analysis and basic test bench instrumentation.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Changes in lab curriculum to develop lab skills.

Paper Type: Contributed

Author: David Kardelis
Utah State University Eastern
451 E 400 N
Price, UT 84501 United States
4356135258 (p)
4356135258 (f)
david.kardelis@usu.edu

Labs currently use equipment ranging from the low tech stop watch timings and a ruler to data loggers and video analysis. This seemingly random mix of high and low tech is being modified to bring a more coherent approach to have students gaining lab skills throughout the semester. For example, the changes have included bringing back some classic labs such as Hooke's Law but with more emphasis on graphing and meanings obtained from the data less on confirming Hooke’s Law. Other labs bring in newer technology such as video analysis,

to help illustrate other aspects of data taking, such as distributions of measurements and uncertainty. A few of the changes and the desired outcomes from these labs will be discussed.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Design, Build, Measure!: “Do-It-Yourself Experimental Atmospheric Physics

Paper Type: Contributed

Author: Holly Maness
University of California Berkeley
McCone Hall
Berkeley, CA 94720 United States
5103400445 (p)
maness@berkeley.edu

“Do-It-Yourself Experimental Atmospheric Physics” is designed to introduce sophomore students to the full cradle-to-grave process underpinning modern observational experiment. Organized around four interdependent projects, students design, build, and deploy instruments constructed from basic components like photodiodes, filters, polarizers, lenses, and gratings to measure fundamental properties of the atmosphere including opacity, polarization, and composition. Through construction of a radiative transfer code, students learn the basics of experimental design — how to ask a scientific question, estimate instrument requirements, and identify components. Students learn later how to build, calibrate, and test their resulting instruments, gaining proficiency with basic lab equipment like electronics test gear, optomechanical components, and computer-aided fabrication tools. Ultimately, students deploy their instruments in the field and interpret their measurements statistically in the context of their model predictions. Completion of this course arms young undergraduates with the skills, knowledge, and confidence necessary to tackle current research questions of their choice.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Developing scientific communication skills using lab notebooks

Paper Type: Invited

Author: Jacob Stanley
University of Colorado, Boulder
Department of Physics, 390 UCB
Boulder, CO 80309 United States
8583377025 (p)
jacob.stanley@colorado.edu

Speaker order: 01

In experimental physics, the use of lab notebooks for scientific documentation is an essential part of the research process. For all of the ubiquity of lab notebooks, little formal attention has been paid to addressing what is considered “best practice” and how researchers come to learn these practices. To explore the role of lab notebooks in table-top experimental physics, we conducted interviews with physics graduate students at a large research university. From these interviews, we gained insight into their experiences with lab notebooks in their undergraduate and graduate education, as well as what features of their lab notebooks they felt were essential for their research. I will present some of the common themes in the interviewees’ experiences and the broad guidelines for what constitutes authentic scientific documentation, which emerged from the interviews. Additionally, I will provide some pedagogical suggestions for how to incorporate these guidelines into a lab course setting.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Developing student attitudes about experimental science and being a scientist

Paper Type: Contributed

Author: Linda E. Strubbe
University of British Columbia
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Vancouver, BC V6T 1Z1 Canada
6477834096 (p)
linda@phas.ubc.ca

Learning in the affective domain is an important goal in many undergraduate laboratory courses: e.g., goals that students increase their appreciation of physics as an evidence-based way of understanding the world, and that they increase their self-identity as scientists. Unfortunately, studies have found that students' attitudes about science are difficult to improve. In our "structured quantitative inquiry" first-year physics lab course at UBC, we have introduced several course components specifically targeting students' beliefs about the nature of science and their self-identification as scientists. We use the Colorado Learning Attitudes about Science Survey for Experimental Physics (E-CLASS) to investigate students' differing incoming attitudes, and how these attitudes change through the course. We describe preliminary results for the ~600 students in our course this year, who include a variety of science majors at both honors and non-honors levels.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Enhancing student-designed experiments using a real-world funding scenario

Paper Type: Contributed

Author: Nathan D. Powers
Brigham Young University
BYU Department of Physics and Astronomy, N490 ESC
Provo, UT 84602-0002 United States
8014225393 (p)
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Acquiring funds and resources is a critical skill for all experimentalists and technical professionals but the benefits of this skill go beyond money. The act of proposal writing requires one to become aware of what is interesting, important, and achievable. Thus, the process of competing for funds improves both the experiment and experimentalist. While proposal writing is not typically associated with laboratory education, it is an effective tool for enhancing a student's ability to design and carry out experiments. I describe a real-world funding scenario that was incorporated into an advanced laboratory course to improve the quality of student-designed experiments. To do this, different sections of a class formed a review panel that decided which experiments should be "funded". "Funded" projects were then developed into full proposals that were reviewed for final approval. Students found the peer evaluation aspect both engaging and insightful.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Flipped modular skills-based introductory electronics course: first-year results

Paper Type: Contributed

Author: Eric Ayars
California State University, Chico
Campus Box 202
Chico, CA 95929-0202
530 898-6967 (p)

eayars@csuchico.edu

After enjoying good results with a flipped introductory physics course, I decided to flip our department's sophomore-level "Electronics for Scientists" course and associated lab. The course redesign got out of control, though, and the course ended up a collection of interdependent modules through which students could progress at their own pace, along multiple paths of their own choosing. As of the submission date for this abstract it is unclear whether this redesign is a good thing or not; but there are already some clear advantages to this approach as well as some expected (and unexpected) problems. I expect that the advantages will dominate, but either way this talk promises to be educational for anyone considering such a course change.

Conflicts: I also have an invited talk, and I'm uncertain whether the prohibition on more than one oral presentation would prohibit this contributed talk. If I may only do one of these two, drop this one rather than the invited talk.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: From cookbook to authentic research - what skills should they be learning

Paper Type: Contributed

Author: Natasha G. Holmes
Stanford University
382 Via Pueblo Mall, Stanford University, Department of Physics
Stanford, CA 94305-1684
650-665-1035 (p)
ngholmes@stanford.edu

The positive outcomes of undergraduate research experiences have been well categorized in a variety of disciplines and many institutions are beginning to try and replace standard lab courses with more authentic research-like experiences. I will present our recent work evaluating the cognitive decisions and processes that students carry out during both undergraduate research experiences and in a variety of lab courses. These comparisons can guide the curricular goals and designs for lab courses, either to better prepare students for research, or to provide a more authentic alternative to research experiences.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Identifying Statistical Reasoning Abilities Necessary for Informed Decision Making

Paper Type: Contributed

Author: Carol Fabby
University of Cincinnati
2600 Clifton Avenue
Cincinnati, OH 45221-0011
513-325-7754 (p)
fabbyc@mail.uc.edu

Social media presents large amounts of data through political polls, scientific reports, and health care percentages; all in an attempt to support a particular claim. However, few people are formally educated on how to make inferences using provided information. Decisions made from such information may be influenced by personal bias and individuals' understanding of provided data. This research utilizes conditional probability assessment questions to identify key features of statistical and probabilistic reasoning (sub-domain of scientific reasoning) which are necessary to understand data as well as to determine if any pre-existing bias affects students' interpretations of data. Assessment results of students enrolled in a college-level introductory physics laboratory course indicate more formal instruction may be necessary to help students learn how to determine (1) if a relationship exists between two or more variables when given a contingency table; (2) the likelihood of an event; and (3) when bias influences decision making.

Conflicts: I can not attend the conference on Wednesday July 20 due to another conflict.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Normal Modes and Symmetry Breaking in single Two-Dimensional Pendulum
Paper Type: Contributed

Author: Arvind Arvind
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Knowledge City, Sector 81
Mohali, Pb 140306 India
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arvind@iisermohali.ac.in

A two dimensional pendulum is expected to execute planner oscillations if the observation time is small compared to one day, so that the effect of the coriolis force can be neglected. What if the cylindrical symmetry of the suspension is broken? It turns out that such a pendulum with a controlled symmetry breaking can be turned into a pedagogical tool. We have developed an experimental setup to demonstrate normal modes and symmetry breaking in a two-dimensional pendulum. The broken cylindrical symmetry leads to non-degenerate normal modes of oscillation whose interplay gives rise to complex motion. This motion has several qualitative and quantitative features which helps us use this experiment to teach three concepts: normal modes, symmetry breaking and appreciating the difficulties associated with building a Foucault's pendulum.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Physics Laboratory Activities for Pre-health and Life Science Students

Paper Type: Invited

Author: Elliot Mylott
Portland State University
SRTC, 1719 SW 10th Ave., Room 134
Portland, OR 97214
503-997-7148 (p)
emylott@pdx.edu

Speaker order: 02

As part of our work in reforming undergraduate physics education for pre-health and life science students at Portland State University, we have developed multiple laboratory activities that present important physical concepts in a biomedical context. Each activity explores the fundamental physics principles behind aspects of physiology or common medical equipment. The biomedical subjects of the activities include radiography, computed tomography, pulse oximetry, bioelectrical impedance analysis, electrocardiograms, and the optics of the human eye. The laboratories teach multiple physical concepts including: how electromagnetic radiation interacts with matter, the Beer-Lambert Law, electronic amplification and filtering, AC circuits, and image formation. By framing the physical application of these concepts in a biomedical context, the activities effectively convey to students the relevance of physics to medicine and the life sciences.

Footnotes: This work was supported by grants (DUE-1141078 and DUE-1431447) from the National Science Foundation.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Scientific Reasoning Curriculum Effect on Students' Control of Variables Skills

Paper Type: Contributed

Author: Krista E. Wood
University of Cincinnati

9555 Plainfield Rd.
Cincinnati, OH 45236
513-745-5745 (p)
Krista.Wood@uc.edu

There is a need to explicitly target the development of scientific reasoning (SR) skills in physics lab and to research the effects of SR-targeted curriculum on students SR skills. Focusing on one SR skill, this study evaluated the development of students' abilities in control of variables (COV) during the first implementation of a SR-targeted lab curriculum at a TYC. Students' COV skills were evaluated using nine COV questions from the Inquiry for Scientific Thinking and Reasoning (iSTAR) assessment that targeted various complexity levels of COV skills. Findings indicated that students' skill development varied at the different COV skill levels. The curriculum appeared to have the greatest impact at the intermediate COV skill level and less impact at the low and high skill levels. These findings will be used to inform lab curriculum revisions, as well as to improve the implementation of the lab curriculum in future terms.

Conflicts: I can not attend the conference on Wednesday July 20 due to another conflict.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Teaching techniques for experimental success

Paper Type: Contributed

Author: David D. Allred
Brigham Young University
N265 ESC
Provo, UT 84602-4636
801-422-3489 (p)
801-422-0553 (f)
dda@byu.edu

Physics laboratory instruction in some institutions focuses on teaching students how to perform classic or state-of-the-art experiments. In some cases, the experiments involve using complex and sometimes expensive equipment. While working with these tools exposes students to equipment that they may use at a future time, it can leave them feeling

dependent on specific equipment to carry out experiments. I describe an advanced laboratory course that instead focuses on introducing students to some core components and techniques that are incorporated into more advanced equipment. Students use the equipment and techniques to design and carry out their own experiment. This approach helps students understand the concepts, limitations, and advantages behind more advanced tools while promoting confidence in their ability to create their own solutions. Examples of student experiments are also presented.

Footnotes: Please put this talk before that of Nathan D Powers. He is my current sponsor but I'm going to renew my membership in the next week or two.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Troubleshooting in the electronics lab: A study of instructor practices

Paper Type: Contributed

Author: Dimitri R. Dounas-Frazer
University of Colorado Boulder
Department of Physics 390 UCB
Boulder, CO 80309-0390
303-862-0337 (p)
dimitri.dounasfrazer@colorado.edu

The ability to troubleshoot systems is a crucial aspect of experimental physics research and an important learning goal for undergraduate laboratory courses. Electronics courses are well suited to developing students' troubleshooting abilities because the need to troubleshoot arises naturally in most lab activities. To understand the role of troubleshooting in electronics courses, we interviewed 19 electronics instructors from 17 distinct institutions. Preliminary analysis of interview data suggests that: (1) developing the ability to troubleshoot is fundamentally tied to the purpose of electronics courses, (2) electronics courses are perceived to be one of the few places in the curriculum where students develop troubleshooting skills, and (3) instruction about troubleshooting occurs primarily during lab activities via apprenticeship-style interactions between the instructor and pairs of students. Few interviewees indicated that they implemented activities or assessments explicitly

designed to teach or test troubleshooting ability. In this talk, we describe our study in more detail.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Different Ways to Flip a Classroom

Committee on Educational Technologies | **Co-Sponsor:** Committee on Physics in Two-Year Colleges | **Type:** Inv/Con | **Organizer:** Daniel Sanchez Guzman

Description:

Call for Papers: Implementation of physics courses that use different technologies and scenarios has created a diversity of combinations and approaches. But, what is the real perception and feeling of students and teachers to all these recent scenarios and how are they facing new challenges and adapt in their instruction. This sesión tries to present an overview of how teachers have improved their class with the adoption of technologies and to be a reflective scenario for future actions.

Abstracts Submitted (# 0)

Do Try This At Home!

Committee on Apparatus | **Type:** Inv/Con | **Organizer:** Stephen Irons

Description:

Call for Papers: We seek talks that describe safe, interesting, and fun activities and demonstrations that anyone can try at home either for their own enjoyment or as part of a more formal learning environment (hands-on homework, distance learning, etc.) Presentations can describe demonstrations or lab experiments that can be conducted using common household items or easily available supplies. We are interested in materials for all grade levels and abilities.

Abstracts Submitted (# 5) | Abstracts You Have Reviewed: 0

Abstract Title: From Online Stunt to Science Literacy

Paper Type: Invited

Author: Pati Sievert
Northern Illinois University
STEM Outreach
DeKalb, IL 60115 United States
8157531201 (p)
8157530666 (f)
psievert@niu.edu

Speaker order: 01

Between YouTube and Pinterest, there's plenty of bad science mixed in with some really cool things for our students to try out at home. How do we turn a cool science activity found online into good science that's still fun? I'll dissect a few old standards along with some bad examples you can turn to your advantage. Having pre-collegiate students interact with family members in the execution of their "at home experiment" can increase both the student and family members' understanding of scientific processes, which along with engineering processes are one thread in the three dimensional NGSS.

Footnotes: www.niu.edu/stem

Conflicts: I'm a Section Rep so cannot present opposite any of those meetings.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Get Your Science On with the Little Shop of Physics

Paper Type: Invited

Author: Brian Jones
Colorado State University
Physics Department 1875
Fort Collins, CO 80523
9709801378 (p)

brian.jones@colostate.edu

Speaker order: 02

The Little Shop of Physics team has shared our hands-on science experiments with half a million K-12 students. Our emphasis is on accessibility—we want the barrier to experimentation to be low. We have a podcast series that tells students how they can reproduce anything we've built at home, and we make sure that the necessary skills and equipment are quite basic. In this talk I'll share some of our favorite experiments, and show where you find information about many more.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Improving Student Involvement Outside of Class with Family Fizx Fun & Everyday Physics Calculations

Paper Type: Contributed

Author: Stephanie C. Hawkins
Barrington High School
201 Lakewood Dr.
Oakwood Hills, IL 60013
8155454385 (p)
shawkins@barrington220.org

Getting regular and low level physics students to do schoolwork beyond the school day can be a major challenge. By asking students to do non-traditional homework has greatly improved my low level students' involvement beyond the school day. One important way to motivate the students is to incorporate parent support in at-home assignment. Family Fizx is a fun low expectation assignment that gets parents interested in helping their student success in my class. There are endless demos which students can take home to their families. Another at home activity is real world data calculations, an example includes have student analyze the motion of a MapMyRun workout. Taking the excitement of physics home has allowed me to provide students with more learning experiences, increased parent involvement, and increased out-of-school participation for low level students.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Physics beyond the formulas: Creating and sharing demonstrations

Paper Type: Invited

Author: Dianna L Cowern
Physics Girl
PO Box 9281
San Diego, CA 92169
8086354331 (p)
dianna.leilani@gmail.com

Speaker order: 03

In classroom learning, the question is often asked, “what does this have to do with real life?” Some of the most effective learning comes from student-driven questions, curiosity and from when students can tie learning concepts to their daily lives. The aim of the PBS YouTube series Physics Girl has been to connect physics to the real world in a conceptual way through curiosity-inspired questions. There are two parts to this talk. One will focus on the characteristics of effective physics demonstrations as guided by the success of certain experiment-based physics videos in an online world full of non-educational noise. What demos work in videos and why? The second part will focus on how sharing can enhance the learning experience. What makes viewers care about these demonstrations? This part will address the collaboration and feedback gained by sharing physics during the learning process.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Try This Experiment Right Now!
Paper Type: Contributed

Author: Anna Spitz
PhysicsVideos.com AAPT Films
PO Box 11032
Newport Beach, CA 92658
714-604-3978 (p)
AnnaSpitzPhysics@gmail.com

Try this Experiment Right Now! Physics Experiments you can do with no additional equipment! Just the cell phone in your pocket or the computer in front of you. Created for the AAPT Films Video Project, this series continues and helps teachers and students who have little access to equipment or just want to learn something new!

Footnotes: Sponsor: James Lincoln

Change Session
No Yes
--Select here if you would like to change the session --
Order (Sorters Suggested order)

Comment:

Submit

Educational Hacking: Repurposing Technology for Teaching

Committee on Educational Technologies | **Co-Sponsor:** Committee on Apparatus | **Type:** Con | **Organizer:** Jeff Groff

Description:

Call for Papers: This session will explore innovative ways that physics instructors and students are modifying, reconfiguring, refurbishing, and/or repurposing hardware and software to enhance this technology's usefullness for the teaching and learning of physics.

Abstracts Submitted (# 0)

Effective Practices in Educational Technologies

Committee on Educational Technologies | **Type:** Con | **Organizer:** Andy Gavrin

Description:

Call for Papers: Are you using technology in an innovative way in your class or in your teaching? If so, consider giving a contributed talk with the details. This session, featured every meeting, always has an interesting mix of talks, covering a variety of topics pertinent to the use of educational technology.

Abstracts Submitted (# 17) | Abstracts You Have Reviewed: 0

Abstract Title: An Interactive Video Vignette on Fall Rates for Different Masses

Paper Type: Contributed

Author: Priscilla W. Laws
Dickinson College
28 North College Street
Carlisle, PA 17013
717 245-1242 (p)
lawsp@dickinson.edu

Several years ago members of the LivePhoto Physics Group received collaborative NSF grants* to create short, single-topic, on-line activities that invite introductory physics students to make and test individual predictions about a phenomenon though video observations or analysis. Each Interactive Video Vignette is designed for web delivery as: (1) an ungraded homework assignment or (2) an exercise to prepare for a class or tutorial session. Sample IVVs are available at the ComPADRE website http://www.compadre.org/ivv/. A new vignette on free fall made at Dickinson College using Vignette Studio software will be presented. Using normal and high-speed videos, this vignette is designed to help students understand that both light and massive objects fall with the same acceleration. Finally, research on the impact of some of our vignettes on student learning will be discussed.

Footnotes: *NSF #1122828 (Dickinson College) & NSF #1123118 (Rochester Institute of Technology)

Conflicts: NOTE: This talk should be placed after the contributed talk proposed by Robert Teese on new features of the Vignette Studio Software.

Change Session

(•) No ( ) Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Creating Learning Communities with Web Technology in Professional Development Programs

Paper Type: Contributed

Author: Andrew W. Dougherty
The Ohio State University
191 West Woodruff Avenue
Columbus, OH 43210-1117
614-247-1953 (p)
dougherty.63@osu.edu

The School Year Based Inquiry Learning Program (SYBIL) is a large Mathematics and Science Partnership (MSP) Program that works with a number of school districts throughout central Ohio. K-12 teachers participate in a year-long professional development program that uses active inquiry-based learning to improve participant teacher and student science and math content gains. Teachers incorporate inquiry methods into their classrooms, and development inquiry-based lesson modules with accompanying pre/post formative assessments. SYBIL staff support teachers throughout the process and maintain contact with the teachers in subsequent school years, in order to further the incorporation if inquiry techniques into as many classrooms as possible. In order to maximize contact with participants, and to foster a learning community among participant teachers spread throughout many buildings and districts, SYBIL has begun leveraging web technologies to improve communication and access to inquiry materials. A brief summary of capabilities useful for a PD program is presented.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Exploring JITT with Traditional Classroom and Modern Technologies

Paper Type: Contributed

Author: Gen Long
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longg@stjohns.edu

In this presentation, we report an ongoing exploring study of adopting Just In Time Teaching in a classroom with heavy traditional setting while adopting modern technologies to help students learn whenever they see fit. By requiring student to preview and review lectures content on their own, as well as providing lecture videos online so that they can access them whenever needed, we found that the average grades of the class are improved.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Innovative Ways to Use Web-based Technologies in Introductory Physics

Paper Type: Contributed

Author: Thomas A. Moore
Pomona College
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Claremont, CA 91711

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tmoore@pomona.edu

Web-based technologies provide many novel opportunities for enhancing student learning in the introductory physics course. Web-based simulation apps and computerized grading systems represent well-known examples. In this talk, though, I will explore some more unusual applications of web-based technology in the introductory course, including targeted apps that allow students to perform calculations that would be otherwise impossible, and a system that supports an innovative student-centered approach to homework. I will also discuss the pedagogical philosophies behind these applications.

Change Session

No Yes

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Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Investigating Students' Usage Pattern of Web-based Computer Coaches

Paper Type: Contributed

Author: Bijaya Aryal
University of Minnesota Rochester
111 S Broadway, Suite 300
Rochester, MN 55904
5072588216 (p)
baryal@r.umn.edu

This presentation describes introductory level physics students' usage patterns of web-based Computer Coaches for physics problem solving. Nineteen students volunteered to participate in this study. Each student interacted with the Coaches individually, followed by semi-structured clinical interviews. Three patterns of usage ('clickers', 'reflectors', and 'optimizers') were identified by analysis of the interview data. Data analysis also revealed that students' difficulties interacting with the Coaches negatively impacted student learning of physics problem solving. Results of this study indicate the importance of adjusting Coaches interactions for optimal task time and rigor for maintaining student engagement in order to improve educational impact of the tool. This study found a qualitative relationship between students' usage pattern and their problem solving and educational performance in physics. Moreover, it demonstrates strong links between the time spent in different parts of a problem solving task and student motivation to use the Coach.

Change Session

No Yes

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Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: iTunes U and iBooks: Pathway to OER

Paper Type: Contributed

Author: Shahida Dar
Mohawk Valley Community College
1101 Sherman Dr
Utica, NY 13501
3157925633 (p)
sdar@mvcc.edu

Description of workshop: The attendees will learn about how to create interactive, dynamic documents using iBooks. The course management using iTunes U will also be explained. Presenter will show various examples of content creation and management. The use of iTunes U and iBooks in setting up Open Education Resources (OERs) will also be discussed.

Change Session

No Yes

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Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Lab Away From Lab: The IOLab's Potential for Avoiding the Space and Equipment Constraints of The traditional General Physics Lab

Paper Type: Contributed

Author: Stephen Mecca
Providence College
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4018652099 (p)
401-865-1438 (f)
smecca@providence.edu

Commercial and open-source multi-sensor instruments have become common in the marketplace. Some of these, for example the basic tablet or smartphone can be inexpensive but may lack features such as adequate sample rates for basic motion experiments. Commercial products from Pasco and Vernier are being introduced with Bluetooth capability allowing a laptop, tablet or hybrid logger to acquire data wirelessly. These products and the open-source IOLab device offer the opportunity to accomplish particular lessons of the general physics laboratory without the need for a physical laboratory and without an expensive inventory of lab equipment. This paper presents the authors' use of the IOLAB with a minimal set of additional components to replicate or slightly modify the existing General Physics laboratory exercises in our two semester sequence in the Department of Engineering-Physics-Systems at Providence College. The potential of this approach to laboratory instruction in traditional laboratory curricula, for distance learning or for resource constrained environments, such as rural schools in the developing world is discussed.

Change Session

(•) No ( ) Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Let's Code Physics: A Playful Approach to Learning Computational Physics

Paper Type: Contributed

Author: W. Brian Lane
Jacksonville University

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9045158098 (p)
9042567326 (f)
wlane@ju.edu

Let’s Code Physics is a YouTube channel that examines physics-related scenarios using computational modeling. Following the popular Let’s Play format (in which a video gamer records their progress through a game while providing commentary, thereby offering both entertainment and insights to the viewer), these Let’s Code videos record the development and implementation of a computational model (the code for which is made available so the viewer may “play along”) while offering commentary on the planning and revision of the code and an analysis of the results. The goals of Let’s Code Physics include spreading interest in computational physics, demonstrating successful coding practices, sharing ideas with viewers, and reducing the perception of dry formality of programming. Let’s Code Physics has proven popular (with 640 subscribers in 70 countries at the start of its second season), particularly among Let’s Play fans and physics students.

Change Session

No Yes

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Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Model Making and Model Breaking with Direct Measurement Video

Paper Type: Contributed

Author: Peter H. Bohacek
Direct Measurement Video Project
1897 Delaware Ave
Mendota Heights, MN 55118
651 238 9175 (p)
peter.bohacek@isd197.org

Curriculum based on direct measurement videos (DMVs) can be used to teach model making and model breaking skills. We define model making as the ability to determine a mathematical pattern in a data set measured from a physical phenomenon. This skill set includes experimental design, measurement, graphing data, curve fitting, and using mathematical relationships to make and test predictions. Model breaking is defined as the

ability to determine whether a known mathematical model accurately describes a specific scenario. Our 160-student study shows evidence that students who use DMV-based curriculum to learn these skills show increased mastery compared to students who do not. We'll also provide updates on new videos and our upgraded web app.

Change Session

No Yes

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Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Personalized learning in Physics with Tabletkoulu learning environment

Paper Type: Contributed

Author: Hannu Turunen
Helsinki Metropolia University of Applied Sciences
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hannu.turunen@metropolia.fi

Engineering students have widely varying skill of physics. Lecturing to the whole group is not working. Some students could move forward more quickly while others would require a slower progression. Personalized learning solves that problem. I introduce a special E-learning environment (Tabletkoulu.fi) where every student can progress with own rate and the teacher is able to see students progression in real time. The teacher gives assistance to the student exactly when needed. The student moves to the new topic only after he masters the earlier content. The environment guides student to do self-assessment after each unit. Student will also take the quiz to test if he masters the content. If student do not pass test, he guides to study more that topic. Student go forward only when he pass the test. I will present how this environment can support personalized learning and how assessment can be done easily.

Footnotes: https://www.tabletkoulu.fi/pages/in_english

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Smartphone and Tablet Physics: Unanswered Questions in Educational Technology

Paper Type: Contributed

Author: Rebecca E. Vieyra
Vieyra Software
225 C St. SE, Apt. B
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3098248853 (p)
rebecca.elizabeth.vieyra@gmail.com

Conversations about general educational technology frequently revolve more around "technology" than "education." This is especially true with the broad implementation of smartphone and tablet apps in K-12 education, and technology that is advancing more quickly than sound educational research to support it. Although there is a research base for the use of commercial probeware in the K-12 and higher education classroom, the educational technology world has given less attention to the use of personal mobile devices as tools for scientific inquiry. This presentation will briefly present some of the unanswered questions in tech ed research, relevant specifically to physics education research and student learning at the K-12 level.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Space Taxi paradigm for freebody analysis

Paper Type: Contributed

Author: Richard A. Zajac
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785-826-2693 (p)
rzajac@ksu.edu

For years we have used this compelling 1980’s computer game in the introductory course to establish a common experiential basis with which to frame Newton’s Laws. More than just a fun visualization tool, the shared experience has been found to serve as a powerful cue for triggering students to activate a Newtonian mindset when modeling real situations. Freebody diagrams and other conventional anlaysis tools emerge naturally from the game, not as imposed pedagogical formalism. Classroom experience and collected student feedback are discussed.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Teaching Physics in a 3D Immersive World

Paper Type: Contributed

Author: Victoria J. Robinson
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53 Lomb Memorial Dr. LBJ 2261
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5857482694 (p)
vjrnts@rit.edu

What if you could assign a lab for homework? One that your students could do at 2 AM from

their dorm rooms? One that would enable them to consult with their classmates at any time convenient for them? And one over which you have control? Welcome to physics in the virtual world of Second Life. At the National Technical Institute for the Deaf in Rochester NY, physics students have been doing homework, lab work, and exams in a virtual physics lab since 2009. This session will share some of the ways that virtual worlds can be used to teach physics.

Footnotes: Robinson, Vicki (2013) "Teaching Physics to Deaf College Students In A 3-D Virtual Lab," Journal of Science Education for Students with Disabilities: Vol. 17: Iss. 1, Article 5. Available at: http://scholarworks.rit.edu/jsesd/vol17/iss1/5

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Two Visualizations of Momentum Conservation in Introductory Physics

Paper Type: Contributed

Author: Darrell F. Schroeter
Reed College
3203 SE Woodstock Blvd.
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503-367-0587 (p)
schroetd@reed.edu

I will present two visualizations of momentum conservation used in the introductory physics course at Reed College. One uses Mathematica to simulate the motion of a handful of particles interacting with each other and display the vector sum of their individual momenta. The other uses video frames ripped from YouTube and a drawing program to demonstrate momentum conservation in a pool break. While these have been used as lecture demonstrations, they can both be straightforwardly reconfigured as hands-on activities.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Update on the Development of Distance Learning Labs for Introductory Physics Using IOLab

Paper Type: Contributed

Author: David R. Sokoloff
University of Oregon and Portland State University
Department of Physics, 1274 University of Oregon
Eugene, OR 97403-1274
5412216543 (p)
5413465861 (f)
sokoloff@uoregon.edu

In January, we presented a preliminary report on our project to develop and research the effectiveness of distance learning (DL) introductory laboratories based on the IOLab, a versatile, relatively inexpensive data acquisition device developed by Mats Selen and his colleagues at University of Illinois (2). With a cost of around $100, students can purchase their own individual IOLab, and can—in theory—use it to do hands-on laboratory experiments at home. The labs we have developed for IOLab are based on RealTime Physics (3), (4). Thus far, testing of these labs has been done in supervised laboratory environments at Portland State University and Chemeketa Community College, with research on conceptual learning and student attitudes carried out using the FMCE (5) and ECLASS (6), respectively. We will report on these preliminary results, and how they have guided us in our first round of testing the labs in a DL environment that is taking place at Chemeketa this Summer.

Footnotes: (1) Funded under NSF DUE – 1505086, July 1, 2015-June 30, 2017. (2) See http://www.iolab.science/ (3) David R. Sokoloff, Ronald K. Thornton and Priscilla W. Laws, "RealTime Physics: Active Learning Labs Transforming the Introductory Laboratory," Eur. J. of Phys.: 28 (2007), S83-S94. (4) David R. Sokoloff, Ronald K. Thornton and Priscilla W. Laws, RealTime Physics: Active Learning Laboratories, Module 1: Mechanics, 3rd Edition (Hoboken, NJ, John Wiley and Sons, 2011). (5) Ronald K. Thornton and David R. Sokoloff, "Assessing student learning of Newton's laws: The Force and Motion Conceptual Evaluation and the Evaluation of Active Learning Laboratory and Lecture Curricula", Am. J. Phys.: 66, 338-352 (1998) (6) See http://www.colorado.edu/sei/departments/phys-advlab-eclass.htm

Conflicts: Conflicts: Not to conflict with the following: (1) Organizer and presider for the following session: Interactive Lecture Demonstrations - What's New? ILDs Using Clickers, Video Analysis (2) Invited session: Lab Guidelines Focus Area 3: Modeling

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Usage of Web-based Personal Response System

Paper Type: Contributed

Author: Jing Han
The Ohio State University
191 W. Woodruff Ave.
Columbus, OH 43210-1168
614-688-2978 (p)
han.286@osu.edu

As more classrooms look to use clicker systems, the need for easy to use, cost effective solutions grows. The vast majority of college students, and an increasing number of younger students, come to class with internet-connected devices, making the use of a web-based clicker system to fulfill this role feasible. This study examines the practical and effective use of WebClicker.org as the personal response system in the Physics classroom. Usage of WebClicker is free, requires minimal setup time for students and teachers, and allows multiple question and answer formats including the ability to create questions on the fly and share responses with the class. Results show that using web-based clickers achieves similar improvement on students' conceptual learning when compared to traditional clickers. Web-based personal response systems such as WebClicker provide a simple and robust way to promote interactive-engagement in the classroom.

Footnotes: Sponsored by Lei Bao

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Vignette Studio Software for Interactive Online Teaching*

Paper Type: Contributed

Author: Robert B. Teese
Rochester Institute of Technology
54 Lomb Dr.
Rochester, NY 14623
585-475-6578 (p)
rbtsps@rit.edu

Vignette Studio is a cross-platform application for creating online activities that contain narrative videos as well as interactive elements such as video analysis, prediction questions and branching. It is being used to develop assignments for introductory physics, advanced physics labs and introductory biology. The software that powers the activities is delivered over the Internet and runs in a normal browser on the user's device. It can be used to make short, single-topic Interactive Video Vignettes, pre-lab exercises, or Interactive Online Lectures for flipped classrooms, online learning and MOOCs. New features added in the past year include text, checkbox, and data table inputs, menus, completion certificates, multi-language closed captioning and bar graphs. The software will be demonstrated and plans for its future development will be described. Vignette Studio is available for download at http://compadre.org/ivv/ .

Footnotes: *Supported by NSF grants DUE 1432286, 1245147, 1122828 and 1123118.

Conflicts: Please schedule this talk just before the contributed talk by Priscilla Laws, "An Interactive Video Vignette on Fall Rates for Different Masses"

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Favorite TPT Articles

Committee on the Interests of Senior Physicists | **Type:** Inv/Con | **Organizer:** Karl Mamola

Description:

Call for Papers: This session will call attention to especially useful and interesting materials that have appeared in the pages of The Physics Teacher.

Abstracts Submitted (# 8) | Abstracts You Have Reviewed: 0

Abstract Title: Coming Full Circle: TPT for All Phases of Teaching

Paper Type: Contributed

Author: Diane M. Riendeau
Deerfield High School
1959 Waukegan RD.
Deerfield, IL 60015
8477440113 (p)
driendeau@dist113.org

Speaker order: 3

Throughout my professional career, The Physics Teacher served as a fantastic source for information, inspiration, dissemination and affirmation. In this talk, I will highlight the articles that supported my growth as I worked through my teaching career, as a teacher, author and column editor. I will highlight articles that helped me transform my teaching style, increased my content knowledge or encouraged me to keep pressing on. As column editor of "The New Teacher," I hope to "pay it forward" to new teachers. I will highlight some of my favorite articles from this era, as well.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: EQUATIONS AS DELIGHTFUL GUIDES TO THINKING

Paper Type: Contributed

Author: Paul G. Hewitt
City College of San Francisco
300 Beach Drive NE 1103
St Petersburg, FL 33701
727 894-5699 (p)
pghewitt@aol.com

Speaker order: 8

Teaching the laws of physics ought to be central in any introductory physics course, whether for non-science or science students. Especially when students are taught to view the laws of physics as the laws of nature — nature's rules — many of which are in equation form. Equations are non-intimidating when presented as guides to thinking, rather than as formulas for solving algebraic problems. Focus on the meaning of symbols and how concepts relate to one another can result in a delightful learning experience. By postponing time-consuming computations to a second course (where they will be welcomed!) time allows coverage of a broad swath of classical and modern physics. Concepts first, computations later.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Favorites from The Physics Teacher

Paper Type: Invited

Author: Thomas B. Greenslade, Jr.
Kenyon College
Department of Physics
Gambier, OH 43022
740 427-2989 (p)
greenslade@kenyon.edu

Speaker order: 02

Over the last fifty years, about 7000 articles have been published in The Physics Teacher. My favorite articles are those published in the latter years of the twentieth century by Al Bartlett and Tom Rossing. We all thought that the series of articles that Al published on The Exponential Function would go on to – well – infinity! And we were all attuned to the series of articles that Tom wrote about Musical Acoustics; I often find myself referring to them. I was responsible for writing LVIII articles under the running title of "Nineteenth Century Textbook Illustrations" that ended up as two and three page articles with several illustrations. Then I wrote a series of articles on the general topic of oscillations and waves. Recently I have been writing a series of articles with John Daffron of Memphis in which we bring older apparatus back to life once more.

Change Session

(•) No ( ) Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Memorable Gems

Paper Type: Contributed

Author: Christopher J. Chiaverina
New Trier High School (retired)
4111 Connecticut Trail
Crystal Lake, IL 60012 United States
8154550399 (p)
8154550399 (f)
fizzforfun@aol.com

Speaker order: 7

When The Physics Teacher journal editor, Karl Mamola, asked if I would like to edit a new column for the journal that would, in his words, "be devoted to very brief contributions that describe all sorts of creative physics teaching ideas such as, but not limited to, simple experiments and demonstrations," I jumped at the chance. I concurred with Karl's suggestion that the column be called "Little Gems," for the name reflects the fact that the activities were to be useful, engaging, and to the point. This coming fall will mark the beginning of the eleventh year for "Little Gems." The number of creative experiments, demonstrations, and teaching tips that have been submitted since the column's inception has been gratifying. This talk will provide examples of what we consider to be "Little Gem" highlights.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Ron Edge : String and Sticky Tape

Paper Type: Contributed

Author: Donald G. Franklin
Penfield College of Mercer University
39 West Main Street
Hampton, GA 30228
404-401-3844 (p)
donfranklin8@gmail.com

Speaker order: 4

Ron Edge has contributed many articles for the Economic Way to Teach Physics. String and Sticky Tape allows for any teacher anywhere to show their students how Physics is parr of their life..

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: The Sand Pendulum

Paper Type: Contributed

Author: Stephen Kanim
New Mexico State University
600 West Union Ave
Las Cruces, NM 88005-3614
(575) 202-2894 (p)
skanim@nmsu.edu

Speaker order: 5

One of the aspects of The Physics Teacher that I find most appealing is that so many of the articles offer ways to share our enthusiasm for physics with others. In this talk I use The Sand Pendulum written by Joe Rizzo and published in TPT in April 1987 as an example of how much impact a single such article can have. In 2004 I worked with an undergraduate student to build a hallway demonstration based on this paper. Our sand pendulum has been tracing out Lissajous figures in the hallway outside our lecture halls ever since. I will describe the modifications we made to the sand pendulum, and show some examples of the different patterns it makes.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: TPT Favorites---Overall trends and individual impact

Paper Type: Invited

Author: Gary D White
The George Washington University Physics Department
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Washington, DC 20052 United States
2029948288 (p)
gwhite@gwu.edu

Speaker order: 01

It's a little like picking favorites among children! Perhaps I have favorites, but is it really wise to admit it? So rather than trying to offer up a "Top Ten" or a "Best of TPT" list, I plan to highlight two kinds of favorites from The Physics Teacher: electronically popular and personally impactful. With the former, I hope to give some sense of which articles get downloaded the most, both by people within AAPT and outside the association. While TPT has thrived for decades without any of this kind of feedback, these are quick-changing times, and there are lessons lurking in these data, methinks. With the latter, I've selected a few papers whose clever ideas and thoughtful approaches have ended up in my own classroom, hopefully in a way that does justice to the authors' visions. Even with this very specific criterion for selection, the pool of papers from which these few are selected is a lot deeper than I imagined, a fact that speaks to the richness of content in TPT. Wise or not, I look forward to sharing these favorites with you.

Change Session

(•) No ( ) Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Why

Paper Type: Contributed

Author: Dwain M. Desbien
Estrella Mountain Community College
10530 W Angels Lane
Peoria, AZ 85383
4809806374 (p)

dwain.desbien@emcmail.maricopa.edu
Speaker order: 6

"Wherefore a science of teaching?" is my Favorite TPT article for many reasons. First it was the article that got me interested in doing my Ph.D. work in PER with it's author David Hestenes. Second, even though published in 1979 many of the points in it are just as valid today as they were 36 years ago. I will share what speaks to me in this article and why I continue to recommend it to readers today.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Innovation Share-a-Thon for Astronomy Education

Committee on Space Science and Astronomy | **Type:** Con | **Organizer:** Joe Heafner

Description:

Call for Papers: Participants will have 5-10 minutes each to share a demo, an activity, a lab, or other teaching component for introductory or intermediate astronomy. After everyone has shared, there will be time for the audience to ask questions, experiment with equipment, and discuss the shared information with presenters. Time allotted may vary depending on the number of presenters.

Abstracts Submitted (# 0)

Innovative Uses of Technology Enabled Spaces

Committee on Educational Technologies | **Type:** Inv/Con | **Organizer:** Ben Van Dusen

Description:

Call for Papers: This session examines novel uses of technology within classrooms and their impacts on students' outcomes.

Abstracts Submitted (# 4) | Abstracts You Have Reviewed: 0

Abstract Title: Appreciating the “space” in technology enabled spaces

Paper Type: Invited

Author: Edward Price
California State University San Marcos
333 South Twin Oaks Valley Road
San Marcos, CA 92096
760 750 8040 (p)
eprice@csusm.edu

Speaker order: 01

Technology is increasingly available in our physics classrooms and instructional labs - from dedicated infrastructure to one-to-one computing to smart phones carried by nearly every student. Educators must consider how to use this technology effectively, if they choose to use it at all. This talk will catalog ways classroom technology can support physics education, including structuring participation and interaction; enabling sharing, archiving, and review of material generated in-class; collecting and analyzing data; supporting the use and coordination of multiple representations; and providing access to resources such as simulations. I will discuss these uses in various physical and technological spaces, including studio-style rooms with dedicated computers, instructional labs with tablets, and standard classroom spaces where students have smartphones. Across these cases, I argue that choosing a particular technology is less important than ensuring alignment between the technology’s affordances and the instructor’s pedagogical goals, and that the physical configuration of the classroom space has a strong influence on both the technology and pedagogy.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Leveraging “Teaching-to-Learn” with Technology to Enhance Student Learning

Paper Type: Invited

Author: Susan Nicholson-Dykstra

University of Colorado at Boulder
School of Education, 249 UCB
Boulder, CO 80309
3038426778 (p)
susie.dykstra@gmail.com

Speaker order: 02

When students participate in Teaching to Learn (TtL) experiences, in which they learn new content, learn about the process of teaching and learning, and apply their understanding of both the content and pedagogy to develop a lesson, they demonstrate greater conceptual understanding of the content. Students can harness technology to create TtL products, such as screencasts, stop-go videos, interactive posters, and animations, in order to communicate scientific ideas to authentic audiences of peers and digital communities. These studies investigate how educators in three different tech-enriched environments utilize TtL products as tools for evaluating student proficiency in language and content understanding. Additionally, these studies examine the role that technology-infused TtL projects play in increasing student engagement and confidence in explaining scientific ideas, and in development of a collaborative scientific community, due to a heightened sense of accountability to peers and community.

Footnotes: Invited by Ben Van Dusen

Conflicts: Would prefer to present closer to end of conference to coincide with also attending PERC

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Smartphones in Labs Don't Have to Be "Black Boxes"

Paper Type: Contributed

Author: Colleen L. Countryman
North Carolina State University
2401 Stinson Dr.
Raleigh, NC 27695 United States
9195137935 (p)

Colleen_Countryman@ncsu.edu

The internal sensors within students’ smartphones can be used to collect data in introductory mechanics labs. Our free "MyTech" app provides students with meaningful laboratory experiences that positively impact their attitudes about physics. Our project includes the development of a curriculum, the creation of a mobile app, and the determination of the impact of students’ smartphones on their learning of physics concepts, attitudes regarding their laboratory experience and use of the devices outside of class. In addition to enhanced abilities to make "real world connections," students using the MyTech app were also more adept at describing how their laboratory equipment collected data when using the smartphone app and its corresponding curriculum. We posit the reasoning for this improved understanding of how the devices collect data. We will discuss these results and how instructors can utilize the app and curriculum in their own classroom.

Conflicts: I will also be presenting a poster during the "Labs/Apparatus"

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: The Ubiquitous Use of "IO-Lab" Digital Sensors in Secondary Physics

Paper Type: Contributed

Author: Christopher P. Cunnings
University of Illinois at Urbana-Champaign
1010 Bernard Way
Joliet, IL 60431 United States
8155920375 (p)
8155920375 (f)
cunning7@illinois.edu

This action research study chronicles the development and implementation of a transformative, student-centered secondary physics education curriculum. The synergistic combination of a “flipped classroom” instructional approach with the 1-to-1, 24/7 access to “IO-Lab sensors”—digital learning tools developed at UIUC that are capable of collecting a vast array of real-time graphical data—served as the basis for the curriculum I have titled the “Flipped IO-Lab,” or “F-IO” physics curriculum. Through the triangulation of quantitative and qualitative research methodologies, evidence indicates that students built a strong

conceptual understanding and appreciation of physics through hands-on, activity-driven, and real-world F-IO educational experiences.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Innovative Uses of Technology Enabled Students

Committee on Educational Technologies | **Type:** Con | **Organizer:** Larry Engelhardt

Description:

Call for Papers: Our students have a different set of skills than we had at that age. They know how to operate their smart phones, use social media (Twitter, Instagram, Tumblr, etc.), surf the web, as well as other skills that we might not have heard of yet! So how do we harness these skills for good instead of evil?? This session will be devoted to innovative and/or effective ways that have been developed to make use of students' prowess with technology.

Abstracts Submitted (# 0)

Interactive Lecture Demonstrations: What's New? ILDs Using Clickers and Video Analysis

Committee on Research in Physics Education | **Co-Sponsor:** Committee on Educational Technologies | **Type:** Inv/Con | **Organizer:** Davied Skoloff

Description:

Call for Papers: We invite papers on creation, presentation and research on Interactive Lecture Demonstrations at the college and high school levels.

Abstracts Submitted (# 2) | Abstracts You Have Reviewed: 0

Abstract Title: ILDs and Other Strategies that Enable Students to Understand Newton's

Third Law

Paper Type: Invited

Author: Priscilla Laws
Department of Physics
Dickinson College
Carlisle, PA 17013
717-245-1242 (p)
lawsp@dickinson.edu

Speaker order: 02

Although most students who complete introductory physics courses can recite Newton's Third Law, very few understand the Law or are aware of the fact that they don't believe it. In this talk, we compare normalized learning gains on Newton's Third Law questions for: (1) students who studied physics in traditional lecture/laboratory courses; (2) students who were exposed to Interactive Lecture Demonstrations (ILDs) at Tufts University and the University of Oregon; and (3) students in Workshop Physics (WP) classes during the first few years of its development. Next we demonstrate how the first ILD on Newton's Third Law is used as part of the WP curriculum. We then discuss why the addition of this single ILD when followed by student groups doing a series of related activities on their own leads to dramatic improvements of their learning gains. In addition we demonstrate how student completion of a short Interactive Video Vignette (IVV) on the Third Law in traditional introductory physics courses can also lead to significant improvements in student understanding of the 3rd Law. We conclude with some reflections on why ILDs and IVVs have such a positive effect on student understanding.*

Footnotes: *ILD and WP development was supported by FIPSE and NSF, and IVV development has been supported by the NSF DUE #1122828 and #1123118.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Interactive Lecture Demonstrations: Active Learning in Lecture Including Clickers and Video Analysis

Paper Type: Invited

Author: Ronald Thornton
Tufts University
12 Temple Street
Medford, MA 02155
781-572-4794 (p)
ronald.thornton@tufts.edu
Speaker order: 01

The results of physics education research and the availability of computer-based tools have led to the development of the Activity Based Physics Suite. (1) Most of the Suite materials are designed for hands-on learning, for example student-oriented laboratory curricula such as RealTime Physics. One reason for the success of these materials is that they encourage students to take an active part in their learning. This interactive session will demonstrate ,through active audience participationŠ Suite materials designed to promote active learning in lectureŠ--Interactive Lecture Demonstrations (ILDs) (2), including those using clickers and video analysis. Research results on their effectiveness will also be presented.

Footnotes: 1. E.F. Redish, Teaching Physics with the Physics Suite (Wiley, Hoboken, NJ, 2004). 2. David R. Sokoloff and Ronald K. Thornton, Interactive Lecture Demonstrations (Wiley, Hoboken, NJ, 2004).

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Lab Guidelines Focus Area 3: Modeling

Committee on Laboratories | **Type:** Inv/Con | **Organizer:** Joe Kozminski

Description:

Call for Papers: According to the AAPT Laboratory Recommendations document, students should "develop abstract representations of real systems studied in the laboratory, understand their limitations and uncertainties, and make predictions using models." How do students develop and reinforce these these skills in your lab/lab curriculum?

Abstracts Submitted (# 3) | Abstracts You Have Reviewed: 0

Abstract Title: Model-Based Reasoning in Upper-division Lab Courses

Paper Type: Invited

Author: Heather Lewandowski
University of Colorado
CB 440
Boulder, CO 80309
303-492-1446 (p)
lewandoh@colorado.edu

Speaker order: 01

Modeling, which includes developing, testing, and refining models, is a central activity in physics. Modeling is most fully represented in the laboratory where measurements of real phenomena intersect with theoretical models, leading to refinement of models and experimental apparatus. However, experimental physicists use models in complex ways and the process is often not made explicit in physics laboratory courses. We have developed a framework to describe the modeling process in physics laboratory activities. The framework attempts to abstract and simplify the complex modeling process undertaken by expert experimentalists. The framework can be applied to understand typical processes such the modeling of the measurement tools, modeling “black boxes,” and signal processing. We demonstrate that the framework captures several important features of model-based reasoning in a way that can reveal common student difficulties in the lab and guide the development of curricula that emphasize modeling in the laboratory.

Conflicts: I am also giving a talk in the "The Physics of the NSF IUSE Program"

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Modeling the Physical World with RealTime Physics

Paper Type: Invited

Author: David R Sokoloff

Department of Physics
1274 University of Oregon
Eugene, OR 97403-1274
5412216543 (p)
5413465861 (f)
sokoloff@uoregon.edu

Speaker order: 02

One of the six focus areas included in the AAPT Recommendations for the Undergraduate Physics Laboratory Curriculum (1) is Modeling: ". . . developing an abstract representation of a real system being studied in the laboratory." In the experiments that make up the four Modules of RealTime Physics: Active Learning Laboratories (RTP) (2), (3) students construct models from real observations of the physical world. These observations are often aided by computer-based tools like sensors and video analysis. The results are usually presented as graphs of the observed physical quantities, and students use analytical tools included in the software to construct descriptive and/or mathematical models of the phenomena. This paper will illustrate RTP modeling with examples from a diverse collection of introductory physics laboratory activities like projectile motion, Coulomb's law of the electrostatic force and Malus' law for intensity of light transmitted through a linear polarizer.

Footnotes: (1) Available from AAPT at http://aapt.org/Resources/upload/LabGuidlinesDocument_EBendorsed_nov10.pdf (2) David R. Sokoloff, Ronald K. Thornton and Priscilla W. Laws, "RealTime Physics: Active Learning Labs Transforming the Introductory Laboratory," Eur. J. of Phys.: 28 (2007), S83-S94. (3) David R. Sokoloff, Ronald K. Thornton and Priscilla W. Laws, RealTime Physics: Active Learning Laboratories, 3rd Edition, Module 1: Mechanics, Module 2: Heat and Thermodynamics, Module 3: Electricity and Magnetism and Module 4: Light and Optics (Hoboken, NJ, John Wiley and Sons, 2011).

Conflicts: Not to conflict with the following: (1) Contributed abstract: Update on the Development of Distance Learning Labs for Introductory Physics Using IOLab (2) Organizer and presider for the following session: Interactive Lecture Demonstrations - What's New? ILDs Using Clickers, Video Analysis

Change Session

(•) No ( ) Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: National Survey: computation uses, resources, and attitudes in undergraduate physics*

Paper Type: Contributed

Author: Norman J. Chonacky
Dept. of Applied Physics, Yale University
36 Lincoln Street
New Haven, CT 06511
203-773-3503 (p)
norman.chonacky@yale.edu

During past decades, computers have evolved from useful lab instruments to necessary problem solvers. Computation has become indispensable, interrelated to both theory and experiment, as a third methodology for solving scientific and engineering problems. By comparison, its effects on undergraduate education have been large in a few enclaves, spotty in others, and somewhere nearly nil. At least a decade of research on recent graduates with physics bachelor degrees has concluded this is a significant problem. Until now there has been no comprehensive assessment of departmental uses of computation, institutional environments for its integration into courses, personnel resources to effect such change, and local understanding of instructional methods helpful to its efficacy for learning physics. This survey is now completed. We report initial results in the context of computational curricular experiences, departmental resources and plans that the survey was designed to assess; complete details will follow at the 2017 winter meeting.

Footnotes: * Supported in part by the National Science Foundation DUE-1432363

Conflicts: This paper is a first report on results of an important national survey project sponsored by the AAPT and funded by the NSF. It will hopefully be followed in the Winter meeting by an invited session and a full report including analyses of the results. If possible, can you schedule it in a session when most attendees are likely to be able to hear it?

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Leadership and Other Skills in the Undergraduate Curriculum

Committee on Women in Physics | **Type:** Inv/Posters | **Organizer:** Juan Burciaga

Description:

Call for Papers: Colleges are being asked to incorporate leadership and other "21st century" skills into the curriculum. How do we incorporate these skills into the major? … in or out of the classroom. What are the pedagogical challenges? What skills can we introduce and develop? … Please contribute a poster on education for leadership and other 21st century skills.

Abstracts Submitted (# 6) | Abstracts You Have Reviewed: 0

Abstract Title: A Fleet of Ships – From Scholarship to Entrepreneurship to Leadership
Paper Type: Invited

Author: Robert W Brown
Case Western Reserve University
109 Rockefeller Bldg, Department of Physics
Cleveland, OH 44106-7079
2163684058 (p)
2163684671 (f)
rwb@case.edu
Speaker order: 03

The set of goals in the classes we teach are usually described in terms of critical thinking and mastery of material – the higher learning of scholarship. We hope to encourage students to work well together to solve problems in school and to overcome the fear of giving, defending, and promoting one's ideas – the development of leadership and citizenship. In today's world we place a high premium on interdisciplinary education – the interrelationship of the many different areas of STEAM (science, technology, engineering, art and mathematics). For almost two decades, Case Western Reserve University has offered PEP – Physics Entrepreneurship Program – with courses and internships and start-up possibilities available to young undergraduates as well as the master's student. We will discuss how undergraduates bolster their group work, interdisciplinary experiences, capability for innovation, self-directed thinking skills, and develop leadership in ESTEAM – Entrepreneurship STEAM.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Educating the Whole Student

Paper Type: Invited

Author: Roel Snieder
Colorado School of Mines
1500 Illinois Str.
Golden, CO 80401-1887
303.273.3456 (p)
rsnieder@mines.edu

Speaker order: 04

Educating undergraduate students is an awesome task. In doing so we ted to focus on teaching them the disciplinary skills and knowledge, this is the easy part of education. But what we are tasked to do as educators is to teach students in their formative years when it concerns growing into the professional of tomorrow. The young professionals will go out in the world, and have an impact for better or for worse, and because they likely will educate or supervise other young people, there is a huge multiplier effect of the way in which we educate students. So what are the ways in which we can help grow young professionals into balanced and well-rounded professionals? I will give an overview of existing educational initiatives at the Colorado School of Mines that assist in this growth.

Footnotes: Invited by Juan Burciaga

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Leadership Development in a Workshop Environment

Paper Type: Poster

Author: Juan R. Burciaga
Bowdoin College/Dept. of Physics & Astronomy
8800 College Station
Brunswick, ME 04011-8448
207-725-3264 (p)
jburciag@bowdoin.edu

"Leadership Roles and Models in the Classroom, Academia and Beyond" is a workshop with a focus on the role of leadership in the professional development of STEM faculty, K-12 teachers, and science professionals. But what is the role of leadership in our careers? On what skills do we focus? What is the structure of the workshop? Are there any ways to structure leadership opportunities for our students? The poster will present a summary of the workshop and describe its goals, format and content.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Motivation and Learning Strategies: Adaptation and Validation of an Instrument

Paper Type: Poster

Author: Oscar Jardey OJS Suarez
Professor Autonomous University of Colombia Foundation
calle 12 B No 4 - 20
Bogotá, AA 11001 Colombia
5713529986 (p)
sistemas29@hotmail.com

This document describes the adaptation and validation of the instrument Motivated Strategies for Learning Questionnaire (MSLQ) for students pursuing careers subjects physics or engineering. The instrument base was created by Pintrich, Smith and McKeachie in 1991 at the University of Michigan. This has been used in a variety of research, however when students studying physical reliability test was not as good as reported in this article was

applied, which led to its adaptation and validation. It is have applied to students in public and private universities in Bogota Colombia, in four cycles, making amendments to the items on the characteristics of the study of physics in the context of higher education. The results Cronbach Alfa is 0,940. The results allow to point out that this instrument is adapted and validated for use in research in the context of physics education or support teaching of physics.

Footnotes: Partially Autonomous University of Colombia Foundation

Conflicts: I hope cooperation in hosting or registration, because the change in pesos to dollar is very difficult.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Strategies for Gender Equity in STEM

Paper Type: Invited

Author: Carol Isaac
Mercer University
3001 Mercer University Dr
Atlanta, GA 30341
352-359-6144 (p)
isaac_ca@mercer.edu

Speaker order: 01

Research concludes that institutional transformation is required to ensure equal opportunities for the participation and advancement of men and women. Such transformation requires changing the habitual attitudes and behaviors of faculty and students in higher education. Approaching implicit bias as a remediable habit, this presentation will present a theoretical basis and conceptual model to give the attendees tools to promote bias literacy among students as a step toward career advancement. This presentation will give an overview of how significant organizational cultural change occurred within an institution (Carnes et al., 2014). This presentation will address three topics: implicit bias as a habit, constructs underlying implicit bias, and strategies to reduce the influence of implicit bias. While this presentation will focus on gender equity, this information is applicable to other under-

represented groups as well. This practical framework gives strategies to mitigate destructive cognitive distortions created by educators as well as their students.

Footnotes: Invited Speaker for Leadership and Other Skills in the Undergraduate Curriculum.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Students Leading for Change: Collaboration Outside the Classroom

Paper Type: Invited

Author: Edmund Bertschinger
MIT
77 Massahusetts Ave, Room 4-250
Cambridge, MA 02139
617-324-7319 (p)
edbert@mit.edu

Speaker order: 02

Leadership skills are learned by practice, not by rote. As the past year has shown, some of the best examples on college campuses arise from student activism. #ConcernedStudent1950 has reminded us of the leadership inherent in Margaret Mead's words, "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has." Teachable moments abound: from sit-ins to teach-ins to student/administration collaboration to effect change. In all cases, the key to success is the development of relationships. Students crave and benefit from relationships with faculty that value them as individuals. In my experience, the most effective relationships are honed outside the classroom, even on the street. I will describe how such relationships led to a collaborative rather than confrontational approach to diversity and inclusion at one university that empowers all students.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Modern Physics Demonstrations and Labs

Committee on Apparatus | **Type:** Inv/Con | **Organizer:** Roger Key

Description:

Call for Papers: Contributed papers which reveal new and exciting ways to illustrate modern physics principles are encouraged.

Abstracts Submitted (# 5) | Abstracts You Have Reviewed: 0

Abstract Title: Chaotic Oscillation of a Magnetic Dipole

Paper Type: Invited

Author: Eric Ayars
California State University, Chico
Campus Box 202
Chico, CA 95929-0202
530 898-6967 (p)
eayars@csuchico.edu

Speaker order: 02

We have built a chaotic oscillator consisting of a rotating magnetic dipole in an oscillating magnetic field. The apparatus allows complete computer control of oscillator parameters via SCPI commands and offers students a unique opportunity to investigate chaos in a simple-to-understand system. In this talk we will present typical student data that can be obtained with this apparatus, and uses of the apparatus in upper-division lab courses.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Demonstrating the Photoelectric Effect in a simple and comprehensive way by using an antique photo cell and LabVIEW virtual instrumentation

Paper Type: Invited

Author: Urs Lauterburg
University of Bern, Physics Institute
Sidlerstrasse 5
Bern, 3012 Switzerland
0041 31 631 44 88 (p)
urs.lauterburg@space.unibe.ch

Speaker order: 01

An antique photoelectric cell is used in conjunction with modern LabVIEW type data acquisition technology to demonstrate the concept of the photoelectric effect in a lecture hall environment. The design and the layout of the experimental setup will be explained and discussed. The presenter will also walk through the steps of the demonstration and its physical content to illustrate the didactical aspects of the experiment.

Footnotes: Sponsored by the PIRA group (Roger Key)

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: The teaching research of 2-dimensional standing waves on metal plates

Paper Type: Contributed

Author: Yizhong Fang
Sun Yet-sen University
xingangxi Road, No.135, Haizhu District,
Guangzhou, GUA 510275 ??
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stsfyz@mail.sysu.edu.cn

The analytical solution of Chladni figures on a thin metal plate is a difficult problem in theoretical acoustics. In our recent works, the two-dimensional standing waves on annular and circular plates (Chladni figures) are investigated both experimentally and theoretically at various kinds of boundary conditions. The experiments accord with the analytical solutions within large frequency scale. Furthermore, the radii of standing wave nodal circles in different frequencies and the elastic modulus of the plate are also obtained. In our program, such a contribution would be divided into three levels for undergraduate training. First, the 2-dimensional standing waves of rectangular and circular plates explicated by freshmen experimentally and theoretically on high frequencies. Second, the similar work of annular plate is experienced by sophomores, who have learned the mathematical physics methods. Third, the problem with complex boundary such as fan or triangle will be studied by juniors or seniors.

Footnotes: This project is supported by NSFC(J1103211).

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Thin Film Tunneling in an SIN Junction

Paper Type: Invited

Author: Dean Hudek
Brown University
182 Hope St #1843
Providence, RI 02912 United States
4018632062 (p)
4018632024 (f)

dean_hudek@brown.edu

Speaker order: 03

Thin film tunneling has been a staple in our advanced labs for many years – which is only appropriate since Leon Cooper, the C in the BCS theory of superconductivity, is one of our faculty. Using photos and videos I will walk through the entire process of performing this lab, from understanding a 4 wire measurement, to creating the junctions in an evaporator, to transferring LHe and finally to collecting data. Along the way I will point out tips, tricks, potential pit falls and safety considerations involved in creating a similar apparatus for your lab and supporting it for students' use. This has long been one of my favorite advanced labs and I look forward to sharing it with you. Hope to see you at the talk!

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Two-photon momentum entanglement and interference

Paper Type: Contributed

Author: Scott C. Johnson
Intel
4635 NW 175th Place
Portland, OR 97229-2165
503-613-3862 (p)
scott.c.johnson@intel.com

Many undergrad labs now have the capability of doing experiments with entangled photons. Most of these use polarization-entangled photon pairs. With relatively small modifications, they can use momentum-entangled photons instead. The advantage of this is that the two-particle wave function, to an excellent approximation, can be calculated and graphed using the two-particle Schrodinger equation, allowing for a clearer and more intuitive visualization than for a polarization wave function. In this talk, I will show both experimental data and Schrodinger wave function calculations for two momentum-entanglement experiments. The first puts a pair of slits in one photon’s path and find a correlated interference pattern between the two photons. The second starts with the same slits in photon 1’s path, then puts a lens in the photon 2’s path, and finds an image of the slits in photon 2’s image plane, even though photon 2 never passed through the slits.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Online Hybrid

Committee on Physics in Two-Year Colleges | **Type:** Inv/Con | **Organizer:** Betsy Chesnutt

Description:

Call for Papers: To meet the needs of a diverse student population, many colleges and universities are adopting an online hybrid course format where some of the course content is delivered online and some face to face. This session will explore the successes and challenges physics instructors have had in creating online hybrid courses.

Abstracts Submitted (# 3) | Abstracts You Have Reviewed: 0

Abstract Title: Teaching Introductory Physics Labs in a completely Online Environment

Paper Type: Contributed

Author: Samya Zain
Susquehanna University
514 University Ave
Selinsgrove, PA 17870
570-372-4006 (p)
zain@susqu.edu

In the summer of 2014 due to student schedule limitations we decided to develop an algebra-based introductory physics I course. We wanted it to be a completely online course and labs are integral part of the course. We recognize that in many online courses students feel unengaged so we tried to make the lab-components as interactive as possible. The labs included an introduction, a pre-lab, lab report and a quiz. The access to each component was contingent on the completion of the previous component. Labs were considered finished on completion of the quiz. For some labs additionally, videos were created to help students feel connected and to allow them to experience a more typical laboratory setting verses

impersonal simulations. Subsequently videos were used for the analysis of the data as well. These strategies have delivered encouraging results and help develop stronger teacher-student connections for future online physics classes.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Technology Enhanced Learning: UT Knoxville's engage Engineering Fundamentals Program

Paper Type: Invited

Author: Amy K Biegalski
University of Tennessee at Knoxville
1506 Middle Drive, 215 Perkins Hall
Knoxville, TN 37996 United States
4403764580 (p)
abiegals@utk.edu

Speaker order: 01

Technology is inseparable from engineering and the current generation of students; educators need to optimize the balance between face-to-face instruction and digital learning. In UT's interdisciplinary ENGAGE freshman engineering program, interaction and teamwork are merged with e-learning. In ENGAGE, students view online lectures and attend faculty team taught interactive lectures, and student teams collaborate in problem based labs and design projects supported by sensor and tablet technology. Our self-designed ENGAGE website brings cohesion to the program. The website includes an online homework system with feedback, daily supplemental materials, and lecture videos. The online discussion board allows students to get instructor assistance during off-hours. The increased student retention rate and student review data suggest that the program has been successful. The program is always in a transformative state and enhancing the student experience to stay at the forefront of best practices in the STEM higher education community.

Footnotes: Sponsored by Betsy Chesnutt

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Using HTML5 simulations to teach conceptual physical science

Paper Type: Invited

Author: Bob Swanson
Itawamba Community College
2176 South Eason Blvd
Tupelo, MS 38804
6626205369 (p)
rsswanson@iccms.edu

Speaker order: 02

Are your online physical science students learning through reading and listening? Would they rather be watching and doing? Would you like your online students to have a learning experience that more closely resembles a traditional classroom? One way to supplement your existing online instruction is through the use of video demonstrations, video tutorials and HTML5 simulations. Utilizing these tools may also create a path toward “flipping” your traditional classroom as well. In any case, transforming your online, hybrid or traditional classes should not require you to reinvent the wheel. This presentation will help you identify low-cost or freely-available resources for video production and HTML5 simulations, as well as demonstrate their implementation in an online class setting.

Footnotes: Betsy Chesnutt, Itawamba Community College

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

PER Findings Related To Latin American Students

Committee on International Physics Education | **Co-Sponsor:** Committee on Research in Physics Education | **Type:** Inv/Con | **Organizer:** Carolina Alvarado

Description:

Call for Papers: This session is intended to share Physics Education Research implementation results, having a special focus on showing the effect on Latin American students.

Abstracts Submitted (# 2) | Abstracts You Have Reviewed: 0

Abstract Title: Physics Education Research: The case of Latin America

Paper Type: Invited

Author: Genaro Zavala
Tecnologico de Monterrey
Garza Sada 2501
Monterrey NL, NL 64849 Mexico
+528183582000, x4631 (p)
genaro.zavala@itesm.mx

Speaker order: 02

In the last decades in the United States Physics Education Research has been a research field of Physics which has produced many outcomes that has changed how we perceive the education of physics. In many cases these results have influenced the way instructors teach physics in the classroom. Although it is not completely widespread, this influence has been important in the high school and university level. In Latin America there are a number of efforts that are worth to mention. However, the impact has been very low if we compare to that in the US. Several factors can be mentioned in order to have this current result. This contribution will describe some cases of success of Physics Education Research in Spanish-speaking countries of Latin America and will discuss some of the factors that prevent Latin America of having much more cases of success.

Conflicts: Please, do not schedule on the last day (Wednesday) of the conference.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: The multi-faceted nature of building successful learning communities for the success of Hispanic students

Paper Type: Invited

Author: Idaykis Rodriguez
Florida International Univeristy
11200 SW 8th Street
Miami, FL 33199
305.348.7898 (p)
irodr020@fiu.edu

Speaker order: 01

Florida International University is a Hispanic-majority institution that has fostered thriving and successful learning communities for many underrepresented students in STEM majors. In physics, we implemented Modeling Instruction in introductory physics courses, have hosted Modeling Instruction professional development workshops for local high school teachers, have built a discipline-based education research group, and have grown a large Learning Assistant (LA) program – all contributing to efforts to model a K-20 learning community that supports the success and persistence of all students. In this talk, I will highlight the long-term partnership between our local public school system and FIU in preparing and recruiting physics majors to the university system and present an examination of physics majors' persistence through to graduation. I will also discuss how reforms in active learning classrooms and the use of LAs have fostered success for our students.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Particle Physics Investigations by Students

Committee on Physics in High Schools | **Co-Sponsor:** Committee on Physics in Two-Year Colleges | **Type:** Inv/Con | **Organizer:** Kenneth Cecire

Description:

Call for Papers: Particle physics may seem unreachable to students and teachers due to the highly sophisticated equipment and high expertise associated with it. However, from data made public by the large collaborations such as ATLAS and CMS at the Large Hadron Collider to tabletop cosmic ray detectors, opportunities are there. Speakers will share these and discuss how to make it all work.

Abstracts Submitted (# 5) | Abstracts You Have Reviewed: 0

Abstract Title: A HS science teacher workshop constructing turnkey cloud chambers

Paper Type: Contributed

Author: Jamie R. Bedard
Siena College
515 Loudon Road
Loudonville, NY 12211
5185362288 (p)
jr06beda@siena.edu

In the summer of 2015, we hosted 10 high school teachers for a three-day "Physics at the Frontier" Workshop. Mornings were spent learning about general nuclear and particle physics concepts and the science of the Large Hadron Collider. Afternoons were spent building turnkey cloud chambers for use in classrooms. The basic design uses Peltier thermoelectric coolers, rather than dry ice. We started with instructions found online but developed our own build that made it easier to use in the classroom and maintain. We also focused on keeping the cost below $200/chamber and created a website with instructions for those who are interested in building their own. This workshop was funded in part by a minigrant for Outreach and Education from the USCMS collaboration. Our experience with the workshop and the lessons learned from the cloud chamber design will be discussed.

Footnotes: Sponsor is Matthew Bellis (mbellis@siena.edu) http://mattbellis.github.io/turn-key-cloud-chamber/

Conflicts: If this session is filled, or if the conference organizers feel we would be a better fit elsewhere, this project also aligns with Educational Hacking: Repurposing Technology for Teaching.

Change Session

(•) No ( ) Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Energetic Students – Developing Interest and Skill in Experimentation

Paper Type: Contributed

Author: Anthony Valsamis
Glenbrook North High School
2300 Shermer Rd
Northbrook, IL 60062
8472726400 (p)
avalsamis@glenbrook225.org

More than 25 students at Glenbrook North High School meet once a week to discuss their high energy physics research. Using QuarkNet detectors, these students work in either small groups or individually to develop experiments using collected cosmic ray data. The use of this data ranges from studying natural phenomena, to learning about how the detectors work. One of the many current projects is focusing on the effect of barometric pressure on measured events of particle detection. Students look at weather patterns and altitude differences in various locations around the world. The goal of this group is to both give students hands on time with real large-scale collaborative experiments as well as help build experimentation skills and analytical abilities.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: High School Students Investigating the World of Particle Physics

Paper Type: Invited

Author: Shane Wood
QuarkNet
3439 Garfield Ave #104
Minneapolis, MN 55408
612-242-7386 (p)
swood5@nd.edu

Speaker order: 02

Physics research today involves many exciting recent discoveries (detection of gravitational waves, discovery of Higgs boson, etc.) and many profound mysteries (search for dark matter, quantum gravity, etc.). Learn how you and your students can tap into this excitement by investigating the world of particle physics. By using e-Labs or participating in a particle physics Masterclass, students can access real particle physics data in order to better understand the world of quarks and leptons, while meeting many standards, including Next Generation Science Standards (NGSS).

Footnotes: This work is sponsored under the QuarkNet program by the National Science Foundation and the Department of Energy Office of Science.

Conflicts: I'd prefer to have only "Minneapolis, MN" listed as my address in the program please...thanks!

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: The Particle Physics Playground: tutorials and activities using experimental data

Paper Type: Contributed

Author: Matthew Bellis
Siena College
515 Loudon Rd.
Loudonville, NY 12211-1462 United States
4123104586 (p)
4123104586 (f)
mbellis@siena.edu

Data from the Large Hadron Collider experiments are available to anyone with the time and inclination to learn the analysis procedures. The CMS experiment, in particular, has made a significant amount of data available in basically the same format the collaboration itself uses, along with software tools and a virtual environment in which to run those tools. These data have been mined for very packaged educational exercises that range from simple to quite advanced. This talk presents an alternative: the Particle Physics Playground website, a project that uses data from CMS and other experiments in tutorials and exercises aimed at the high school and undergraduate student level. The data are stored as text files and users are provided with starter Python/Jupyter-notebook programs and accessor functions which can be modified to perform fairly high-level analyses. The status of the project, success stories, and future plans for the website will be presented.

Footnotes: http://particle-physics-playground.github.io/

Change Session

(•) No ( ) Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Using Cosmic Rays to Introduce Special Relativity in a College Physics Course

Paper Type: Invited

Author: Martin Shaffer
Cowley College
125 S 2nd St.
Arkansas City, KS 67005
620-441-5329 (p)
martin.shaffer@cowley.edu

Speaker order: 01

This talk will discuss the use of a QuarkNet cosmic ray detector in a college physics course at Cowley College in Arkansas City, Kansas, to measure the speed of cosmic ray muons. Results from student work with real data will be used to examine what happens to particles moving close to the speed of light. This leads to the introduction of Einstein's theory of special relativity to explain the relative abundance of cosmic ray muons on the surface of the Earth.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Physicists with Disabilities

Committee on Women in Physics | **Co-Sponsor:** Committee on Diversity in Physics | **Type:** Inv/Con | **Organizer:** Jennifer Blue

Description:

Call for Papers: Are you a disabled physicist? Willing to share your story? Have you made your course more accessible for individuals with disabilities? If so, please consider submitting an abstract for the session on Disabled Physicists. Physicists with all types of disabilities are welcome.

Abstracts Submitted (# 5) | Abstracts You Have Reviewed: 0

Abstract Title: Am I wanted: Disabled undergraduate student experiences in physics

Paper Type: Contributed

Author: Rosemary A. Carroll
810 W Main St
Platteville, WI 53818
5634514380 (p)
carrollr@uwplatt.edu

I will present my experiences as a female student with unseen disabilities, how this affected my interactions with my professors and department, how this shaped my doubts and decisions to pursue graduate school, and my perspective on accommodations in physics education.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Exploring best practices in accessible design of interactive science simulations

Paper Type: Contributed

Author: Elise C. Morgan
University of Colorado Boulder
The PhET Project
Boulder, CO 80309
7726319559 (p)
elise.phet@gmail.com

The PhET project has begun an initiative to increase the accessibility of its suite of science and mathematics simulations. In this work, we focus on the development of accessibility features that support students with visual impairments: keyboard navigation and auditory descriptions. Through an iterative process, we designed and implemented navigation and auditory descriptions for two physics PhET simulations. This process involved the use of interviews with college students and recent graduates with visual impairments. Here, we share results from these interviews focusing on best practices regarding keyboard navigation and auditory descriptions, shown by patterns in user interaction that have emerged. For example, our findings indicate that the inclusion of an easily navigable scene description upon the simulation first opening is crucial to users knowing what interactive elements are available. This research contributes to understanding how to develop physics education resources capable of supporting diverse students, including students with disabilities.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: I am a disabled physicist! But you don't look handicapped!

Paper Type: Contributed

Author: Rebecca Lindell
Purdue University
525 Northwestern Ave
West Lafayette, IN 47907
7654305688 (p)
rlindell@purdue.edu

Speaker order: 01

I am one of many disabled physicists who does not look handicapped. Many of us remain hidden and do not share our disability with others for fear of being judged incapable of being a physicist. In this talk, I will introduce this special session on being disabled in physics, as well as hopefully raise the awareness of what it means to be a disabled physicist.

Conflicts: Per discussion with G. Amann, this talk should be placed before the invited talk to serve as an introduction to the session. Please contact me at rlindell@purdue.edu if you have any questions. Also do not schedule this session on Wednesday July 20th in the PM. I am co-organizing the PERC and will be in conflicting session all afternoon.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: My Joyous Struggle: Defying the Odds...and Still Climbing

Paper Type: Invited

Author: Angela M Moore
Chicago State University
7650 S. Saginaw Ave., 2nd Floor
Chicago, IL 60649 United States
7739606737 (p)
angela.moore27@gmail.com

Speaker order: 02

The focus of this talk is to detail my personal struggles with multiple chronic health conditions, while trying to obtain degrees in Engineering, Physics, and a certification in Secondary Education. I will cover how disability has affected my ability to pursue my original career, and caused me to search for a second. This has been a struggle that has lasted for more than two decades. The struggle has been intensified by caring for a disabled parent, and a special needs child, but is far from over. I will share my insights on how my path could have been a little easier. I hope to inspire and empower other women in physics to keep climbing and to defy the odds. Disability, gender, and race, will not limit me.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Surviving the Physics Classroom with ADHD

Paper Type: Contributed

Author: Jordan K. Steckloff
Purdue University - Department of Earth, Atmospheric, and Planetary Science
550 Stadium Mall Drive
West Lafayette, IN 47907
2482279413 (p)
jstecklo@purdue.edu

ADHD does not negatively affect my ability to understand physics. However, as a student with ADHD, I faced a series of systemic challenges that seem to discourage me from

continuing my studies in this field. In high school and undergrad, I was told repeatedly by classmates and instructors that ADHD doesn't exist, or is at best overdiagnosed (implying that I don't actually have it). Starting at the 300 level, courses starting meeting twice a week for 80 minutes, rather than three times a week for 50 minutes,creating a struggle to focus for an additional half hour and engage with lecture content. Additionally, timed testing largely eliminated my ability to approach problems from time-consuming first principles (the way I had come to understand physics). I discuss the challenges I faced during my physics education, and how they are largely artificial, as they do not affect my ability to conduct research.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Physicists with Disabilities - A

Committee on Women in Physics | **Co-Sponsor:** Committee on Diversity in Physics | **Type:** Con | **Organizer:** Jennifer Blue

Description:

Call for Papers:

Abstracts Submitted (# 5) | Abstracts You Have Reviewed: 0

Abstract Title: “But you don't look sick..." Tenure track with a disability

Paper Type: Invited

Author: Wendi N. Wampler
Central Oregon Community College
2600 NW College Way
Bend, OR 97703 United States
(541) 318-3776 (p)
wwampler@cocc.edu

Speaker order: 03

In this talk, I will discuss my experiences dealing with my physical disability in graduate school, as an adjunct professor, and now as a tenure-track professor. My focus will be on the difficulties I faced finishing graduate school, my continuing difficulties achieving a work-health balance, as well as long-term wellness plans being considered by my institution.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Balancing caregiving with work.

Paper Type: Contributed

Author: James P Vesenka
University of New England
11 Hills Beach Road
Biddeford, ME 04005 United States
2076022560 (p)
2076022560 (f)
jvesenka@une.edu

How do you perform your teaching responsibilities and continue to be the breadwinner of a household when a family member struggles with cancer? There are no easy answers. You get lots of sympathetic nods and kind words, but none of these help with the disabling impact on your emotional wellbeing. In the six years since the diagnosis I have slowly transformed from an energetic and passionate purveyor of reformed physics pedagogy to one who almost dreads teaching class if not for the opportunity to lose myself in helping students to discover the physical world. The great pleasure I use to take in presenting the content in memorable ways using dialect and humor is lost now to distractions of worry for the future. In this talk I will share my family's journey dealing with the emotional challenges of caregiving and the impact it has on teaching.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Demonstration with One Leg To Stand On: Anecdotes on Different.

Paper Type: Contributed

Author: David E. Sturm
University of Maine Department of Physics & Astronomy
5709 Bennett
Orono, ME 04469
2074784937 (p)
sturmde@maine.edu

We often prefer 'differently-abled' to disabled for good reason. Many with disabilities have to think differently, to prepare and handle situations not experienced by the majority. What to do if a few minutes before your lecture, your condition befalls you? Does one call off class, or find a way to do things differently? In the middle of a demonstration you can't stand. What now? Certainly different. You're walking down a corridor and in the blink of an eye, you fall. Or, you find that a building has no elevator and only stairs and you're expected on the fourth floor in five minutes. You come out and find your car, legally parked in a handicapped space -- blocked by unconcerned facilities workers. Ah, the joys of non-"normal" experiences! A sharing of anecdotes; but also antidotes.

Conflicts: If the Physicists with Disabilities session that Rebecca Lindell is not scheduled, I prefer to withdraw the talk.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Suddenly Handicapped, How my Life changed after a Serious Accident

Paper Type: Contributed

Author: Erin Combs Sutherland
Kennesaw State University
4206 Rockpoint Drive
Kennesaw, GA 30152-7726
256-714-8495 (p)
esutherl@kennesaw.edu

. On August 2, 2013, I finished my classes for the day and got in my car to drive from Atlanta to Huntsville, Alabama to meet some friends for dinner and a weekend of tennis. About halfway there, at the top of Lookout Mountain, I began to feel drowsy. I woke up a week later at Huntsville Hospital and my life has not been the same since. I spent another week in Huntsville Hospital, two weeks in a rehab hospital in Marietta and three months bedridden at home and unable to bear weight on my shattered hip. It has been three years since the accident and I am still recovering and learning what it is like to have a disability that is not always obvious to others.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: You're smart but . . . . Experiences as a disabled graduate student

Paper Type: Invited

Author: Cristina I Moody
73 Pier Dr Apt 102
Westmont, IL 60559
303-506-6808 (p)
cristina_moody@yahoo.com

Speaker order: 04

I will present my perspective on being a woman with unseen disabilities, how this impacted the interactions, attitudes, and policies of my professors and department, and how this shaped my decisions to pursue and, ultimately, leave my Ph.D. in physics.

Footnotes: Sponsored by Rebecca Lindell.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Post-deadline Papers I

| **Type:** Con | **Organizer:**

Description:

Call for Papers:

Abstracts Submitted (# 1) | Abstracts You Have Reviewed: 0

Abstract Title: Exploring Problem-Based Cooperative Learning (PBCL) in Undergraduate Physics Labs

Paper Type: Contributed

Author: Shane Bergin
Trinity College Dublin
School of Physics
Dublin, Dublin NA1 Ireland
+35318962168 (p)
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berginsd@tcd.ie

This study addresses the potential of problem-based cooperative learning (PBCL) as a teaching approach in expanding students' understanding of the scientific process and perceptions of their own learning, and in engaging students in higher order, problem-solving skills. Contrasting a traditional, manual based approach to labs with a PBCL approach, this

study provides further insight into issues surrounding lack of student engagement in their undergraduate learning. Participant-led methodology was utilized in constructing the research instrument and this analytic focus on engaging small groups of students as co-researchers enables another contribution of this research. Findings suggest that students in the PBCL group engaged in more higher-order, problem-solving skills and had a deeper understanding of the scientific process as a result of this approach to learning. Furthermore, students in the PBCL group were more positively engaged with their learning than their counterparts in the traditional, manual-based group.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Post-deadline Papers I

| **Type:** Con | **Organizer:**

Description:

Call for Papers:

Abstracts Submitted (# 0)

Post-deadline Posters

| **Type:** Con | **Organizer:**

Description:

Call for Papers:

Abstracts Submitted (# 1) | Abstracts You Have Reviewed: 0

Abstract Title: Radioactive Nuts and Fertilizers—Quantitation of Specific Dose Levels

Paper Type: Poster

Author: Amogh Anakru
Newark Academy
91 South Orange Avenue
Livingston, NJ 07054
973-723-6188 (p)
aanakru17@newarka.edu

The current study investigates a method for the absolute quantitation of Potassium-40 (K-40) in a variety of foods and fertilizers by comparing the energy efficiency method for a NaI scintillation detector with the KF-calibration method that eliminates the dependence on the geometry of the setup. Data shows that the ratio of the specific activities of chemicals with known quantities of K-40 have reasonably low error (<5%) while individual absolute activities have errors less than 15%. The study also shows that common foods such as Brazilian nuts, raw almonds, and pecans have measurable levels of K-40, and based on their specific activities, one can calculate their dose to human tissue. While the dose is extremely low (negligible as compared to the sum of all natural sources), this method tested reliable procedures to be used for other measurements of radioactivity in the environment, such as common fertilizers and leakage from nuclear reactors.

Footnotes: Amogh Anakru, Alexander Chang, and Tarun Maddali are high school students at Newark Academy in Livingston, NJ. They completed membership registration but are not fully paid members. Dr. Buna is a professor of engineering physics at Ramapo College; her membership number is 54020.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Preparing Pre-service Physics Teachers for the Middle School Classroom

Committee on Physics in Pre-High School Education | **Co-Sponsor:** Committee on Teacher Preparation | **Type:** Inv/Con | **Organizer:** Geraldine Cochran

Description:

Call for Papers: Many of our pre-service teachers are earning certification for the secondary school physics and middle school science simultaneously. Despite the apparent shortage of qualified physics teachers, some of our teachers are finding more opportunities in the middle school classroom. In this session, we will discuss preparing pre-service physics teachers for the middle school classroom. In particular, we will discuss classroom management strategies for an active engagement classroom and middle school science content.

Abstracts Submitted (# 2) | Abstracts You Have Reviewed: 0

Abstract Title: Learning through doing: educating pre-service elementary and middle school teachers

Paper Type: Invited

Author: Robert Zisk
Rutgers University
10 Seminary Pl
New Brunswick, NJ 08901-1281
7326729432 (p)
7326729432 (f)
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Speaker order: 02

Pre-service teachers preparing to enter the middle and elementary school science classroom often face challenges related to content knowledge, confidence and how to adapt more complex science topics for younger learners. The implementation of the Next Generation Science Standards has added to these challenges by emphasizing the development of science practices as a way to learn the science content. In order to overcome these challenges, we have spent the past 5 years developing a course to increase pre-service teachers' comfort with science, develop content knowledge and help them develop a philosophy that students' learn science best through engagement in science practices. In this talk, I will use artifacts from the course to describe how the students in the course learn to teach science to young students through first participation in lessons as they would be taught in an elementary or middle school classroom and then reflecting on them as teachers.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: What Can Help Middle School Science Teachers be Successful?

Paper Type: Invited

Author: Gordon Aubrecht
The Ohio State Univeristy at Marion
193 North Washington Street
Delaware, OH 43015-1609
(740) 725-6250 (p)
aubrecht.1@osu.edu

Speaker order: 01

A successful program for inservice middle school teachers offers suggestions for features that would better help prepare prospective teachers for the "real thing." These include, in addition to content support from staff and / or teachers, content support from peers as part of unit creation, experience of alternative methods of teaching rather than telling (such as, but not limited to, Physics by Inquiry), autonomy in choice of standard-supported units, and training in the use of formative assessments.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Progress in Pedagogy for Introductory Physics for Life Science

Committee on Research in Physics Education | **Co-Sponsor:** Committee on Physics in Undergraduate Education | **Type:** Con | **Organizer:** Nancy Beverly

Description:

Call for Papers: Curricular development to meet the physics needs of the life science population at the introductory level has been widely progressing. The typical first and important stage is integration of biology or health with the physics. Beyond this, the pedagogical approaches need to be different from physics/engineering majors. Please contribute your pedagogical strategies that incorporate but go beyond the interdisciplinary context.

Abstracts Submitted (# 8) | Abstracts You Have Reviewed: 1

Abstract Title: A new IPLS course: From design to dissemination*

Paper Type: Contributed

Author: Alice D. Churukian
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Department of Physics and Astronomy
Chapel Hill, NC 27517
919-962-5001 (p)
adchuruk@physics.unc.edu

At the University of North Carolina at Chapel Hill, we have finished the complete transformation of our large-enrollment two-course sequence of introductory physics for life science majors. Both courses are now taught in the integrated lecture/studio format and use biological phenomena to motivate the physics. Across both courses, we have created a suite of 54 active-engagement modules, each consisting of studio activities, an interactive lecture, and assessment questions, all of which have been developed using the findings and best practices from PER. This suite includes materials for many topics that are important for life science majors, but are not part of the traditional introductory physics curriculum, including stress and strain, diffusion, chemical energy, and life at low Reynolds numbers. In this talk, we will provide an overview of what these two courses now look like, how we implement our curricula, the challenges we overcame during the development process, and our plans for dissemination.

Footnotes: *This work is partially funded by NSF DUE-1323008 and AAU Undergraduate STEM Education Initiative

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Impact of mindset and awareness on Life Sciences students

Paper Type: Contributed

Author: Claudia De Grandi
Yale University

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New Haven, CT 06520
6173198449 (p)
claudia.degrandi@yale.edu

We analyze the impact of different pedagogical interventions in a two-semester sequence of an introductory physics course for the Life Sciences. The course has been taught in two parallel sections: one in a TEAL classroom (a technologically innovative classroom where students sit at round tables of 8-10 people) and one in a traditional lecture hall. Performance and attitude in the two classrooms are compared. Motivation and awareness of personal learning were prompted by reflections on: mindset (fixed versus growth) and consequences of multitasking, by additionally banning the use of laptops and cell phones in class. Students were also offered optional choices such as: sharing weekly anonymous feedback on the class and lectures, and resubmitting revisions of their midterm exams in order to gain partial credits on missed points. We'll discuss students' responses to these different class variables and highlight the successes and failures towards increasing engagement and performance.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Incorporating Research-Based, Biologically-Authentic Physics Problems in IPLS

Paper Type: Contributed

Author: Deborah Hemingway
University of Maryland, College Park
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College Park, MD 20742-2421
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deb.hemingway@gmail.com

Prior research has shown that when life-science students perceive physics problems as providing authentic insight into biological phenomena, they achieve more expert-like ways of knowing in physics. This work discusses the incorporation of biologically-authentic, research-based physics problems into a reformed introductory physics for the life sciences course (IPLS) that is part of the National Experiment in Undergraduate Education (NEXUS/Physics)

at the University of Maryland, College Park (UMD). The problem set combines an ongoing collaborative research project between labs at UMD and the National Institutes of Health (NIH) that examines the biophysical properties of collective cell migration with modern biophysical research methods. More specifically, this work focuses on the determination of cellular biomechanical properties during micropipette aspiration and the application of mathematical modeling in the posterior lateral line primordium migration during the embryonic development of danio rerio.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Incorporating Student Ideas and Interests

Paper Type: Contributed

Author: Brian Jones
Colorado State University
Physics Department 1875
Fort Collins, CO 80523
9709801378 (p)
brian.jones@colostate.edu

The General Physics course at Colorado State University is largely populated by students in the life sciences. Most of these students are juniors and seniors with a wealth of background in the fields whose content we seek to integrate. We have started holding regular sessions with students to brainstorm possible topic areas for lecture and lab exercises. This has provided pedagogical benefits that go far beyond the identification and development of topic areas and has provided ideas for new strategies for the course.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: NEXUS/Physics: Open-ended Design and Peer Review in IPLS

Paper Type: Contributed

Author: Kimberly A. Moore
University of Maryland
6525 Roosevelt St
Falls Church, VA 22043
(240)413-9663 (p)
MoorePhysics@gmail.com

UMd-PERG's NEXUS/Physics for Life Sciences laboratory curriculum, piloted in 2012-2013 in small test classes, has been implemented in large-enrollment environments at UMD in 2013-Present, and adopted at several institutions beginning in 2014. These labs address physical issues at biological scales using microscopy, image and video analysis, electrophoresis, and spectroscopy in an open, non-protocol-driven environment. In the 2015-2016 iteration, we have added peer review elements to the second semester course. We have collected a wealth of data (surveys, video analysis, etc.) that enables us to get a sense of the students' responses to this curriculum at UMD. In this talk, we will provide a brief overview of what we have learned and a discussion of the challenges in integrating simultaneous interdisciplinary and pedagogical reforms. (This work is supported by funding from HHMI and the NSF.)

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Student Self-Assessment of Learning Outcomes in the IPLS Course

Paper Type: Contributed

Author: Nancy Beverly
Mercy College
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Dobbs Ferry, NY 10522 United States
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nbeverly@mercy.edu

The students enrolled in the Physics for Life Science course sequence at Mercy College consist primarily of those preparing for futures in medicine or other health fields. Learning outcomes for this course were chosen to align with the physics competencies most supportive of the health professions. To improve student competence in these areas and to reorient their mind-set away from grades and towards learning itself, assignment rubrics aligned to the learning outcomes were used, and the course grade is now largely dependent on achievement of these learning outcomes. This year, to help students focus on these learning skills and monitor their own progress, assignment self-assessment checklists, also aligned with the course learning outcomes, were required with submission of each major assignment. An analysis is ongoing comparing the competencies displayed in the semester-long student projects this year and the previous two years.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Teach Poiseuille First: Call for a Fluid Dynamics Paradigm Shift

Paper Type: Contributed

Author: Bradley S. Moser
University of New England
11 Hills Beach Rd
Biddeford, ME 04005-9988
207-602-2039 (p)
bmoser@une.edu

Blood pressure rises in arterial expansions and airplanes lift due to the Bernoulli principle; so states the standard approach to fluid flow in textbooks and lesson plans. These promote Bernoulli first, then Poiseuille's law second (if at all). Yet it is known that lift is a complex phenomenon, invoking multiple conservation principles. Detailed study of the human circulatory system shows that blood pressure steadily drops as blood flows through the system. Regretfully, the two approaches to fluid dynamics are kept entirely separate: either Bernoulli applies (often misapplied) OR Poiseuille. In this talk, the presenter will review the growing evidence against pure Bernoulli descriptions and discuss contradictory results from a circulatory system model we developed [1], which support a Poiseuille first approach to teaching fluid dynamics. The growing emphasis on life science applications heightens the need to shift focus toward more realistic viscous and turbulent fluid properties.

Footnotes: 1. http://dx.doi.org/10.1119/perc.2015.pr.085

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: The source of student engagement in IPLS

Paper Type: Contributed

Author: Benjamin Geller
Swarthmore College
500 College Ave.
Swarthmore, PA 19081
7174970878 (p)
bgeller1@swarthmore.edu

Effectively teaching an Introductory Physics for the Life Sciences (IPLS) course means engaging life science students in a subject matter for which they may not have considerable preexisting interest. While we have found that the inclusion of topical examples of relevance to life-science students can help to engage students whose initial interest in physics is less developed, we have found that the inclusion of biological content is just one of several dimensions supporting student engagement in IPLS. When describing what is salient to them about their IPLS experiences, students are just as quick to cite particular pedagogical structures and supports as they are to cite issues relating directly to content choices. In this talk we begin to unpack this complex interplay of content and pedagogy in fostering student engagement in the IPLS classroom. We also describe the role that explicit messaging around disciplinary coherence may play in students' experiences.

Conflicts: This talk is one of two paired talks contributed to the "PER: Modeling student engagement" session. The other talk is: Gerardi et al., "Traditional physics vs IPLS: Comparing student experiences." Please, if at all possible, place these two talks back-to-back during the session. Thank you.

You have submitted comments on this item

Change Session

No Yes

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

Order (Sorters Suggested order)

10

Comment:

Update

SPS Undergraduate Research and Outreach Poster Session

AAPT SPS | **Type:** Posters | **Organizer:** Sean Bentley

Description:

Call for Papers: Poster submissions for SPS Undergraduate Students.

Abstracts Submitted (# 22) | Abstracts You Have Reviewed: 0

Abstract Title: A Demonstration of Polarization using a Mach-zehnder Interferometer

Paper Type: Poster

Author: Adam T. McKinley
120 menlo way
Chico, CA 95926
530 3216850 (p)
amckinley3@mail.csuchico.edu

The Mach-Zehnder interferometer is a sensitive diagnostic and measurement instrument which makes it ideal for use to measure how temperature changes in gas affect the density and pressure of the gas, and variation of an objects index of refraction. It has addition practical applications in the classroom as a specialized interferometer which has a beam split into two beams with equal amplitude and later recombines before hitting a screen where an interference pattern is observed. However by adding a linear polarizing lenses in the path of each beams which changes the phase difference between the two respective beams and in turn changes the phase difference of the two beams causing different fringe pattern when observed on a screen and can cause the interference pattern to disappear; however with the use of a third polarizer place at the output of the Mach-Zehnder interferometer the pattern can be made to reappear.

Footnotes: sponsored by Dr. Eric Ayars

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: A soil-plate-oscillator apparatus for research projects and student demonstrations

Paper Type: Poster

Author: Melissa Pineda Brown
Department of Physics, U.S. Naval Academy
572 C Holloway Road, Chauvenet Hall Room Ch295
Annapolis, MD 21402
4102936683 (p)
4102933729 (f)
korman@usna.edu

A model apparatus called the “soil-plate-oscillator” is useful in understanding resonant vibration behavior. It is an open column of granular medium supported by a circular clamped plate. A sleeve keeps the soil in the column. The plate is driven from below by a coil located below a magnet (underneath the plate). An amplified swept sinusoidal chirp drives the coil. An accelerometer signal is fed into a spectrum analyzer. Results for masonry sand and glass spheres are compared. Here, the resonant frequency vs. granular mass loading decreases, then increases with further loading due to granular flexural stiffness overcoming the loading effects.

Conflicts: Prof Murray S. Korman is an AAPT member and will be paying the registration fee.

Melissa Pineda Brown and Brianna D. Taliaferro are both undergraduate students.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Analysis of the Effectiveness of Heat Exchangers on Backpacking Pots

Paper Type: Poster

Author: Jessalyn E. Ayars
Chico High School
1866 Lodge Pine Lane
Chico, CA 95926
5305885774 (p)
jessalyn@ayars.org

Is a backpacking pot with an attached heat exchanger worth the extra weight? After testing the efficiency of a common design it was found that the weight of fuel saved is greater than the weight of the heat exchanger if the trip is above a certain length. For shorter trips there was no advantage other than shorter cooking times.

Footnotes: Sponsored by Dr. Eric Ayars.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Between nature of the things, Representations and mathematical object: The case of the scalar and vector fields

Paper Type: Poster

Author: Eduardo Chávez Lima
ESCOM-IPN
Miguel Othon de Mendizabal s/n
Mexico, MEX 07738 México
5255157296000 (p)
echavezl@ipn.mx

When we considered the Physics like a general science, and thus isolated of the individual sciences sometimes forget it interpreting the phenomena by their representations available to the human being. If it's possible, sometimes gives it a explanation of the nature of the "thing", is develop a mathematical model that give formalizing but, How is geometric interpretation? How is described in the regular language? How was made the modeling of phenomena? A fundamental element is how is learn and linked this three element in a regular class, even more if we used like mediator tool the technology. In this proposal, we made proofs using an APP in a mobile device to integrate this three elements to teach and learn scalar and vector fields

Change Session

No Yes

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Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Between nature of the things, Representations and mathematical object: The case of the scalar and vector fields

Paper Type: Poster

Author: Mario Ramirez Diaz
CICATA IPN
Legaria 694, México City

Mexico, MEX 11500 México
5255157296000 (p)
mramirezd@ipn.mx

When we considered the Physics like a general science, and thus isolated of the individual sciences sometimes forget it interpreting the phenomena by their representations available to the human being. If it's possible, sometimes gives it a explanation of the nature of the "thing", is develop a mathematical model that give formalizing but, How is geometric interpretation? How is described in the regular language? How was made the modeling of phenomena? A fundamental element is how is learn and linked this three element in a regular class, even more if we used like mediator tool the technology. In this proposal, we made proofs using an APP in a mobile device to integrate this three elements to teach and learn scalar and vector fields

Change Session

No Yes

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Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Between the nature of the things, Representations and Mathematical Object: A study case, scalar and vector fields

Paper Type: Poster

Author: Eduardo Chávez Lima
ESCOM-IPN
Juan de Dios Batiz esq. Miguel Othón de Mendizabal
Mexico, MEX 07738 México
+525541419010 (p)
+525541419010 (f)
echavezl@ipn.mx

When considering Physics like a general science with universal validity, and therefore isolated of the idiographic sciences (or single sciences), sometimes do not taking on account interpreting of the phenomena by their representations affordable to human being. If it's possible, is given an explanation of the nature of the "thing", is built a mathematical model that formalizing it, but, How is interpreted geometrically? How is described the phenomena in regular language? How is made the model? And a fundamental element, How is learned and linked this three elements in class? Even more taking the technology like the mediator

element in the learning. In this proposal we made proofs with an APP in a mobile device to integrate this three elements to teach Scalar and Vector fields, evaluating the conceptual gain with Hake's factor

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Bubbles and related physics

Paper Type: Poster

Author: Botao Wei
The middle school attached to Sun Yat-sen university
135?xingangxi road
Guangzhou, GD 510275 China
86-13380992063 (p)
1556872676@qq.com

Soap bubbles are very common in our daily life, but their physical properties are still very interesting for us to explore in detail and more theoretical work remain open to study. Based on the survey of other contributions we demonstrated a further study of the bubbles. Through the experiment various bubble-groups have been photographed and measured with the dependence of the size, temperature, numbers, materials. We have found series of the bubble-groups patterns experimentally and have discovered some laws about the membrane of bubble-groups. In the part of theory, we testified such laws observed in our experiment. More specially, we have studied about the intensity of pressure of bubble-groups and the character of the material exchange among bubbles. In addition, the intersection angle among the bubbles' membrane which are in the same bubble-groups will be discussed and the laws of these membrane will be given.

Footnotes: This project was supported by the outreach programme of SPS chapter of Sun Yat-sen University

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Charged Particle Irradiation of Stainless Steel 316L

Paper Type: Poster

Author: Benjamin D Hunt
Glenbrook North High School
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Northbrook, IL 60062
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bdhunt16@gmail.com

Stainless Steel 316L (SST-316L) was irradiated in a charged particle beam, and analyzed using atomic force microscopy and scanning electron microscopy to compare surface defects to conventionally irradiated SST-316L nuclear cladding material. The density of these dislocations from the charged particle irradiated SST-316L were compared to that of the dislocation density of the traditionally irradiated cladding material. Analysis of these dislocations was the primary method used to compare the results of this process to the results of the test-reactor irradiation process.

Change Session

No Yes

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Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Cheap and Eye-Catching Demo of Young's Double Slit

Paper Type: Poster

Author: John Avallone
Math for America and Stuyvesant High School
345 Chambers St
New York, NY 10282
9175172023 (p)
john.avallone@gmail.com

Many images that represent the double-slit interference phenomenon are opaque and indecipherable to those who do not already understand the concept. This extremely simply, hand-made device gives the teacher and the student a way to work through the problem and come to an understanding of the topic that goes beyond the equations and then makes the equations more sensible.

Conflicts: I need leave Sacramento on/by the evening of the 18th.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Chemically Synthesized Nanostructures Based Solar Cell

Paper Type: Poster

Author: Gen Long
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We fabricate heterojunction solar cell devices using chemically synthesized nanostructures such as nanoparticles and nanowires. The heterojunction solar cell was fabricated with home-made nanostructures, including chemically synthesized narrow gap, IV-VI group semiconductor nanoparticles (PbS or PbSe) of 3~6nm diameter, wide gap semiconductors such as TiO_2 nanoparticles (~20nm) or hydrothermally grown ZnO nanowires (of 500nm~1 ?

m length and 30~50nm diameter), and gold nanoparticles (~5nm to 50nm), by spin-coating (~10cycles) onto FTO/ITO glasses, in ambient conditions (25C, 1atm). The synthesized nanostructures were characterized by XRD, UV-VIS-NIR spectrometer, SEM, AFM, TEM, solar simulator, etc. Nanostructures of variant sizes were integrated into the heterojunction devices to study the effects on photocurrent and solar cell performance. The sizes, lengths, thicknesses of nanostructures were studied. The effects of fabrication conditions (such as growth temperature, growth time, anneal temperature, ligand treatments, in air or in N2, etc.) on device performance were also studied. We have demonstrated that the heterojunction devices with a combination of wide gap and narrow gap semiconductor nanostructures can function for photovoltaic applications. The key challenges are to minimize the trap states and optimize the interface of nanostructures.

Change Session

No Yes

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Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Classroom Tools - Vpython

Paper Type: Poster

Author: Zakary T. Noel
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Making use of modern computing techniques, members of Lee College SPS (newly formed in early 2016) have been working to expand the usability of the programming language Vpython in order to introduce a new type of lab environment to the physics classroom. Vpython is an easy to learn 3D programing tool that bridges principal building blocks of physics together such as calculations, vectors, 3-dimensional space, and derived behaviors. Efforts of the Lee College SPS center on incorporating visual and interactive aids into the program that can be used to better understand how the simple mathematics and relationships coded by students work together to simulate real physical systems. Some applicable subjects include kinematics, electricity and magnetism, waves, and relativity.

Footnotes: Sponsored by Tom O'Kuma, Lee College

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Electromagnetic Field Duality in Light Polarization Using Geometric Algebra

Paper Type: Poster

Author: Elijah C. Ryan
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S. 16th Ave. and Nob Hill Blvd. P.O. Box 22520
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In the Clifford Algebra of Spacetime, dubbed the Spacetime Algebra, the duality of vectors to trivectors and bivectors to bivectors provides a simple language to formulate the duality of the Electric and Magnetic Fields. The equations of Maxwell that describe these classical fields can, by using Geometric Algebra, be placed in the form of a single field equation in the pseudo-Euclidean four-space of the Spacetime Algebra in place of the two distinct Classical Field Equations formed by the derivatives of the Faraday Tensor and its dual. The duality of bivectors in the four-space can be used to show the orthogonality of the Electromagnetic Field, with specific application in the polarization of light. The Geometric Algebra developed by David Hestenes is applied to take advantage of the directional qualities and simplicity of the Geometric Product in the Spacetime Metric.

Footnotes: The sponsor for the presenter Elijah C. Ryan is Dr. Stephen M. Rodrigue, Yakima Valley Community College. Please note that the contact information listed is for the sponsor, Dr. Stephen M. Rodrigue.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: High resolution measurement of lattice spacing of a Sodium Chloride monocrystal using X-Ray Diffraction

Paper Type: Poster

Author: Misganaw Getaneh
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mgetaneh@utm.edu

High energy electrons that are stopped at a Molybdenum surface produce two types of x-rays. These are bremsstrahlung x-rays produced through deceleration of electrons and material characteristic x-rays, K-alpha and K-beta emission lines, produced by transitions in the Molybdenum atoms when high energy electrons hit the surface. A small portion of the x-rays produced at the source goes through a collimator and is scattered by a NaCl monocrystal target. Data of count rate versus target angles was collected for the scattered x-rays for electron accelerating voltage of 35 kV. Analysis of the scattered K-alpha and K-beta lines gives d=280±4 pm for lattice spacing, which is consistent with the literature value d=282.01 pm. The measurement was repeated using a much higher resolution accessory. This gave a much more resolved image of the scattered x-rays. This resulted in lattice spacing d=281.54±1.60 pm.

Change Session

No Yes

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Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Interference or Diffraction, Start from LED Decoration Film

Paper Type: Poster

Author: Mingchen Sun
The true light middle school in Guangzhou
No.17, Peizhen Road, Baihedong, Liwan Disdtrict
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13450253638 (p)
1273035372@qq.com

Interference and diffraction are the two concepts in our high school physics. In the course we have only the opportunity to discuss the Yang's double slit interference and Fresnel diffraction. But in our daily life these two concepts are often entangled together so that we can not distinguish which play the main role. For example, from a series of LED decoration products called as decoration film we can not judge whether it originates from interference or diffraction. Such complicated behaviors motivate us to explore the interference behaviors and the diffraction ones. The talk will focus on the wave optics phenomena and give a step further analysis to various illumination patterns with Virtual Lab software as well as the short but clear principle deduction.

Footnotes: Thank for the support of the outreach program from SPS Chapter of Sun Yat-sen University, China

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Learning of Biot-Savart law using the Project-Based Learning methodology and development of experimental prototypes in Mexico

Paper Type: Poster

Author: Lilia Teresa Carrera de Anda
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lili.carrerada@gmail.com

In this work we present the results of educational research to measure the effectiveness of learning the Biot-Savart Law using the Project-Based Learning methodology and development of experimental prototypes. The objective of the research is measurement the learning effectiveness in Electromechanical and Mechatronics Engineering students from Instituto Tecnologico de Parral. The investigation was carried out with Mechatronics Engineering students who served as experimental group and Electromechanical Engineering students as a control group, both groups of trainees subject of Electromagnetism. A 27 items of an instrument that was used in investigations by Guisasola and Almudi were used. In assessing the results Hake factor was introduced to determine the gain in both the experimental group and the control. The analysis results show that the Project Based Learning and development of experimental prototypes is a good method of teaching Biot-Savart law on the subject of Electromagnetism and the ¨ physical make ¨ favors understanding and building concepts

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Modeling acoustic landmine detection using a soil-plate oscillator

Paper Type: Poster

Author: Joshua M. Lewis
Department of Physics, U.S. Naval Academy
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Annapolis, MD 21402

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korman@usna.edu

In laboratory acoustic landmine detection experiments a plastic cylindrical drum-like simulant is buried in a soil tank. Sound (generated from subwoofers located above the soil) drives the soil particles causing subsequent particle vibration over the compliant top plate of the simulant. Measurements of surface particle velocity vibration vs. frequency were recorded for various scan locations across the surface in an effort to profile the buried simulant. Resonant behavior can be modeled using a soil-plate-oscillator (SPO) apparatus, which involves a thick-walled cylindrical column of granular material (sand or light density edible materials) supported by a circular acrylic plate clamped to the bottom of the column. A small accelerometer on the granular surface measures tuning curve results across the surface using a sweep spectrum analyzer. Landmine simulant and SPO results are compared to help analyze the behavior of the resonant tuning curves.

Conflicts: Professor Murray S. Korman is a member of the AAPT and will be paying the registration fee. Joshua M. Lewis and Miahnna K. Nguyen are both undergraduates.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Newton's Second Law

Paper Type: Poster

Author: Vincent Coletta
Loyola Marymount University
1 LMU Drive
Los Angeles, CA 90045-1373
31-338-7352 (p)
vcoletta@lmu.edu

Students pull each other on carts, sheets of plywood that roll on low friction, Rollerblade wheels. One student pulls the cart on which a second student is seated as the cart moves down the hall. The cart is pulled with a rope and spring scale, so that the student who is pulling can monitor the force during the motion. The riding student uses a metronome and marks the floor at one second interval so that the distance traveled as a function of time can

be measured. This experiment serves to develop both students' understanding of Newton's Second Law and also their facility with handling multiple variables and their relationships.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Nonlinear vibration experiment: Clamped elastic plate with granular material loading

Paper Type: Poster

Author: Emily V. Santos
Department of Physics, U.S. Naval Academy
572 C Holloway Road, Chauvenet Hall Room Ch295
Annapolis, MD 21402
4102936683 (p)
4102933729 (f)
korman@usna.edu

Experiments using soil-plate-oscillators (SPO) involve a cylindrical column of granular media (masonry sand, glass spheres, uncooked brown rice, un-popped popcorn kernels, or "Toasty Oats" ™ cereal) supported by a circular elastic acrylic plate (20.3 cm diam, 3.2 mm thick) clamped to the bottom of the tube. An AC coil driven by a swept sinusoidal chirp drives a magnet fastened to the underside center of the plate. A spectrum analyzer measures the accelerometer vibration amplitude vs. frequency. The resonant frequency decreases with increasing amplitude – representing softening in the nonlinear system. Experiments involving fixed amplitude resonant frequency vs. mass loading were performed.

Conflicts: Prof Murray S. Korman is an AAPT member Emily V. Santos is an undergraduate student. Prof Korman will be paying the registration fee.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Particle Physics and Minecraft

Paper Type: Poster

Author: Amanda Depoian
Siena College
515 Loudon Rd
Coram, NY 11727 United States
6317935580 (p)
al17depo@siena.edu

At Siena College, the physics department runs a program on Saturdays for inner city middle school students to come to campus and learn about science and the arts. A class was developed for middle school students to learn about particle physics. Hands-on activities, videos, and Minecraft worlds were developed where the students learned about quarks, the makeup of atoms, particle detectors, and particle accelerators. These activities along with the results of a pre- and post-test assessment that measures how well the students learned and retained about particle physics will be presented.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Use of Facebook like instrument to teach Photovoltaic Theory under the theoretical framework of Instrumental Genesis

Paper Type: Poster

Author: Mario Humberto Ramirez Diaz
CICATA IPN
Av. Legaria 694
Mexico, MEX 11500 Mexico
52 (p)
mramirezd@ipn.mx

Facebook is the most popular social network among college students. Its significance has transcended beyond its purpose to the point where is presumed to be able to support a learning environment for teaching physics. The purpose of this research was investigate if Facebook offers a useful and meaningful educational environment able to support, enhance or strengthen the learning of Physics in college students. The research will conduct an experiment in which observable throw achieve identify the concept of students about the use of Facebook as a virtual environment that facilitates learning of physics, identify instrumentative elements developed by students during the use of Facebook as a learning environment in the subject of photovoltaic theory and identify the significant difference in learning of a group of 40 students in their first year of college. All this under the theoretical framework of Instrumental Genesis

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Use of Facebook to teach Photovoltaic

Paper Type: Poster

Author: Mario Humberto Ramirez Diaz
CICATA IPN
Av. Legaria 694
Mexico, MEX 11500 México
5255157296000 (p)
mramirezd@ipn.mx

Facebook is the most popular social network among college students. Its significance has

transcended beyond its purpose to the point where is presumed to be able to support a learning environment for teaching physics. The purpose of this research was investigate if Facebook offers a useful and meaningful educational environment able to support, enhance or strengthen the learning of Physics in college students. The research will conduct an experiment in which observable throw achieve identify the concept of students about the use of Facebook as a virtual environment that facilitates learning of physics, identify instrumentative elements developed by students during the use of Facebook as a learning environment in the subject of photovoltaic theory and identify the significant difference in learning of a group of 40 students in their first year of college. All this under the theoretical framework of Instrumental Genesis

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Vibration experiments: Clamped elastic plate with edible granular material loading

Paper Type: Poster

Author: Ebonie S. Smith
Department of Physics, U.S. Naval Academy, Annapolis
572 C Holloway Road, Chauvenet Hall Room Ch295
Annapolis, MD 21402
4102936683 (p)
4102933729 (f)
korman@usna.edu

A soil-plate oscillator (SPO), apparatus, studies flexural vibrations of a soil loaded acrylic plate (8 inch diam, 1/8 inch thick) clamped below a cylindrical tube supporting granular material. An accelerometer attached to a small magnet (below the plate) is used to detect the plate’s vibration. The plate is driven from below by an AC coil using an amplified swept sinusoidal current. The accelerometer signal is measured vs. frequency using a spectrum analyzer. Experiments were performed with uncooked rice, instant oats, popcorn kernels, and pretzel gold fish. Resonant frequency decreases then increases with added granular media due to the material’s stiffness.

Conflicts: Professor Murray S. Korman is an AAPT member. Prof. Korman will be paying the registration fee. Ebonie S. Smith and Blair E. Lewis are undergraduates.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Supporting Hispanic Women Students in Physics

Committee on Women in Physics | **Co-Sponsor:** Committee on International Physics Education | **Type:** Inv/Con | **Organizer:** Daryl McPadden

Description: The Hispanic population is the largest minority group in the United States, making up 17% of the total population, and is projected to increase to 31% by 2060. However, Hispanic students are disproportionately underrepresented in physics, especially in the intersection of Hispanic women. This panel will focus on the experiences of, research with, and strategies for supporting Hispanic women students in physics.

Call for Papers:

Abstracts Submitted (# 3) | Abstracts You Have Reviewed: 0

Abstract Title: Examining the identity development of female physics majors

Paper Type: Invited

Author: Sissi L Li
California State University Fullerton
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Fullerton, CA 92831-3547
6572787027 (p)
6572787027 (f)
sissili314@gmail.com

Speaker order: 02

The challenges of becoming an expert in and a member of a field are both content-based and sociocultural. In pursuing a degree in physics, social interactions with faculty and peers can help shape students' understanding of what it means to be a physicist. Cultural expectations are learned through social interactions and show how student identities fit into the community. Because physics is perceived as one of the most difficult in STEM, and it is one of the least diverse fields (81% of US physics BS recipients are white, and 79% male (AIP, 2010)), women and other underrepresented groups must overcome cultural differences and barriers while learning physics content. We will present the experiences of women who have successfully achieved a bachelor's degree in physics. Through interviews with these women, we will shed light on prominent features of their experience that helped shape their identity as physicists in their undergraduate endeavors.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: One Among Many: Experiences of a Hispanic Woman in Physics

Paper Type: Invited

Author: Ana V. Aceves
518 Beacon St.
Boston, MA 02215
(209) 761-2706 (p)
ana.aceves1291@gmail.com

Speaker order: 01

Like many, my parents emigrated from Mexico to the United States seeking a better lifestyle – and that included giving us the opportunity of a higher education. Eighteen years later, and I was packing my bags and moving 120 miles away from home to get a degree in astrophysics. I was the first in my family to graduate from college. It wasn't easy, and it wasn't because my classes were hard. Looking around my physics classes, I noticed no one else looked like me. There were women and Hispanic men, but no Hispanic women. I decided I wanted to make a difference, so I'm a Spanish-language science communicator. In this session, I will speak about my experiences as a Hispanic woman in physics and give suggestions on how to make classrooms more inviting for other Hispanic women.

Footnotes: Daryl McPadden, Committee for Women in Physics

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Using Social Psychology to Support Underrepresented Students in Physics

Paper Type: Invited

Author: Gregg A Muragishi
Stanford University
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Stanford, CA 94305-2130
6268906963 (p)
muragishi@stanford.edu

Speaker order: 03

Two important tasks for teachers are to decide what material to cover and how to present it. Recent research in social psychology, however, shows that fostering student learning requires more than just presenting the material in an engaging manner – it also requires teachers to understand how students experience the classroom environment. Students from groups that are negatively stereotyped or underrepresented in physics are more likely to question whether they belong in school and look for evidence to confirm or allay these doubts. From this perspective, behaviors that seem positive to a teacher, like offering extra help, can make a student wonder if the teacher doubts their ability. How, then, can physics teachers create positive classroom environments for all students? This talk will review organizational mindsets, feedback, and affirmation strategies and describe how teachers can harness the power of social psychological research to help support the needs of all students.

Footnotes: Daryl McPadden

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Teacher in Residence (TIR) role in Mentoring

Committee on Teacher Preparation | **Type:** Inv/Con | **Organizer:** Jon Anderson

Description:

Call for Papers: Mentoring new physics teachers is critical to their success and retention. Teachers in Residence and Master Teachers are in a unique position to provide this mentoring. If you have worked as a TIR and served as a mentor or have been mentored by a TIR, please share your expertise and insight by contributing to this session.

Abstracts Submitted (# 8) | Abstracts You Have Reviewed: 0

Abstract Title: An Informal Mentoring Program Using Outreach and Volunteering

Paper Type: Contributed

Author: Jeffrey A. Rodriguez
University of Cincinnati
8593 Coran drive
Cincinnati, OH 45255 United States
5133049363 (p)
5133049363 (f)
jeffrodriguez@foresthills.edu

Informal mentoring and contact with physics majors can be accomplished through outreach and volunteering opportunities. A discussion of the type of activities developed in order to get physics majors a feeling for what its like to be a physics teacher. Participation in several Saturday physics programs for high school students, judging local science fairs, assisting with science Olympiad, and giving demonstrations through a traveling science show will be addressed.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Creating a New PhysTEC Program at WVU
Paper Type: Contributed
Author: Michael Tilley
West Virginia University
135 Willey Street
Morgantown, WV 26505 United States
3042933422x69936 (p)
michael.tilley@mail.wvu.edu
Even with accommodating faculty and staff, starting a PhysTEC program in a new location has its challenges; these challenges mount when the program leads are also new to the university. Being a Teacher in Residence (TIR) through such a change has been exciting. A well-designed, cooperative support structure and professors with PhysTEC experience ensured that this new program started successfully. I will discuss my role as TIR in recruiting new future teachers to the also recently launched WVUteach, a UTeach replication site. I will discuss strategies for providing accessible information about teaching for introductory students and helping more advanced students through a complicated licensure environment. I will also discuss the TIR's role in developing a culture of respect for the art of teaching and knowledge of active learning strategies in a traditional teaching assistant population.

Change Session
No Yes
--Select here if you would like to change the session --
Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Defining the Role of the TIR

Paper Type: Contributed

Author: Cherie Bornhorst
Mines/UNC STEM Teacher Preparation Program
920 W 29th Street
Loveland, CO 80538 United States
9706135200 (p)
cherie.bornhorst@thompsonschools.org

One of the newest PhysTEC sites is operating on the School of Mines campus, a highly-selective pubic applied sciences and engineering research university, but is a partnership with one of the state's premier teacher preparation institutions, the University of Northern Colorado. In efforts to clearly define the Teacher in Residence role within the Mines/UNC STEM Teacher Preparation Program we (the three first-year TIR's) formed a Teacher Advisory Group (TAG). We have met regularly with the teachers, administrators, state officials, and policymakers who make up our TAG, and gained information from them about what makes for strong university-school partnerships. We've also learned that mentoring needs extend beyond the teacher candidates to also include host teachers, administrators, and faculty in the schools and districts where our students are being placed.

Footnotes: PhysTEC

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Expert Teacher Advice and What “We” expect from Student Teachers

Paper Type: Invited

Author: Frank Lock
Georgia State University
c/o 4424 Sardis Rd.
Gainesville, GA 30506
941-475-1578 (p)
fasterlock@att.net

Speaker order: 01

One assignment the Teaching Candidates (student teachers) at Georgia State were required to complete was an interview with an expert teacher. Responses to such an interview will be presented and discussed, as well as the expectations of the pre-service teachers who are preparing for a career teaching high school physics.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Power of the Emotional Component in Teaching and Learning

Paper Type: Contributed

Author: Michael J. Ponnambalam
M. Sundaranar University
7-40 Sannathi Street, Vadakkankulam, Tirunelvely Dt.
Tamil Nadu, 627116
(91) 770 876 9909 (p)
michael.ponnambalam@gmail.com

The author is a Master Teacher, and Mentor for New Physics Staff, University of the West Indies, Jamaican Campus from 2006 to retirement at 2013. This paper presents details on the enormous power of the teachers' infectious enthusiasm and caring attitude in teaching and learning.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Rowan University: New PhysTEC Teacher in Residence Perspectives
Paper Type: Contributed

Author: Patrick L. Chestnut
Rowan University
201 Mullica Hill Road
Glassboro, NJ 08028-1700
856 256 4303 (p)
chestnut@rowan.edu

Rowan University was recently awarded a Comprehensive Site grant by the Physics Teacher Education Coalition (PhysTEC). The goal of Rowan's PhysTEC project is to increase the number of highly qualified physics teachers entering the workforce by creating a teacher-rich environment within the Department of Physics & Astronomy where teaching high-school physics is a relevant and admirable career path for physics majors. The purpose of this discussion is to provide insight related to opportunities and challenges encountered in the creation of new physics teachers at Rowan University. We will present topics from the perspective of a new TIR including site-specific considerations in hiring, training, and placing learning assistants in physics classrooms, the impact of students working as learning assistants on teaching dispositions, the formation of regional professional learning communities, potential solutions to overcoming challenges in navigating teacher certification pathways, and lastly, long-term sustainability of PhysTEC programs.

Footnotes: PhysTEC, APS

Conflicts: Presentation date is Monday, July 18th per Jon Anderson. PhysTEC Teacher in Residence Coordinator

Change Session
No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Shared Responsibility: Multiple Teachers in Residence
Paper Type: Contributed
Author: Pamela Word
Texas State University
601 University Dr
San Antonio, TX 78666
210-325-1713 (p)
Pamelakay0707@gmail.com
Texas State University is a first year PhysTEC site that chose to bring on three current classroom teachers to fulfill the responsibilities of the Teacher in Residence (TIR) role. This model of TIR implementation benefits both the site and the teachers. The teachers are from three different school districts, and provide unique perspectives, opportunities, and resources for mentoring current and prospective students. In addition to the diversity afforded to the program, the sharing of TIR responsibilities among the three teachers allows for a better balance between their classroom teaching and university mentoring. This presentation will elaborate on these benefits as well as address possible challenges that may be encountered when implementing this model.

Footnotes: Sponsored by Jon Anderson

Change Session
No Yes
--Select here if you would like to change the session --
Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Transience with Continuity: the TIR Paradox

Paper Type: Contributed

Author: Adam LaMee
University of Central Florida
517 London Rd
Winter Park, FL 32792
850-567-2288 (p)
adamlamee@gmail.com

In mentoring future Physics teachers, a Teacher-in-Residence often draws upon what has worked in the past, networks with the existing K-20 Physics education community, and connects with undergraduates more personally than a series of mass emails would allow. And the TIR position can also rotate in as little as one year. So how can a TIR build continuity knowing much of what they accomplish will have to be done by a stranger next August? Time is well-spent enhancing the university culture of valuing the teaching profession. Being a catalyst for local teachers to come together, either socially or for professional development, fosters a community of educators who anticipate being contacted each year to host students for field experience. As TIRs come and go, culture and community persist. And cloud storage. Meticulously organized cloud storage.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Teaching Physics in High Needs High Schools

Committee on Professional Concerns | **Co-Sponsor:** Committee on Physics in High Schools | **Type:** Inv/Con | **Organizer:** Colleen Megowan-Romanowicz

Description:

Call for Papers: Teaching physics in a high needs school entails a number of unique challenges that are not encountered in the typical suburban middle class high school. This session will examine conditions associated with serving high needs students and shed light on both the challenges and the opportunities teachers encounter in this setting.

Abstracts Submitted (# 6) | Abstracts You Have Reviewed: 0

Abstract Title: Crossing Cultural Borders

Paper Type: Contributed

Author: Danny Doucette
International School of Latvia
Meistaru iela 2
Pinki, LV-2107 Latvia
+371-29365151 (p)
danny.doucette@gmail.com

Many of the challenges we face as teachers stem from the tremendous cultural divide between students' experiences outside of the classroom and the unique physics culture they find within. The concept of cultural border crossing is a useful way to understand students' experiences and needs. By approaching language learning, gender/racial gaps, and student disengagement as aspects of cultural border crossing, we can engage with the root causes of students' cultural challenges and change our teaching practice appropriately.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Effects of Instructional Strategies on Students’ Academic Performance in Physics.

Paper Type: Contributed

Author: Omole Vincent Opeyemi
College of Education Ikere Ekiti
Department of Physics College of Education PMB 250
Ikere , Ekiti 234 Nigeria
2348034457676 (p)
omoopevincent2015@gmail.com

Abstract The study investigated the effects of Demonstration, Programmed and Projects Instructional Strategies on Student’s Academic Performance in Physics. The purpose of the

study is to determine experimentally the effects of the selected strategies on Student's Academic performance and also determine if the strategies are more effective than the Traditional chalk and talk strategy. The study employed the quasi- experimental pre test pos-test control group design. Demonstration, Programmed and Projects Instructional Strategies were grouped as experimental while Traditional chalk and talk strategy is used as the control group. Data generated were subjected to descriptive statistics of mean, standard deviation as well as inferential statistical analysis of Analysis of Variance.The results shows that students exposed to Programmed strategy were the best and most effective if compared with Demonstration, Project and the Traditional chalk and talk method strategies. The findings from the study revealed that location of school is helpful in enhancing Academic Performance in Secondary School as most Students in urban areas performed better than those in rural areas.Programmed and demonstration strategies should be adopted as effective strategies of teaching Physics .

Footnotes: Keywords: Programmed Demonstration ,Project and Chalk and Talk, instructional Strategy, Academic Performance To be sponsored by Tertiary Education Trust Fund.(Nigeria)

Conflicts: kindly consider my abstract. i am optimistic that the research will add positive value to teaching and learning of Physics in High Schools.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Motivating students with limited skills to learn Physics concepts through challenges.

Paper Type: Contributed

Author: Cliff Gerstman
Middle College High School
3325 GOndar Avenue
Long Beach, CA 90808
714-953-3900 (p)
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cliffg37@verizon.net

Having taught Physics for ten years in the inner city of South Central Los Angeles, I needed to develop ways to motivate students with low interest and limited math skills to really grab Physics concepts. What I came up with was a series of one or two class competitions that made students want to succeed. Each challenge competition would come with a goal, and analysis questions to be answered individually by the students. In this round about method, students answered questions and internalized concepts without ever realizing they were doing so.

Conflicts: None, It's all good.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Reflections on Modeling Instruction in Urban Schools

Paper Type: Invited

Author: Bradley Gearhart
Buffalo Public Schools
256 South Elmwood Ave.
Buffalo, NY 14201
(716) 816-3888 (p)
fizz6guy@yahoo.com

Speaker order: 03

Over the past decade, I have employed Modeling Instruction as the main mechanism by which physics content is delivered in my classroom. During that time, my classroom setting has varied greatly as I transitioned from a private catholic school, to a high-achieving suburban school, and finally to an under-performing urban school district. Despite the diverse demographic and socio-economic shifts that came with each transition, my use of Modeling Instruction and reflection have been important to me as I have seen the benefits in each of these educational environments. During this talk, I will use student work and RTOP to define the quality of instruction, describe how extending Modeling Instruction within the Buffalo Public School District and mentoring my colleagues through the Interdisciplinary Science and Engineering Partnership (ISEP) informs and develops my physics teaching practices.

Conflicts: This abstract replaces the one previously submitted!!!

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Sometimes the Science Comes Second: Modeling in High Needs Schools

Paper Type: Invited

Author: Steve Nixon
Marina High School
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Marina, CA 93933 United States
9168357934 (p)
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stnixon@gmail.com

Speaker order: 02

One of the major challenges faced in a high needs school is the students' social emotional health. Instructional curricula such as Modeling can be an effective technique to boost the social emotional health of students while also increasing academic achievement in physics classes at multiple levels. Specifically, in my experience, Modeling techniques, such as goalless problems and whiteboarding, along with other instructional strategies like Project Based Learning, increase scientific reasoning skills, student confidence, and student engagement. I will present Classroom Test of Scientific Reasoning results and in-class evidence and anecdotes of student gains that span multiple schools.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Twenty-plus years of physics teacher professional development in rural Kansas

Paper Type: Invited

Author: Paul E Adams
Fort Hays State University
600 Park St.
Hays, KS 67601-4099
785-628-5344 (p)
785-628-4447 (f)
padams@fhsu.edu

Speaker order: 01

Fort Hays State University (FHSU) has focused on providing professional development for teachers of physics in high need schools – primarily rural schools in Kansas - for over twenty years. Through numerous grants and formation of partnerships with other universities and service centers, FHSU has provided not only professional development for cross-over, novice, and expert physics teachers utilizing the Modeling Method of physics instruction, but also thousands of dollars of teaching apparatus from sensors to robots, and a support system for physics teachers in high need areas. While our efforts have been successful, it required meeting the challenge of place and time bound teachers, under-funded school districts, shortage of STEM teachers, and leveraging resources of time, talent and treasure. The experiences – both success and failures – at FHSU provide insight for other institutions looking for ideas to provide sustained on-going professional development to assure high quality physics teaching for all students.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Using Popular Media to Teach Astronomy

Committee on Space Science and Astronomy | **Co-Sponsor:** Committee on Science Education for the Public | **Type:** Inv/Con | **Organizer:** Richard Gelderman

Description:

Call for Papers: Do you make use of popular media to encourage student learning; and have you studied the actual success for such approaches? Books, poetry, comics, magazines, and news-stories provide opportunities to study science. Video from "Interstellar," "The Martian," or the newest superhero movie demonstrate science principles. Analysis of "Angry Birds" or other games allow us to bring physics into our students' lives. Please share your analysis of the advantages of science through pop culture references.

Abstracts Submitted (# 5) | Abstracts You Have Reviewed: 0

Abstract Title: How I Learned to Stop Worrying and Love Science in Movies

Paper Type: Invited

Author: Jacob Clark Blickenstaff
Pacific Science Center
200 2nd Ave North
Seattle, WA 98109
206-443-2903 (p)
jclarkblickenstaff@pacsci.org

Speaker order: 01

We should never underestimate the influence high school teachers have on their students. My high school physics teacher, Jerry Fujii, used to post newspaper articles that connected to some aspect of our class. I remember clearly that one had the headline “Superman Fails Physics,” and now I realize that is where my interest in looking for real science in films and TV began. Since 2008 I have contributed a regular column to the National Science Teachers Association newsletter titled “Blick on Flicks.” I will share a bit of the origin story for the column, describe a couple of the fun connections I have made, and attempt to stimulate some further thinking about using creative media in the science classroom.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Interdisciplinary Teaching: Science Fiction, Poetry, Drama, Music and More

Paper Type: Invited

Author: Andrew Fraknoi
Foothill College
12345 El Monte Rd.
Los Altos Hills, CA 94022 United States
6509497288 (p)
fraknoiandrew@fhda.edu

Speaker order: 02

For over three decades, I have enhanced my astronomy and "physics for poets" classes by including discussions of science-fiction, music, drama, and poetry inspired by science in the course. I can make the properties of black holes come alive through a story where the protagonist swiftly must "dump" part of his spaceship into a black hole, so that his part remaind above the event horizon. Only later does he realize his girlfriend was on the part he dumped! Students enjoy pieces of music that relate to topics we study in astronomy, including some where science-data determine the notes or rhythm. I keep a website of science fiction with good physics and astronomy at: www.astrosociety.org/scifi and a list of astronomically inspired music at: http://dx.doi.org/10.3847/AER2012043 I'll have a handout on where to find a range of such interdisciplinary resources and fun examples that your students are likely to enjoy.

Conflicts: I am also on the panel on The Great American Eclipse

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Just Real Enough - The Art of Physics at Pixar

Paper Type: Invited

Author: William A Wise
Pixar Animation Studios
1200 Park Ave.
Emeryville, CA 94608
(510) 922-3694 (p)
bwise@pixar.com

Speaker order: 03

At Pixar we use many physics based tools to achieve the look of our films. From the light transport mechanisms used to model translucency in skin shading, to the bi-directional reflectance functions used in our lighting tools, to the fluid and finite element simulators we use to produce water or flesh and skin simulations - all use physics based approaches drawn from many disciplines. But given that our task is to create Art (and please directors and production designers) and not scientific visualization, there are a host of ways in which we cheat modify or otherwise bend physics to achieve our esthetic desires. This presentation investigates both the science and art of using Physics to create the illusion of reality.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: OK GO! (and other popular culture contexts to learn astronomy!)

Paper Type: Contributed

Author: Richard P. Hechter
University of Manitoba
Education Building, Room 234
Winnipeg, MB R3T2N2 Canada
2044749013 (p)
richard.hechter@umanitoba.ca

Come join us as we describe our use of popular culture media, including OK GO's "zero-g" music video for their song "Upside down and inside out", and other music, film, and

television pieces as the contexts to teach and learn astronomical phenomena. This presentation will detail how we merged pragmatic strategies of this pedagogical approach with theoretical underpinnings of teaching and learning physics in our teacher education program, and how we shifted that focus in the secondary school to using the integration of popular culture media to encourage greater student investment in their learning.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Abstract Title: Survivability of potatoes and soil bacteria in a Mars chamber

Paper Type: Contributed

Author: Jay Nadeau
Caltech
1200 E. California Blvd.
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A key plot element of The Martian is death of potato plants grown by a stranded astronaut when the plants are subjected to Mars ambient temperature and pressure for ~1 day. It is a common misconception that water evaporates very rapidly on Mars. However, observations have demonstrated that the evaporation rate of water at low and moderate temperatures is relatively slow, allowing for a water cycle on the surface of the planet. Binding of water to soils also reduces evaporation. Based upon these studies and calculations of maximum evaporation rates, we hypothesized that potato plants and associated soil bacteria would be able to survive 24 h at 6 torr at either ambient temperature (~10 ºC, Martian summer) or -20 ºC. Tests were performed in a Mars chamber using a 2-gallon Russet potato. Results, including estimates of water loss and soil bacteria counts, are shown and discussed in a thermodynamic context.

Conflicts: Prefer July 18-20 over 16-17, but not an absolute constraint.

Change Session

No Yes

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

Order (Sorters Suggested order)

Comment:

Submit

Generic Abstracts

PER: Investigating Classroom Strategies

Abstracts Submitted (# 0)

PER: Problem Solving

Abstracts Submitted (# 0)

PER: Student Reasoning

Abstracts Submitted (# 0)

PER: Topical Understanding and Attitudes

Abstracts Submitted (# 0)

Astronomy Paper

Abstracts Submitted (# 5) | Abstracts You Have Reviewed: 0

Abstract Title: "How To Be Invisible?" As an Introduction to the Electromagnetic Spectrum 5016

Paper Type: Contributed

Author: Richard Gelderman
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1906 College Heights Blvd
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"I need your help. I must find a way to be completely invisible." This request is a perfect way to start any unit on optics and the nature of light, because the responses from the students in your class will invariably hit on every topic you hope to cover. Let then describe what it means to be opaque or transparent. Let them work out what it means to get light to bend from its tendency to travel in straight lines. Let them bring up detection at infrared, or other wavelengths in the electromagnetic spectrum.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Impact of Prior Astronomy Learning Experiences on TOAST Scores 5651

Paper Type: Contributed

Author: Timothy F. Slater
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1000 E University (Mail Code 3374)
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As Introductory Astronomy educators become more interested in experimentally testing innovative teaching strategies to enhance learning in ASTRO 101, scholars are placing increased attention toward better understanding factors impacting student gain scores on the widely used Test Of Astronomy STandards (TOAST). Usually used in a pre-test and posttest research design, one might naturally assume that the pre-course differences observed between high- and low-scoring college students might be due in large part to their pre-existing motivation, interest, and attitudes about astronomy. To explore this notion, 12 non-science majoring undergraduates taking ASTRO 101 at West coast community colleges were

interviewed in the first few weeks of the course to better understand students pre-existing affect toward learning astronomy. Perhaps surprisingly, there was only weak correlation between students' motivation toward learning astronomy and their pre-test scores. Instead, the most fruitful predictor of pretest scores was the quantity informal, self-directed astronomy learning experiences.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Learning to See in Astronomy: Distinguishing Nebula in Telescopic Images 5648

Paper Type: Contributed

Author: Luke D. Conlin
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East Palo Alto, CA 94303 United States
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2402717665 (f)
lconlin@stanford.edu

A critical skill in astronomy, for professional astronomers and citizen scientists alike, is to distinguish astronomical objects in telescopic images. Little is known about the process of learning this skill, or how to effectively teach it. This study presents an experimental comparison of two approaches for training undergraduate students to distinguish and classify nebulae (planetary nebulae and supernova remnants). In one approach, students learned the visual characteristics of nebulae by comparing several exemplars to highlight similarities. In the other approach, students compared images that were paired as contrasting cases to highlight differences. Results from pre- and post-test measures show that both approaches helped students learn to distinguish nebulae, with contrasting cases showing descriptively (but not significantly) higher gains. Pre- and post-test measures of confidence suggest that part of the learning may be metacognitive: students learned to attune their confidence to their performance. Implications for teaching and research will be discussed.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Overview of US Astronomy Education Research Dissertations in the iSTAR Database 5643

Paper Type: Contributed

Author: Stephanie J. Slater
CAPER Center for Astronomy & Physics Education Research
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Laramie, WY 82070
520-9753826 (p)
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Collecting and synthesizing the surprisingly vast amount of discipline-based astronomy education research is of great interest to astronomy education research scholars trying to understand the range and depth of prior studies. In support of those efforts, the CAPER Center for Astronomy & Physics Education Research has been developing the infrastructure needed to create and curate a comprehensive International Study of Astronomy Reasoning (iSTAR) Database, an online, searchable research tool, intended to catalog, characterize, and provide access to astronomy education research production, world-wide. As a first step to test iSTAR's functionality we surveyed the previously uncatalogued set of U.S.-based doctoral dissertations. This first-light target population was selected for its anticipated familiarity to the iSTAR team, and for its small expected sample size (50-75 objects). To our great surprise, our first-light observations revealed an excess of 300 astronomy education research dissertations, which were characterized across multiple variables.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: The Cosmic Perspective Timeline 5636

Paper Type: Contributed

Author: Kristi D. Concannon
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The study of astronomy is vast both in space and time. To students, the 15-week tour of the universe is often little more than a series of facts and figures related to objects beyond reach or comprehension; there is little connection to their human story. To them, our understanding of the universe seems fixed, not fluid. While students may learn the story of the physical universe, they fail to appreciate how our understanding of our human place in the cosmos has changed over time. The cosmic perspective timeline is a short activity that encourages students to consider the timing of the key shifts in our understanding of the universe and to appreciate the changing nature of science.

Change Session

No Yes

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

Order

Comment:

Submit

Gender

Abstracts Submitted (# 7) | Abstracts You Have Reviewed: 4

Abstract Title: Gender differences in students' epistemologies regarding the nature of experimental physics 5251

Paper Type: Contributed

Author: Bethany R Wilcox
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2510 Taft Dr Unit 213
Boulder, CO 80302 United States
9704125014 (p)
Bethany.Wilcox@colorado.edu

The existence of a gender gap has been repeatedly demonstrated in scores on conceptual and attitudinal assessments. This gap is often present in student's pre-instruction scores and persists in their post-instruction scores. One instrument that has not been examined for the existence of a gender gap is the Colorado Learning Attitudes about Science Survey for Experimental Physics (E-CLASS). Here, we utilized a national data set of responses to the E-CLASS to determine if they demonstrate a significant gender gap. We also investigate how this gap varies along multiple student and course demographic slices, including course level (first-year vs. beyond-first-year), major (physics vs. non-physics), and pedagogy (traditional vs. transformed). We find that a gender gap in pre- and post-instruction scores is observed in nearly all cases; however, when controlling for pre-instruction scores, the gap in post-instruction scores vanishes for several of these subpopulations (e.g., physics majors and beyond-first-year students).

Conflicts: If at all possible, this talk should be placed in a PER session.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Impacts of lecture-based teaching and faculty disconnection on STEM majoring 5411

Paper Type: Contributed

Author: Melissa Dancy
University of Colorado

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7047630125 (p)
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Over 300 university seniors were interviewed about their experiences pursuing a major. The students were either STEM majors, had left a STEM major or had considered but never pursued a STEM major. The majority of students interviewed were from an underrepresented group, i.e. women and/or racial minority. Students reported a preference for interactive teaching yet experienced high levels of lecturing in college classes. Additionally, they report positive influences of high school teachers but rarely of college faculty in their decisions to pursue or continue a STEM major. Students report particularly negative experiences in physics. Poor college level teaching appears to disproportionally impact underrepresented groups.

Conflicts: Do not overlap with Katherine Rainy Presentation

You have submitted comments on this item

Change Session

No Yes

PER: Topical Understanding and Attitudes--G

Order

Comment:

Identity cluster

Update

Abstract Title: Learning Assistant Practices in an Active Learning Landscape 5614

Paper Type: Contributed

Author: Hagit Kornreich-Leshem
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With increased efforts to engage women and underrepresented minorities in STEM our project focuses on the impact of Learning Assistants in collaborative STEM College classrooms on student success and intent to pursue a STEM career. Using epidemiological-type methods, this retrospective cohort study examines the extent to which classroom interactions with Learning Assistants influence academic outcomes, affective outcomes and

career aspirations. LA practices under examination include frequency of interactions, type of conversations between LAs and students, discussion facilitation, conditions that broaden student participation, and positioning acts. Controlling for experiences outside the classroom with and without LAs, study habits and instructor interactions allows for a construction of predictive models that isolate the effect of in-class student interactions with LAs. We will present findings that bridge practice and research and provide foundation for addressing issues associated with student success and retention in Introductory STEM courses.

Conflicts: I would like to add an additional author as the 4th author. The name to add is Idaykis Rodriguez and institute is also Florida International University. The author list should read as follows: Hagit Kornreich-Leshem, Rocio Benabentos, Zahra Hazari, Idaykis Rodriguez, Geoff Potvin, and Laird Kramer

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Sense of belonging in STEM: Intersections of race and gender 5291

Paper Type: Contributed

Author: Katherine D Rainey
University of Colorado at Boulder
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Sense of academic and social belonging have been shown to affect retention and performance of students in STEM. Though many studies have looked at differences among gender or race in this respect, few studies discuss the intersections of of the two. To investigate factors contributing to students' choices to major in STEM, interviews were conducted with over 300 college seniors who majored in STEM, left a STEM major, or avoided majoring in STEM. Interviews were analyzed and coded based on social connection and study habits. In this presentation, we discuss factors regarding women's sense of belonging in STEM, specifically focusing on racial aspects.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Sentiment Analysis of Teaching Evaluations to Explore Gender Bias 5236

Paper Type: Contributed

Author: Scott V. Franklin
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1 Lomb Memorial Drive
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Sentiment analysis is a computational linguistics tasks that characterizes affective meaning, such as positive-negative tone, expressed in language data. We analyze more than 5,500 student comments spanning over eight years of biology, chemistry, physics and math courses and explore differences in sentiment pertaining to instructor competence, organization/presentation, personality/helpfulness, and overall satisfaction. Of particular interest are differences in perception conveyed toward male and female faculty, and between faculty of different disciplines. We also compare automatically extracted sentiment scores with quantitative Likert ratings that students enter alongside their comments, and report on the extent to which the quantitative and qualitative evaluations correlate.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Student discourse about equity in an introductory college physics course 5519

Paper Type: Contributed

Author: Abigail R. Daane
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5104075239 (f)
abigail.daane@gmail.com

In a typical introductory college calculus-based physics course, the makeup of the classroom looks much like the physics community, including few women and even fewer underrepresented minorities. This lack of representation is well known, but is rarely an explicit topic of conversation in physics courses. In an introductory physics course at Seattle Pacific University, I facilitated several activities aimed at raising student awareness about the disparity between the demographics of the physics community and the demographics of the general population. Students had the opportunity to discuss and reflect about what it means to do physics, who does it, and why particular groups of people are not equitably represented in the field. In this presentation, I share preliminary findings about the impact of and response to these activities.

You have submitted comments on this item

Change Session

No Yes

PER: Topical Understanding and Attitudes--G

Order

Comment:

Identity cluster

Update

Abstract Title: The Role of Personality and Gender in Performance in Physics 5432

Paper Type: Contributed

Author: Rossina B. Miller
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rtmiller@mix.wvu.edu

The Big Five Inventory (BFI) measuring the 5-factor personality model was given to 804 science and engineering students in introductory physics classes across two semesters at a large eastern university. Science and engineering students showed similar personality characteristics as would be expected from measurements of the general population, with only women scoring significantly differently on the neuroticism scale. The BFI facets had differential explanatory power for test average and course grade with the conscientiousness facet as the only significant treatment effect for course grade, but it was not significant for test average. Personality facets, when combined with high school GPA, explained substantially different levels of variance in course grade for male and female physics students.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Research-based assessment instrument cluster

Update

High School

Abstracts Submitted (# 14) | Abstracts You Have Reviewed: 0

Abstract Title: A Customizable Private Online Resource for Flipping your AP physics classroom 5652

Paper Type: Contributed

Author: David E Pritchard
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Cambridge, MA 02139-4307
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dpritch@mit.edu

The RELATE.MIT.edu group at MIT is offering our audited College Board AP C level physics MOOC, 8.MechCx Introductory Mechanics, as a free Custom Course on edX.org (CCX) for high school or college instructors. "Custom Course" is a new feature of the edX platform that allows individual instructors to assign resources (problems, videos, texts) chosen from our MOOC to their own students according to their own schedule. This course features over 1000 high quality problems at different levels of difficulty, over 370 pages of e-text written and edited by MIT faculty based on PER research, as well as interactive online simulations, labs based on Direct Measurement Videos created by Peter Bohacek and simple "build it yourself" laboratories. In this talk we will describe the course and the research-based pedagogy; then demonstrate the CCX course, show how to enroll your own students, assign resources, set due dates and view student progress.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Argument-Driven Inquiry in Physics 5372

Paper Type: Contributed

Author: Victor Sampson
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Argument-Driven Inquiry in Physics Lab Investigations for Grades 9–12 Learn about Argument-Driven Inquiry and how it can help students learn how to use core ideas,

crosscutting concepts, and scientific practice to explain natural phenomena.

Footnotes: none

Conflicts: none

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Closing the STEM Learning Gap for Underserved Populations 5375

Paper Type: Contributed

Author: Mark D. Greenman
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Many students from low income urban communities are denied access to rigorous college level Advanced Placement science courses. A team at Boston University is testing a blended MOOC that incorporates the best of the formal supportive structures from the student's home school, a private online tool specifically adapted to support underserved students and weekly tutoring and laboratory experience at a local university to test a scalable and replicable model for effectively delivering AP physics to underrepresented high school students. This is the first year of a pilot program impacting 25 students from 7 different Boston area high schools that do not offer AP Physics as part of the school's program of study. Seventy percent of participating students are students of color and/or ethnic Latino. Twenty weeks into the program, attendance at tutoring sessions remains high at 90% and the dropout rate remains low at 8%.

Conflicts: It is intended that this talk and Andrew Duffy's talk be given back-to-back, with Professor Duffy's talk going first.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Definition of Physics in Introductory Physics Classes 5069

Paper Type: Contributed

Author: Genrikh Golin
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Genrikhgolin@yahoo.com

The following is a summary of the introductory lecture "What Is Physics?". This is that we generally start a physics course. This topic can be used also as the concluding lecture. Indeed, Physics is the study of matter moving in space and time. Scientists still hold seven forms of matter movement, and physics as science (and a course) is splitting into seven branches. Physicists today study three worlds: macro-, micro-, and mega- worlds. All three kinds of objects move differently, are defined by different laws and theories, and are discovered at different times. In the presentation we will construct a table including forms of motion and the corresponding branches of physics. Traditionally, the first three branches of physics are called classical physics. Optics belongs both to classical physics and modern physics, the last three branches belong to modern physics.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Designing and Testing Crash Barriers, an Engaging NGSS Activity 5085

Paper Type: Contributed

Author: Daniel J. Burns
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20 High School Court
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408-354-2730 x382 (p)
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The design of highway crash barriers is rich in physics and the potential to engage students. Crash barriers are ubiquitous in urban, suburban, and rural areas. There are many different types in use. Designing them is an effective way to address NGSS standard HS-PS2-3 that asks students to apply scientific and engineering ideas to design a device that minimizes the force on an object during a collision. Crash barriers involve many physics topics like Newton's Laws, impulse and momentum, energy, and kinematics. The lab requires only one set of equipment but no eggs! Students design and build crash barriers from inexpensive materials and test them using a cart, track, and accelerometer. They can use their test results to improve their design. We will show several variations of crash barrier test setups using a variety of vendor equipment. We will show student examples and test data.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Doing Physics: Holding Urban Public Schools Accountable 5632

Paper Type: Contributed

Author: Pravin Jammula
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jpravin@gmail.com

The new AP Physics 1 and 2 courses emphasize science practices. This aligns with studies showing students learn best when they are actively engaged in doing science, and follows 21st century learning goals. The College Board requires schools offering AP Physics 1 and 2 to participate in an audit process. In course proposals, schools and instructors must commit to spending at least 25% of instructional time on lab activity. Furthermore, the quality of labs must shift from cookbook-style to inquiry-based. Fulfilling this commitment may pose particular challenges to public schools in urban settings because of DOE structures and constraints. This study asks, do public schools and educators follow through on their commitment, and what factors influence the implementation of a lab based inquiry approach? Participants are AP Physics teachers at public schools in a major urban city. Implications include suggestions for assuring proper implementation of new AP Physics courses.

Footnotes: Sponsor - Dr. Diane Jammula

Conflicts: My best physics teacher, who also happens to my better half is also presenting a paper. Her name is Dr. Diane Jammula. Please do not hold our presentations during the same time or immediately one after the other. I want to fully participate in her session and likewise.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Integrated Approach to Learning Physics that increases student engagement in the Physics Classroom 5103

Paper Type: Contributed

Author: Kimal Honour Djam
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In the past decade, there has been significant breakthroughs in the development of innovative teaching approaches in science in general and in physics in particular. Despite these exciting developments in physics education research, the performance of students in AP Physics as well as introductory university physics courses lag behind other sciences. In addition, the number of students in physics courses is also minimal compared to other sciences given that physics is the most fundamental of all the sciences. This is proof that there is a missing link between physics education research and student learning. This paper presents an integrated approach to facilitating student learning in a physics classroom taking into consideration the latest developments in physics education research.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Student Performance and Attitudes in Self-Selected vs. Teacher-Assigned Groups 5107

Paper Type: Contributed

Author: Kelly R. Lubkeman
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This PER study explores the hypothesis that teacher-chosen groups will promote stronger student understanding of conceptual physics compared to when students select their own groups. It is hypothesized that teacher chosen groups within an experimental physics curriculum promote data analysis and scientific reasoning. Researchers studied three high school physics sections in which students learn concepts through working closely with group members during guided experimentation. Daily quiz scores as well as student responses on a survey about the different groupings were examined. When chosen by the teacher, groups were comprised of heterogeneous personality types as seen by the teacher. Preliminary results suggest that while students advocate for working with a group of their own choice, they perform better on conceptual physics assessments when grouped by the teacher.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Summarizing discussion interventions and student content learning gains 5503

Paper Type: Contributed

Author: Jared W. Sommervold
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3037766014 (f)
sommervold_jared@svvsd.org

This physics education research study focuses on how student-led summarizing discussions help solidify physics content understanding following inquiry-based lab activities among high school students. This study was conducted in eight sections of physics taught by three teachers. We investigated different formats for running summarizing discussions, and compared them to learning outcome data. Discussion formats that were studied included whole class student led discussions, consensus board discussions with grade impact, gallery walk with anonymous feedback, and teacher led discussions which resembled traditional lecture formats. Findings suggest that different formats range in their effectiveness, and discussions do not always lead to assessment growth gains. Results will be shared, and limitations and benefits of each format will be discussed.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Sustainability Topic Coverage and Sustainability Agency In High School Physics 5477

Paper Type: Contributed

Author: John Christopher Doscher
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410 SW 87 CT
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There has been substantial discussion recently about the effects of unsustainable human occupation of the planet and the necessary immediacy for response to those effects, both observed and predicted. In particular, stress caused by severe weather events, sea level rise, fresh water scarcity, and energy supply shortages will motivate science and engineering advances to address these growing issues. Physics education has a part to play in developing the necessary associated knowledge base. The high school physics classroom provides an excellent opportunity for students to comprehend global sustainability issues using physics concepts and simultaneously be empowered by their physics learning. Drawing on data from a large national survey study of college students about their high school science experiences and applying an action-oriented theoretical perspective, we develop constructs for sustainability agency based on students' significant sustainability-related actions. These actions are then predicted by exposure to sustainability topics in high school physics. The results will elaborate whether high school physics can play a role in empowering students to address sustainability in their own lives and beyond.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Teaching AP Physics 1 to the World, A Second Time 5406

Paper Type: Contributed

Author: Andrew G. Duffy
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aduffy@bu.edu

This year, for the second time, Boston University taught an AP Physics 1 course online on edX, with a goal of helping students prepare for the AP Physics 1 exam in May. In this talk, we will discuss improvements we made to the course between the first and second runs, and also compare the outcomes from the first run (Jan. – May 2015) and the second (Sept. 2015 – May 2016). After the first run, students who took the AP Physics 1 exam told us that our course needed to be even more conceptual than it was, and we will discuss, in particular, how we responded to that feedback.

Conflicts: It is intended that this talk and Mark Greenman's talk be given back-to-back, with this talk being the first of the two. Mark Greenman's work was based on this online AP Physics 1 course.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: The Effect of Discussion and Student-Generated Data on Written Scientific Explanations 5175

Paper Type: Contributed

Author: Alisa P. Grimes
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Students need help learning how to use evidence and reasoning to support their claims when developing written explanations. Constructing and critiquing evidence-based explanations engages students in an authentic scientific practice and helps them develop problem-solving and reasoning skills. In this study we examine ways to help secondary students build written scientific explanations. We employed 4 treatments: (1) students were provided data but no time was given to discuss with their peers before they wrote their scientific explanation; (2) students physically collected quantitative or qualitative data and used this data to write their scientific explanation; (3) students were provided class time to participate in a whole class or small group discussion regarding their data before they wrote their scientific explanation; and (4) students physically collected data and were provided time to discuss this data in a whole group or small group discussion before they wrote their scientific explanation.

Conflicts: I have travel conflicts that would prevent me from presenting before the 20th of July

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Using Modeling Techniques in AP Center in Wuxi, China 5140

Paper Type: Contributed

Author: Igor V. Proleiko
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!8 Erquan Middle Road
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Teaching Chinese students using Modeling Instruction presents number of challenges. Despite being highly motivated, the students have most experience with lectures and direct instruction method. The classroom discussion, laboratory presentations and whiteboarding are not familiar techniques to the students. I will discuss my experience incorporating these

method into AP Physics instruction, will also compare with my experience of teaching inner city students in the US.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Using technology to increase student learning and teacher confidence 5126

Paper Type: Contributed

Author: Meera Chandrasekhar
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meerac@missouri.edu

Mobile devices are replacing textbooks in classrooms. We describe a conceptual physics curriculum app and its use in a college-level class for elementary education majors. The Exploring Physics curriculum app, based on inquiry and modeling pedagogies, is a combination textbook, workbook and lab-book. Students can enter text, drawings, graphs, tables or data in the app. They submit their work for grading and receive feedback through the app. Two studies have been conducted on the use of this app in the classroom. The first study compared the technology self-efficacy of two sections of the class; in one that used a traditional workbook, and the other that used the app. In the second study students' growth in physical science content knowledge was measured as they used the app. Results of the studies will be presented. Findings have implications for preservice teacher preparation for future use of technology in science teaching.

Change Session

No Yes

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

Order

Comment:

Submit

Introductory Courses

Abstracts Submitted (# 15) | Abstracts You Have Reviewed: 0

Abstract Title: A Situated Learning Approach to Introductory Laboratory Reform 5581

Paper Type: Contributed

Author: Katherine Ansell
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crimmin1@illinois.edu

At the University of Illinois, we have piloted a new laboratory approach that has changed the context of students' lab experiences by introducing dorm room prelab experiments and increasing the flexibility of the laboratory classroom setting. These changes were chosen in order to facilitate a shift from a "classroom" learning approach toward an "authentic" approach - that is, a learning approach that is consistent with coherent and purposeful activities – according to situated learning theory. The prelab experiments, which are held through an online delivery and response system, adds a new social context that both affects students' learning approach in the course and documents the effects of this approach. In this talk, we will discuss our observations of this learning approach and its implications for instruction.

Conflicts: This talk is intended to go along with Mats Selen's and William Evan's talks. As I understand, the requested order is: 1. Mats Selen 2. Katie Ansell 3. William Evans

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Advanced Placement Program 5176
Paper Type: Contributed
Author: Trinna S. Johnson
College Board
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tjohnson@collegeboard.org
The College Board AP program is a rigorous academic program built on the commitment, passion, and hard work of students and educators from both secondary schools and higher education. Since 1955, the AP Program has enabled millions of students to take college-level courses and exams, and to earn college credit or placement while still in high school. The AP College Board program offers more than 30 courses. By taking an AP course and scoring successfully on the related AP Exam, you can save on college expenses: most colleges and universities nationwide offer college credit, advanced placement, or both for qualifying AP Exam scores. AP can transform what once seemed unattainable into something within reach. There are a million paths to a student's future. By giving students the opportunity to explore their interests, AP courses can help them find and pursue their unique direction.

Footnotes: Tiberiu Dragoiu-Luca

Conflicts: The AP Annual Conference ends on July 16 and I am required to be at the conference until it ends. I will travel to AAPT immediately. Please schedule talk after July 16, 2016.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: An Introductory Laboratory Reform Effort at the University of Illinois 5582

Paper Type: Contributed

Author: Mats A. Selen
University of Illinois at Urbana-Champaign
1110 W. Green St.
Urbana, IL 61801
217-898-3834 (p)
mats@illinois.edu

At the University of Illinois, we have piloted a new laboratory approach that has changed students lab experiences by introducing dorm room pre-lab experiments and focusing the classroom activities on experimental design and sense-making rather than physics concepts. This semester-long study involved students in our first-semester calculus-based mechanics course and used Interactive Online Laboratory (IOLab) devices with a curriculum inspired by the Investigative Science Learning Environment (ISLE). In this presentation, which is the first of three related talks in this session, we will describe the overall approach and discuss student experiences with the technology as well as the instructional approach.

Conflicts: We are submitting 3 related talks to this same topic. Please place us in the same session and have the order of these talks be 1: Mats Selen, 2: Katherine Ansell, and 3: William Evans, all from the University of Illinois.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Changing the paradigm of the Jumping Ring Demonstration 5286

Paper Type: Contributed

Author: Rondo N. Jeffery
Weber State University
2508 University Circle

Ogden, UT 84408-2508
801-731-2329 (p)
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The opposing-poles explanation for the force on the jumping ring is challenged by recent experiments using a long-coil design where the ring is allowed to move over the energizing coil and not just the extended iron core. Iron filings show a dipole field pattern, with a reversal of the radial magnetic field at the center of the long coil. Rings jump up or down, depending on if they are placed above or below the point where the radial field changes sign, called the Null Point. With the apparatus in the horizontal configuration, narrow rings will jump left or right of the Null Point. This contradicts the prediction of the opposing-poles theory but is completely consistent with the Lorentz force theory. We hope these new results will open a dialog on the proper explanation to give for this popular physics demonstration.

Footnotes: www.jumpingring.com

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Data-Driven Efforts to Improve General Physics at NIU 5244

Paper Type: Contributed

Author: Michael Eads
Northern Illinois University
Department of Physics, LaTourette 202
DeKalb, IL 60115 United States
8157536492 (p)
8157536492 (f)
meads@niu.edu

Northern Illinois University is a large, public, research university located 40 miles west of Chicago. About 500 students enroll in algebra- and calculus-based general physics courses each semester. The format of these courses has historically been very traditional, focused on lectures with a weekly lab session. Starting in 2013, standard assessment instruments (such as the Force Concept Inventory) were administered as part of an effort to critically assess the effectiveness of these courses. As of the Fall 2015 semester, concept inventories are

being administered in all sections and levels. This data is now being used to help judge the effectiveness of several course improvement efforts, including a small Themed Learning Community section, and changes to instructional strategies, including active learning efforts. While state and university budget situations make for a challenging environment for course transformation, other efforts to improve the general physics sequence are ongoing.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Game Design and Demonstration to Highlight Evidence-Based Reasoning 5258

Paper Type: Contributed

Author: Kathleen A. Harper
Department of Engineering Education, The Ohio State University
244 Hitchcock Hall, 2070 Neil Ave
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614-688-7538 (p)
harper.217@osu.edu

At Ohio State, an elective engineering course, based on Maloney's work,1 focuses on puzzles and games as metaphors for human problem solving and scientific reasoning. One activity that is currently unique to Ohio State's offering is a game design and demonstration assignment. This experience not only incorporates engineering principles, but prompts the students to think critically about the role of evidence. Students work in groups to design a new game, with the constraint that they may only use materials from the four games they previously played in class. Once they have developed a full set of rules for the new game, they must create a short series of demonstration games that, when observed by someone unfamiliar with the game, will allow that person to determine the rules. Details of the assignment, along with samples of student work, will be shared.

Footnotes: 1 Maloney & Masters, "Learning the Game of Formulating and Testing Hypotheses and Theories," Phys Teach 48, 22-24 (2010).

Conflicts: I feel like I already submitted this, but I have no e-mail record of it - apologies if this is a duplicate!

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Game Design and Demonstration to Highlight Evidence-Based Reasoning 5070

Paper Type: Contributed

Author: Kathleen A. Harper
Department of Engineering Education, The Ohio State University
244 Hitchcock Hall, 2070 Neil Ave
Columbus, OH 43210
614-688-7538 (p)
harper.217@osu.edu

At Ohio State, an elective engineering course, based on Maloney's work,1 focuses on puzzles and games as metaphors for human problem solving and scientific reasoning. One activity that is currently unique to Ohio State's offering is a game design and demonstration assignment. This experience not only incorporates engineering principles, but prompts the students to think critically about the role of evidence. Students work in groups to design a new game, with the constraint that they may only use materials from the four games they previously played in class. Once they have developed a full set of rules for the new game, they must create a short series of demonstration games that, when observed by someone unfamiliar with the game, will allow that person to determine the rules. Details of the assignment, along with samples of student work, will be shared. 1 Maloney & Masters, "Learning the Game of Formulating and Testing Hypotheses and Theories," Phys Teach 48, 22-24 (2010).

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Implementing Studio Physics: The effect on physics identity development 5369

Paper Type: Contributed

Author: Robynne M. Lock
Dept. of Physics & Astronomy, Texas A&M University-Commerce
PO Box 3011
Commerce, TX 75429
903-468-8767 (p)
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The number of students earning bachelor's degrees in physics has increased in recent years but remains small. To increase the number of physics majors, modifications to introductory courses are needed. Strategies found to have a positive effect on physics identity, a predictor of physics career choice, include focusing on conceptual understanding and students teaching classmates. Models such as Studio Physics and SCALE-UP are consistent with these strategies. Additionally, these models have previously been found to improve problem-solving ability and to have a neutral effect on attitudes. We report on the implementation of Studio Physics in our two-semester introductory calculus-based physics sequence at Texas A&M University-Commerce. The effect of Studio Physics on students' physics identities was measured using a previously-developed physics identity instrument. Additionally, we interviewed students. We measured the effect on conceptual understanding through pre/post testing with the Force and Motion Conceptual Evaluation and the Brief Electricity and Magnetism Assessment.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Interpretations of Physics Differentials and Derivatives in Introductory Physics 5383

Paper Type: Contributed

Author: Nathaniel Amos
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Columbus, Ohio 43214 USA
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Introductory university physics courses frequently involve calculus concepts in physical contexts. Existing evidence suggests that students in these courses may lack basic conceptual understanding of calculus in physics despite traditional calculus instruction. Because derivatives in physics can be understood as both instantaneous rates of change and quotients of differentials, we conducted group-tutorials to determine if training on either of these interpretations yielded differences in score on a short post-test, which assessed both. The "rate" condition emphasized derivatives as instantaneous rates of change; differentials were explicitly instructed as "not rates." By contrast, the "differential" condition avoided the concept of rate, and instead built derivatives from infinitesimal quantities, or "differentials." In addition, we also assessed the effect of units and dimensional analysis on this training. Our results show significantly higher post-test performance among students trained on the differential quotient interpretation of derivatives; dimensional analysis was not a significant main effect.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Investigating Effects of Reformed Laboratories on Student Motivation and Attitude 5579

Paper Type: Contributed

Author: William R. Evans
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At the University of Illinois, we have piloted a new laboratory course that has changed the context of students' lab experiences by introducing dorm room pre-lab experiments and increasing the flexibility of the laboratory classroom setting in order to focus on critical thinking and sense-making. In this presentation we report on the effects of this new laboratory experience on students' motivation, attitude, and achievement goal orientation. We also look at the effects of the lab experience on other aspects of the course, including their ability to learn from analogous solutions. The information from the reformed lab sections is compared to that from parallel sections taught in a more traditional style.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Power boxes: A novel graphical representation of energy in circuits 5592

Paper Type: Contributed

Author: Jason E. Dowd
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137 Bio Sciences Building
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9196849863 (p)
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In order to clarify and provide a conceptual understanding of energy use in circuits, we introduce a new representation for analyzing DC circuits – Power Boxes. Although DC circuits are not generally considered to be among the most insidious topics in introductory physics courses, understanding the role of energy in such circuits can be deceptively challenging. Oftentimes, students see circuits as an infinite source of energy, and many mechanical energy analogies only further this idea. Instead, Power Boxes allow us to discuss and

illustrate the role of electric potential energy in circuits at a given time, while simultaneously building upon (rather than competing with or writing over) representations of energy established in mechanics. Power Boxes can provide an intermediate, conceptual step between drawing a circuit diagram and writing equations.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Satellite splat! Exploring sticky collisions with a surface-launched projectile 5130

Paper Type: Contributed

Author: Philip R. Blanco
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El Cajon, CA 92020-1799
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A projectile launched from the surface of a planet collides and sticks to satellite in a circular orbit. What happens next? The resulting motions display a rich variety of outcomes dependent on the projectile's trajectory, the satellite's orbital radius, and the projectile/satellite mass ratio. We show how conservation of mechanical energy, angular momentum, and linear momentum are used to determine whether the combined object will subsequently crash into the surface of the planet, remain in orbit, or escape. One important result is that there is a maximum orbital radius beyond which a satellite cannot be brought down in this manner. This exercise can help students gain insight into the role of angular momentum in orbital motion. We shall present simulations of some of the motions involved, and suggest further investigations for students to explore.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Student Symbolic Problem Solving Skills in Introductory Calculus-Based Physics 5380

Paper Type: Contributed

Author: Gregory Mulder
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mulderg@linnbenton.edu

Symbolic reasoning is a critical skill for being a physics major, particularly in making the transition from introductory to more advanced physics courses. We explore students' performance and views about solving and interpreting problems symbolically. We will present the results of problem solving interviews with students in a third quarter of calculus-based introductory physics course. During these interviews, students solve pairs of problems with numeric and symbolic parameters. We will discuss differences in student performance on these two problem types and consider cognitive affordances of numeric and symbolic parameters.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Students’ understanding of “Centripetal Acceleration” as evidenced by answers to a guided inquiry based lab. 5555

Paper Type: Contributed

Author: D. G. Sumith P. Doluweera
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25 Park Place
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4044136074 (p)
ddoluweera@gsu.edu

GSU is a comprehensive PhysTEC site and has undertaken a reform of calculus-based physics labs in introductory physics sequence I and II. Enhancing students’ conceptual understanding of basic physics is a major goal of lab reforms. FCI is the standard instrument of measuring conceptual understanding of mechanics and FCI gains recorded after the introduction of reformed labs (Fall 2014 and later) show significant increase in gains. Increased gains suggest that labs have positively impacted on students' learning. To further investigate the effectiveness of the labs one of the guided inquiry based labs developed, “Centripetal Acceleration” is presented as a case study. An analysis of students’ answers for the selected lab for understanding related concepts, how well students managed to get good data, understanding and interpreting graphs, and making a conclusion based on available data are discussed.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Why active-learning physics teachers should think about facework 5138

Paper Type: Contributed

Author: Jon D. H. Gaffney
Eastern Kentucky University
521 Lancaster Ave, NSB 3140
Richmond, KY 40475
7246015936 (p)

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Interacting with other people requires a certain amount of vulnerability, and one of the ways we protect others and ourselves is through the mechanism of "facework." Face refers to the favorable self-worth that we hope others have of us; whenever we feel that self-worth threatened or attacked, we feel negative emotions such as embarrassment or shame. However, in social interactions, we can help others "save face," which should mitigate those negative feelings. As active-learning physics classes become more ubiquitous, teachers in those classes find themselves with the power (and obligation?) to support their students' face needs during classroom interactions. In this short talk, we discuss how facework correlates with student satisfaction, and we challenge teachers to think about their own classroom interactions in light of this theoretical construct.

Change Session

No Yes

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

Order

Comment:

Submit

Introductory Labs/Apparatus

Abstracts Submitted (# 12) | Abstracts You Have Reviewed: 1

Abstract Title: A laser apparatus for measuring angular resolution of the eye 5336

Paper Type: Contributed

Author: Timothy L McCaskey
Columbia College Chicago
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Chicago, IL 60605-1996
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tmccaskey@colum.edu

We have built a device using laser light and fiber-optic cables to let students measure the angular resolution of the human eye. The cables transmit laser light to the front of a black box where the separation of sources can be carefully adjusted. Experimenters move the light sources closer together until a distant observer can no longer resolve them. By using

different colors of laser light, one can investigate the effect of source wavelength on spatial resolution.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Adapting AAPT Lab Recommendations to Meet Local Conditions: DATA Lab 5512

Paper Type: Contributed

Author: William M. Martinez
Michigan State University
Biomedical and Physical Sciences
East Lansing, MI 48824-2320 United States
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marti790@msu.edu

The AAPT Recommendations for the Undergraduate Physics Laboratory Curriculum developed broad learning goals, in part to focus physics instruction on critical practices that are best engaged within a laboratory. However, adapting these goals to an institution's curriculum must involve molding these recommendations to local conditions. In this talk, strategies and practices that we employed at Michigan State University will be discussed, primarily focused on faculty interviews to set goals and develop buy-in. These discussions have lead to locally-implemented learning goals for Design, Analysis, Tools, and Apprenticeship (DATA) Lab, our recently transformed algebra-based lab for non-majors. Further, we will describe how our local goals relate to those set forth by the AAPT.

Footnotes: This work is funded by a Howard Hughes Medical Institute Science Education Grant

Conflicts: Diverse Investigations chosen because nothing else seems to quite fit, but would be appropriate with other PER Lab Development and PER Lab Transformation work. Thank you.

You have submitted comments on this item

Change Session

No Yes

Introductory Labs/Apparatus--G

Order

Comment:

Update

Abstract Title: An easily assembled spectrograph for the intermediate lab 5200

Paper Type: Contributed

Author: Timothy Todd Grove
IPFW
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Fort Wayne, IN 46805 United States
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2604816157 (f)
grovet@ipfw.edu

We have been using low-cost spectrographs called shoebox spectrographs for a few years. In the process of our study, we decided to make a spectrograph using the same basic optical design (as the shoebox spectrograph) but with quality optical parts. This spectrograph was found to be easily aligned by students and enables intermediate and advanced students to study molecular spectral lines as well as the spectral line differences between hydrogen and deuterium.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: An Easy Determination of an Approximate Value for Absolute Zero 5558

Paper Type: Contributed

Author: A. James Mallmann
Milwaukee School of Engineering
20250 W Jeffers Drive
New Berlin, WI 53146-2522 United States
2625491773 (p)
2625491773 (f)
mallmann@msoe.edu

A method to determine an approximately accurate value for absolute zero will be described. The needed data can be easily obtained using simple, inexpensive apparatus, and the value for absolute zero can be determined without doing any calculations or using any equations.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Apparatuses for measurement of forces of an electrostatic and magnetic interactions. 5505

Paper Type: Contributed

Author: Roman Ya Kezerashvili
Ne3w York City College of Technology, City University of New York
300 Jay Street
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718 260 5276 (p)
rkezerashvili@citytech.cuny.edu; orton.richard4@gmail.com

We develop two apparatuses that allow one to make precise and direct measurements of forces of electrostatic attraction between two parallel plates and two parallel conductors. The laboratory apparatuses are designed for use in general physics courses. The purpose of the

first apparatus is to investigate the dependence of the electrostatic force between two parallel plates on the applied voltage and the separation distance between plates, and to find the permittivity of free space. The purpose of the second apparatus is to explore and analyze the magnetic interaction between two parallel current-carrying conductors and to show that the force of interaction is directly proportional to the currents and varies inversely with the separation between the conductors. These measurements allow one to determine the permeability of free space.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Exploratory Freedom for Student Learning in Laboratory Settings 5296

Paper Type: Contributed

Author: Peter W. Odom
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Tulsa, OK 74105
9182133435 (p)
9182133435 (f)
podom@oru.edu

This paper discuses two separate physics laboratory experiments where the students were permitted to use more time than traditionally scheduled for each lab as well as permitted to deviate from specific lab instructions if they desired. The result of this added freedom was unprecedented success in experimental measurement accuracy. One of the experiments was to measure the speed of light using the Foucault method, and the other was to measure the charge-to-mass ratio of the electron using J. J. Thompson's method. With their measurement of the speed of light, they eventually achieved an accuracy which only had 0.8% error relative to the accepted value. Comparable success was achieved with their measurements of the charge-to-mass ratio of the electron. After recounting the process by which the students improved their methods in these two experiments, this paper discusses the merit of letting students have more freedom when exploring experimental methods.

Footnotes: I am an undergraduate student being funded by a PhysTEC supported site for this specific conference.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Hacking the Pasco Power Brick for Direct Analog Measurements 5588

Paper Type: Contributed

Author: Roland C. Woodward
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400 University Dr.
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The rapid and large-scale data acquisition made possible by microcomputer-based laboratory equipment has undeniably been a boon for physics teaching labs. However, I often found that my students must use the full system of computer, interface box, and sensor, in situations where a simple manual measurement would suffice. (The two most common measurements were temperature and magnetic field.) Rather than purchase new equipment, I modified the power supply "brick" for the Pasco interface box so that it could drive any Pasco analog sensor directly and feed the resulting signal to an ordinary voltmeter. In this talk, I give the details of the modification, describe my experience with it in my introductory physics labs, and argue that, in addition to reducing my dependence on my increasingly flaky computer interface boxes, this arrangement gives the students a more authentic lab experience.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Implementation of a laboratory activity designed to promote scientific practice 5532

Paper Type: Contributed

Author: Abhilash Nair
Michigan State University
500 W Lake Lansing Rd Apt B6
East Lansing, MI 48823
847-636-3007 (p)
nairabhi@msu.edu

In the context of transforming a second-semester introductory physics lab course to better align with scientific practice, we investigate the alignment of student work with the envisioned goals of an activity that took place in the pilot semester. We first highlight learning goals of the two-week activity as well as broader course goals which were collected through interviews with the designers of the transformation. We then present analysis of small group work to consider the implications of such a design in helping promote practices such as students in working collaboratively in a group, developing a systematic approach to experimental design, understanding how to utilize different measurement devices, and understanding the uncertainties involved in measurements. We use these results to consider how to iterate on the design of course structures and lab activities to better support students in achieving the learning objectives.

Footnotes: My sponsor is Marcos Daniel Caballero

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Ionizing Radiation Experiments as a Mobile Lab 5110

Paper Type: Contributed

Author: Jan D. Beks
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Vleuten, 3452 JE Netherlands
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Initiated by the Dutch Ministry of Education, the Ioniserende Stralen Practicum at the Freudenthal Institute, Utrecht University, developed a mobile lab around 45 years ago. While currently equipped with three mobile labs, students from the tenth through twelfth grades throughout the Netherlands familiarize themselves with radionuclides, the produced ionizing radiation and some of the processes involved. We describe the unique character of the experiments in their simple and easy to troubleshoot set-ups. The schools are offered closed lab instructions or open lab instructions, in which students design experiments using the limitations as given by the provided lab equipment. We will discuss (i) how the experiments support a Physics curriculum, (ii) our unique approach of offering labs regarding ionizing radiation, and (iii) evidence of their positive impact on student concepts. In addition, we will share some early plans for implementing the use of smartphones and tablets to acquire and process data.

Footnotes: Keywords: radionuclides, ionizing radiation, experiments, physics curriculum

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Simple Hack of a CRT for Photoelectic Effect Demonstration 5144

Paper Type: Contributed

Author: John Avallone
Math for America and Stuyvesant High School
345 Chambers St
New York, NY 10282 USA
9175172023 (p)
john.avallone@gmail.com

This presentation will show how a cathode ray tube, laser pointers and an ammeter can be used to demonstrate, in "real life", the photoelectric effect. It is a simple, possibly accessible demonstration of a topic that, in high school classrooms, may otherwise only be heard about and "demonstrated" through PhET applet or the like. I have found it an exciting and attention grabbing "mystery" for my students to solve, that sets the stage for a deeper discussion of the topic.

Conflicts: Must leave Sacramento evening of July 18th.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Teaching experimental and data analysis skills in online labs 5488

Paper Type: Contributed

Author: Firas Moosvi
University of British Columbia
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Vancouver, BC V6T 1Z4 Canada
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Firas@moosvi.com

In this study, we evaluate the feasibility and pedagogy of transforming the lab component of an introductory physics course (N=800) such that it can be done entirely at home with common materials, a smartphone, and online support. Student performance in the online labs is compared to students doing similar labs face-to-face in a campus laboratory. The comparison is based on the end-of-term final projects that serve as the main assessment of learning for the lab component of the course. For the final projects, students first come up with a research question and then use the experimental and data analysis techniques learned over the term to attempt to answer the question. Fifteen TAs were used to assess

the final projects using a rubric, and no signi?cant performance difference was found between the face-to-face and the online lab format. The main features of the labs and the comparison analysis will be presented.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: The Physics of Color Temperature in Photography 5208

Paper Type: Contributed

Author: Steven Wetrich
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626-755-1272 (p)
swetrich2@gmail.com

When setting up lighting for photography or video, mixing color temperatures is an enormous problem. The origins of the problem are that the human eye adjusts to the color temperature of the environment, correcting for color temperature differences in order to recognize contrasting tones. In this talk, I begin with the Planck Black Body Theory and discuss how various light sources are represented, such as tungsten, fluorescent, and sunlight. Then I discuss how photography is an important application of this Modern Physics concept and how knowing more about it can engage students in these ideas.

Footnotes: Sponsor: James Lincoln

Change Session

No Yes

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

Order

Comment:

Submit

Other Paper

Abstracts Submitted (# 5) | Abstracts You Have Reviewed: 0

Abstract Title: Arts + Physics = STEAMed Physix 5027

Paper Type: Contributed

Author: Taoufik Nadji
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Interlochen, MI 49643
2312766089 (p)
NADJIT@INTERLOCHEN.org

The presenter will share parts of a successful workshop conducted at MIAAPT's last Fall Meeting. He shall discuss/share how he has been incorporating various arts media to introduce Physics concepts and encourage deeper reflections, better discussions, and richer writing within the Physics curriculum.

Conflicts: Monday & Tuesday are best days. Thank you for your understanding!

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: How can asynchronous communication support virtual faculty learning communities? 5462

Paper Type: Contributed

Author: Joel C. Corbo
University of Colorado Boulder
860 35th Street
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joel.corbo@colorado.edu

The Physics and Astronomy New Faculty Workshop (NFW) does a good job of inspiring participants to try evidence-based teaching practices, but participants often face significant barriers to innovation that cause them to eventually revert to traditional instruction. Faculty Online Learning Communities (FOLCs) are year-long, virtual faculty communities designed to support participants after attending the in-person NFW. FOLCs provides participants with a community of peers and ongoing support to make it more likely that they will overcome barriers to improved teaching. In this presentation, we will analyze one FOLC communication channel: a private online message board. We will discuss how factors like the frequency and type of comments change over time as FOLC participants generate mutual trust and how these discussions support the learning that takes place during the synchronous FOLC meetings.

Conflicts: There are two other talks being submitted on the FOLCs, one by Andy Rundquist and one by Adrienne Traxler. Please put us into the same session if that is reasonable given the other abstracts you are sorting.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Infinite circuits are easy. How about long ones? 5123

Paper Type: Contributed

Author: Mikhail Kagan
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A ladder circuit is composed of resistors with alternating connections in series and parallel. An infinite ladder circuit made of identical resistors is known to have a “golden ratio” equivalent resistance. Things get much more interesting when the circuit is not infinite and when resistors are not all identical. We show how to derive a general explicit expression for the equivalent resistance as a function of the number of repeating blocks, R(n). This expression provides an insight on some adjacent topics, such as Fibonacci numbers, continued fractions and a druncard's random walk in a street with a gutter. We also remark on a possible method of solving the non-linear recurrent relation between R(n) and R(n+1). This result can be easily incorporated in a hands-on lab activity.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Outreach Program for High School Physics Students and Teachers 5154

Paper Type: Contributed

Author: Michael F. Vineyard
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Department of Physics and Astronomy
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vineyarm@union.edu

Beginning in 2008, the Department of Physics and Astronomy at Union College has held an annual workshop for high school physics teachers and students. In this one-day workshop, five to seven teams of teachers and students perform experiments to measure fundamental physical constants and gain experience with modern instrumentation and laboratory techniques. The goals of the program are to stimulate students to study physics and pursue careers in STEM, provide teachers with an exciting and enriching professional development experience, and establish a network through which the Department can support local high school physics education. An average of 17 students and 6 teachers per year have

participated in the program. The workshop has been supported by the NASA New York Space Grant, the New York State Section of the APS, and the Department. We will describe the workshop and discuss the benefits to the students, teachers, and the Department.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Resonance in Long LC-Ladder Circuits 5304

Paper Type: Contributed

Author: Elizabeth K. Seber
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We investigated long but finite "ladder" circuits composed of alternating identical inductors and capacitors connected in series and parallel and derived an expression for the equivalent impedance of such circuits. The impedance formula's remarkable simplicity allowed for the direct procurement of all resonance and anti-resonance frequencies. We tested our analytical results by constructing circuits ranging from one to one hundred elements using the standard circuit simulation software (Multisim©), resulting in an equivalent impedance and voltage reading that agreed with our theoretical calculations. Additionally, we resolved the paradoxical phenomenon that for driving frequencies below some critical value, the impedance of a infinite purely reactive infinite circuit acquired a non-zero active part. Our formula revealed no paradox, and we investigated the behavior of the equivalent impedance as the circuit size increased. We did so for various representative values of driving frequency and again found our theoretical predictions in agreement with the modeled circuits.

Footnotes: Sponsored by Mikhail Kagan.

Conflicts: Please put in the same session as "Infinite circuits are easy. How about long ones?" by Mikhail Kagan and Xinzhe Wang.

Change Session

No Yes

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

Order

Comment:

Submit

PER: Diverse Investigations (Use this sorting category if you feel your work doesn't fall into the previous four PER categories.)

Abstracts Submitted (# 37) | Abstracts You Have Reviewed: 37

Abstract Title: "Who Can Be an Engineer?" Investigating Attitudes and Self-Identification 5374

Paper Type: Contributed

Author: Jacqueline Doyle
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11200 SW 8th Street, CP 204
Miami, FL 33199
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doylejackd@gmail.com

Robust physics and engineering identities are strong predictors of students' choice to pursue a degree in physics or engineering; students who go into either of these fields are often drawn from the same pool of potentially-interested high schoolers, who must decide between majoring in the two fields. Many studies of engineering students have treated them as a homogenous population or focus only on one sub-discipline, rather than distinguishing engineers between disciplines more carefully. Recently, we surveyed students on several attitudinal constructs, such as Grit, the "Big 5" Personality Traits, and Performance-Approach mindset, which have been correlated with the development of identity and academic success in these fields. Using data from the 2,966 introductory engineering students surveyed, we investigate the associations between student attitudes and both physics and engineering identity and disaggregate by major to uncover differences and similarities which will help broaden a conversation about who "can" be an engineer.

You have submitted comments on this item

Change Session

No Yes

PER: Topical Understanding and Attitudes--G

Order

Comment:

Identity Cluster

Update

Abstract Title: Algebra-Based Students & Vectors: Assessing Physical Understanding in Arrow vs ijk 5654

Paper Type: Contributed

Author: John B. Buncher
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john.buncher@ndsu.edu

A recent study of students in a calculus-based introductory physics course found that students performed significantly better on vector addition and subtraction tasks when the questions were given using the ijk representation instead of an ``arrows-on-a-grid'' representation, and also presented evidence that working knowledge of the ijk format was necessary to correctly perform vector operations in the arrow format. A follow-up study found that students in an algebra-based physics course also performed significantly higher in the ijk representation than the arrow representation in both one- and two-dimensional problems, even though no explicit ijk instruction was given in the course. In a subsequent investigation we asked students in the algebra-based course to physically interpret their answers, in order to assess if the higher performance on ijk questions indicates physical understanding or is the result of algorithmic ``plug-and-chug'' thinking. Our findings will be discussed along with instructional implications.

You have submitted comments on this item

Change Session

No Yes

PER: Problem Solving--G

Order

Comment:

Representations cluster

Update

Abstract Title: Applying Business Literature to Product Development in STEM Education 5493

Paper Type: Contributed

Author: Raina M. Khatri
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Over the past few decades many innovations to improve undergraduate STEM education have been developed, only to fizzle out as they struggle to find an audience. Funding agencies have noticed this problem and are putting increased attention on development projects that build in aspects of sustainability after the project funding has ended. In recent years there has been research done within physics and STEM education on developing and disseminating education research projects. But, there is a much longer history and body of literature with common goals in the business literature related to product development and innovation. In this talk I discuss product development and launching the product from a business perspective, and how what is known about this process can be directly applied to developing and propagating an education innovation.

Footnotes: Supported by the National Science Foundation under Grant No. 1122446

Conflicts: Monday will be tight for me but I think "PER: diverse investigations" is usually Tuesday or Wednesday anyway.

You have submitted comments on this item

Change Session

(•) No ( ) Yes

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

Order

1

Comment:

Update

Abstract Title: Assessing the interactivity and prescriptiveness of professional development workshops 5163

Paper Type: Contributed

Author: Alice R. Olmstead
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4133877876 (p)
aolmstead@astro.umd.edu

Professional development workshops are a primary mechanism used to help physics faculty improve their teaching, and draw in many instructors every year. Although workshops serve a critical role in changing instruction within our community, we rarely assess them through careful consideration of how they engage faculty. In order to encourage a shift towards more reflective, research-informed professional development, we have developed an observation tool, the Real-Time Professional Development Observation Tool (R-PDOT), to document the form and focus of faculty's engagement during workshops. During this talk, I will describe the development of the R-PDOT and introduce example R-PDOT data from sessions at the Physics and Astronomy New Faculty Workshop. We intend this tool to serve as a catalyst for workshop leaders' critical reflection and a stepping stone for future research on faculty professional development.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Career preparation models: Understanding the interplay between education and industry 5387

Paper Type: Contributed

Author: Benjamin M. Zwickl
Rochester Institute of Technology
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ben.zwickl@rit.edu

The national need for a knowledgeable and diverse STEM workforce is a powerful motive for improving physics education and conducting physics education research. However, there is a need for coherent models for workforce training. Some STEM advocates believe training is the responsibility of higher education, while others see industry playing an integral and cooperative role. We studied career preparation using 30 semi-structured interviews with new hires and their managers in physics-related careers. We developed a data-driven model for where learning happens and how it transfers into the workplace, and found that essential learning occurs inside and outside of the classroom (e.g., hobbies, internships). We compared our model with others suggested in literature. Workforce development advocates would benefit from a holistic training model that encompasses higher education and industry. Further, physics departments would benefit from understanding the broad range of opportunities they can offer students for their future careers.

You have submitted comments on this item

Change Session

No Yes

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

Order

2

Comment:

Update

Abstract Title: Classroom Instruction Promotes Posterior Medial Cortex Brain Activity During Problem-Solving 5099

Paper Type: Contributed

Author: Jessica E. Bartley
Florida International University

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3039411053 (p)
jbart047@fiu.edu

Understanding of physics-related concepts is often quantified through physics problem-solving (PPS) assessments. However, no study has characterized neurobiological processes underlying PPS or skill development via classroom instruction. We used functional magnetic resonance imaging (fMRI) to delineate PPS brain networks and probe differences resulting from classroom instruction. 15 students underwent pre- and identical post-instruction PPS fMRI sessions. We assessed brain activity and identified regions more engaged post- relative to pre-instruction ($P<0.05$). Data revealed consistent fronto-parietal networks contributing to PPS. Moreover, significantly increased post-instruction fMRI activity in posterior medial cortex (PMC), accompanied by improved PPS scores, implicated this region's critical role in skill development. As PMC supports spatial memory and attentional focus [1,2], these novel neurobiological observations provide insight into how education experience may augment brain activity which, in turn, contributes to enhanced PPS skills. [1] Leech et al. 2014 Brain 137 [2] Vann et al. 2009 Nat Rev Neurosci 10

You have submitted comments on this item

Change Session

- (•) No ( ) Yes

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

Order

3

Comment:

Update

Abstract Title: Curricular Knowledge as an Entry Point for Responsive Instruction 5282

Paper Type: Contributed

Author: Amy D. Robertson
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robertsona2@spu.edu

Instruction that attends to and takes up the substance of what students are saying and doing – or "responsive instruction" – has the potential to transform learners' participation in the

practices of science, support learner agency and voice, and promote equitable participation in the classroom, while preserving the conceptual gains our field has so long prized. In this talk, we show that the development of curricular knowledge – in this case, an understanding of the purposes of questions or sequences of questions in the "Tutorials in Introductory Physics" curriculum – can support the enactment of responsive teaching practices among novice teachers. We suggest possible implications for teacher education and future research.

Footnotes: The material in this talk is based upon work supported by a Seattle Pacific University Faculty Research Grant and by National Science Foundation Grant Number 122732.

Conflicts: I am the presider for the "Physics Teaching for Social Justice" session, so please do not schedule my talk at a time that conflicts with this session. In addition, I have a medical condition that makes it difficult for me to reliably be up and about before 11:00 a.m. Please schedule my talk for sometime after 11:00 a.m. Thank you so much!

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Embedded experts: A productive approach to transforming undergraduate STEM education 5571

Paper Type: Contributed

Author: Stephanie Viola Chasteen
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chasteen@colorado.edu

In order to achieve broader educational change in STEM discipline, research suggests that we need to engage faculty within a discipline, with opportunities to reflect on their teaching over long periods of time. One strategy which achieves this is the "embedded expert" model, where postdocs and other educational experts are partnered with faculty within a department to support course transformation. This model has been successfully used in the

Science Education Initiative (http://colorado.edu/sei) at two institutions, using postdoctoral fellows as embedded experts. This model is being adapted and studied at 7 institutions, using various embedded experts, in a new NSF-funded project (TRESTLE; http://www.colorado.edu/csl/trestle) in order to test how this intervention can be implemented in different institutional contexts to propagate widespread STEM education reform. I will discuss the embedded expert model, past results, the variations used in TRESTLE, and how we plan to test them.

Footnotes: This material is based upon work supported by the National Science Foundation under Grant No. 1525331

Conflicts: I am also presenting two posters.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Equivalence of Web and Paper-based Physics diagnostic testing 5570

Paper Type: Contributed

Author: Joseph Fritchman
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9372311088 (p)
joseph.fritch@gmail.com

Web-based administration of diagnostic assessments allows students to participate in research studies from internet connected devices while minimizing use of already limited classroom time. In order to examine determine the efficacy of web-based assessments, shortened versions of the FCI and iSTAR have been adapted to compare students' performances on web and paper-based versions of the assessments, taken both in the lab and at home. Effects of context, content, cognitive load, and difficulty will be examined. Results show only minor differences between modes of testing and multiple benefits to the web-based version, including students' preference to complete the assessment electronically.

Footnotes: Sponsored by Lei Bao

Conflicts: If possible, it is important to be able to present while seated due to a medical condition causing occasional fainting when standing for too long.

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: Examining Time-use in Introductory Calculus-based Physics Students 5255

Paper Type: Contributed

Author: Seth T. DeVore
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stdevore@mail.wvu.edu

Student time use is a major element of success in any course, especially in physics courses in which expertise is earned largely through exposure to the problem solving process. Surveys were developed which probed the distribution of student time use across various typical tasks associated with the introductory, calculus-based physics sequence. These surveys were implemented at four points in each the fall 2015 and spring 2016 semesters. Two of these surveys explored time use during weeks in which students were preparing for the first two exams of the semester, while the other two were implemented during typical non-test weeks. Measurements of incoming student SAT/ACT score, student grade expectations and student test grades were taken. An analysis of this data, including how students at large and potential sub-categories of students regulate their time use in response to exam scores and grade expectations, will be discussed.

You have submitted comments on this item

Change Session

No Yes

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

Order

4

Comment:

Update

Abstract Title: Exploring Disagreements through Positioning 5650

Paper Type: Contributed

Author: May H. Lee
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To provide opportunities to meaningfully engage with core concepts and practices in physics, an introductory mechanics course was designed where students collaborated in small groups to solve complex problems. Since solving problems requires groups to come up with ideas on how to move forward, disagreements occur when group members are not in accord with the same ideas. I present a case study that highlights how students in one group changed the ways they positioned themselves and each other over time during disagreements in their group work. Conversational analysis was used to analyze video-recordings of these disagreements. Initial findings indicate that while group members were self-positioning themselves as capable of doing physics, each member seemed to be other-positioning their peers in the group in different ways as they worked with each other over the course of three and a half weeks, leading to implications for future research and instruction.

You have submitted comments on this item

Change Session

No Yes

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

Order

5

Comment:

Update

Abstract Title: Exploring Student Sensemaking through Layers of Epistemic Games 5528

Paper Type: Contributed

Author: Michael Vignal
Oregon State University
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vignalm@oregonstate.edu

Several studies have demonstrated the utility of epistemic games in understanding problem-solving behavior in physics. Many researchers acknowledge the issue of grain-size as a challenge when identifying epistemic games in data, but few papers discuss games with various grain sizes. In analyzing a problem-solving episode with upper division physics undergraduate students, we explore grain-size in an effort to understand student sensemaking. We identify distinct layers of epistemic games in the episode and look for relations between these layers.

You have submitted comments on this item

Change Session

No Yes

PER: Examining content understanding and reasoning--G

Order

Comment:

Upper division topics

Update

Abstract Title: Facilitating Physics Education Reform: An Ethnographic Study of Organizational Change 5633

Paper Type: Contributed

Author: Diane C. Jammula
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dec2142@columbia.edu

Findings from PER have the potential to transform student learning if institutions and educators adopt research-based practices. With the goal to deepen students' understandings of physics and reach a wider range of students, this paper asks what attitudes & beliefs, rituals & practices, and structures facilitate or impede physics education reform at the departmental level. The setting is a small physics department at a minority-serving university in an urban center. Ethnographic methods were conducted for one academic year, including participant observation, fieldnotes, journaling, and interviews. Findings show negative beliefs about student ability and anecdotal educational philosophies work to hinder growth. Rituals including departmental meetings are spaces to voice beliefs. However, academic hierarchies, such as tenure, work to silence and validate different perspectives. Implications include the utility of organizational change theory to support physics education reform while avoiding the stalemate of defensive departmental culture.

Conflicts: My husband Pravin Jammula is also presenting. If possible, I hope our times do not conflict.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Helping engineers to become effective physics teachers – Part A 5313

Paper Type: Contributed

Author: Shulamit Kapon
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How can we attract top university physics and engineering students to a career in teaching physics? How should we structure our teacher training programs to fit and best prepare talented people to become effective physics teachers and educational leaders? The Views program, launched at the Technion – Israel Institute of Technology, invites Technion graduates back to the Technion to earn an additional bachelor's degree in the Faculty of Education in Science and Technology. This talk discusses the physics education track within this program and focuses on the changes that are being made in the four physics PCK courses to provide a better fit for this unique population of students. The underlying principle guiding the design is to train these prospective physics teachers to become "learning engineers" instead of "transmitters of knowledge", and to shift their attention from "what I teach" to students' engagement and their learning.

Conflicts: (1) This talk is the first in a series of two talks: Helping engineers to become effective physics teachers – Part A and Helping engineers to become effective physics teachers – Part B. Please schedule them one after the other in the same session. (2) Please do not schedule the talks on the July 16 or 17, since the second author is a religious Jew who cannot travel or work on Saturdays.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Helping engineers to become effective physics teachers – Part B 5314

Paper Type: Contributed

Author: Avraham Merzel
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How can we attract top university physics and engineering students to a career in teaching

physics? How should we structure our teacher training programs to fit and best prepare talented people to become effective physics teachers and educational leaders? We discuss the design, teaching, and learning in an innovative physics methods course that was structured as a workshop. This course is the first of four that focus on physics PCK in the Views program at the Technion – Israel Institute of Technology. The program invites Technion graduates back to the Technion to earn an additional bachelor's degree in science teaching. We present preliminary findings from a study that followed the students throughout the course, focus on the difficulties these pre-service teachers experienced with regard to the design and teaching of engaging lessons in physics, and discuss how we supported the students in this process.

Footnotes: Shulamit Kapon is the AAPT sponsor of Avraham Merzel

Conflicts: (1) This talk is the second in a series of two talks: Helping engineers to become effective physics teachers – Part A and Helping engineers to become effective physics teachers – Part B. Please schedule them one after the other in the same session. (2) Please do not schedule the talks on the July 16 or 17, since the presenting author is a religious Jew who cannot travel or work on Saturdays.

You have submitted comments on this item

Change Session

○ No ● Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Identifying Different Student Groups using Cluster Analysis 5146

Paper Type: Contributed

Author: John C. Stewart
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jcstewart1@mail.wvu.edu

This paper presents an analysis of the effect of pre-preparation and effort on the performance in a physics class using data collected over 21 semesters (N=1747). An overall significant negative correlation with total time out-of-class time invested was found

($p<0.0001$). Cluster analysis was used to identify distinct subgroups of students with different levels of incoming preparation for the class and distinctly different out-of-class study behaviors. The highest performing subgroup invested the lowest out-of-class time but began the class with superior preparation in the material covered. Representation of students of different gender was not uniform across the set of clusters ($p<0.0001$). Female students were underrepresented in the cluster of students with high pre-preparation and overrepresented in the cluster whose primary mode of exam preparation was reading. Male students were overrepresented in the cluster identified by the failure to submit required assignments.

You have submitted comments on this item

Change Session

No Yes

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

Order

21

Comment:

Update

Abstract Title: Improved recruitment to build a better Faculty Online Learning Community 5469

Paper Type: Contributed

Author: Adrienne L. Traxler
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adrienne.traxler@wright.edu

A Faculty Online Learning Community (FOLC) is a follow-up experience for participants in the Physics and Astronomy New Faculty Workshops. FOLC cohorts, comprised of faculty members from around the country, meet biweekly by video for discussion with guest speakers and with each other about implementing active learning in their classrooms. Between meetings, members continue conversations, post materials, and ask for advice in a private social media group. FOLCs are intended to support faculty in meeting the challenges of classroom reform, which can be substantial even after attending the New Faculty Workshop. As a secondary benefit, FOLC cohorts have also proved to be a sounding board and discussion space for a broader range of issues facing junior faculty. Here we describe the ongoing development of the cohort formation process, with a particular focus on how

recruitment and community-building efforts have evolved during the project.

Conflicts: Associated with two other talks: "Online Learning Communities to Support Scholarship of Teaching and Learning," lead author Andy Rundquist; and "How can asynchronous communication support virtual faculty learning communities?," lead author Joel Corbo. This talk should be the first of the three.

You have submitted comments on this item

Change Session

No Yes

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

Order

2

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Linking workshop design to faculty's engagement in professional development 5414

Paper Type: Contributed

Author: Chandra Anne Turpen
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Faculty often become motivated to try research-based instructional strategies (RBIS) after attending professional development workshops, but they are often underprepared to succeed in using RBIS [1]. In order to further explore the outcomes of faculty professional development, we analyze video-recordings of faculty's interactions during the Physics and Astronomy New Faculty Workshop. We select workshop episodes using our Real-time Professional Development Observation Tool, which allows us to identify instances where faculty members are voicing their ideas and collaborating with each other. We consider how workshop leaders' design decisions seem to influence faculty's engagement, e.g., how faculty take up workshop instructions, make sense of workshop activities, share and elaborate on their ideas, and justify their arguments. Lastly, we discuss the potential implications of these findings for faculty's future teaching practice.

Footnotes: [1] C. Henderson, M. Dancy, M. & M. Niewiadomska-Bugaj (2012). Phys. Rev. ST-PER, 8(2), 020104.

Conflicts: Please do not schedule this session simultaneously with either of the following two invited sessions: Rachel Scherr's Preparing and Supporting University Physics Educators AND Mel Sabella's Knowing and leveraging the strengths of diverse populations in the physics classroom

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Making Use of Resources: Nudging and the Opportunity for Revisions 5524

Paper Type: Contributed

Author: Evan Halstead
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ehalstea@skidmore.edu

In the fall of 2015, I instituted a revision policy in my classes in which students could change their grades by revising their work and then speaking with me during 5-minute weekly sessions. Students in one section of a calculus-based introductory physics course at a small, liberal arts college signed up for weekly meeting times at the beginning of the semester. Students in a second section of the same course were allowed to meet with me any time during office hours. I kept track of how many students showed up to these meetings each week as well as the days of the week in which they came to see me. In this talk I will discuss the differences that I observed between the two sections.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Teaching method evaluation cluster

Update

Abstract Title: New resources on PhysPort: Supporting physics teaching with research-based resources 5506

Paper Type: Contributed

Author: Sarah B McKagan
American Association of Physics Teachers
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sam.mckagan@gmail.com

Physics education researchers have created research results, teaching methods, curricula, and assessments that can dramatically improve physics education. PhysPort (www.physport.org) is the go-to place for ordinary physics faculty to find resources for research-based teaching and assessment. First released in 2011 as the PER User's Guide, PhysPort has undergone re-branding, redesign, and expansion, including many new resources: overviews of over 50 research-based teaching methods and over 50 research-based assessment instruments, Expert Recommendations, the Virtual New Faculty Workshop, the Periscope collection of video-based TA training and faculty professional development materials, and the Assessment Data Explorer, an interactive tool for faculty to get instant analysis and visualization of their students' responses to research-based assessment instruments including the FCI, BEMA, and CLASS, and compare their results to national averages and students like theirs. The development of PhysPort includes research to determine faculty needs and usability testing to ensure that we meet those needs.

You have submitted comments on this item

Change Session

No Yes

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

Order

5

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Novice Index Representation of Conceptual Transformation during Physics Instruction 5177

Paper Type: Contributed

Author: Michi Ishimoto
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ishimoto.michi@kochi-tech.ac.jp

The Newtonian score representation of students' understanding of force and motion concepts has been a standard index in quantitative studies on conceptual transformation. Whereas students' proficiency before physics instruction is associated with learning gain, the robustness of novice views is attributed to learning inefficiency among low proficiency students. This study attempts to relate the inefficiency and the robustness of the primary commonsense conceptions by devising a noviceness index using a large number of students' pretest and posttest results on the Force and Motion Conceptual Evaluation. The results show that the proportion of change from novice responses to correct responses increased with an exponential regression curve, with R2 close to 1. The exponential rate of the transformation of a novice view could bring forth empirical data on other aspects of this transformation, such as what is involved in the rewiring of a neural network to build a new network.

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: Online Learning Communities to Support Scholarship of Teaching and Learning 5204

Paper Type: Contributed

Author: Andy Rundquist
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6512521778 (f)
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Faculty Online Learning Communities (FOLC) have recently been added to the New Faculty Workshops for Physics and Astronomy to help foster reflective teachers who are aware of and successfully adopt evidence-based pedagogical strategies. FOLC participants are encouraged to research their own teaching and the FOLC serves to support them and provide opportunities for communal research. This presentation will detail the first round of this research including an effort by several participants to have their students assess the work of their colleagues' students on the same lab taught at multiple institutions.

Footnotes: Please try to schedule this back-to-back with Adrienne Traxler's submission entitled "Building a better Faculty Online Learning Community: Recruitment focus"

You have submitted comments on this item

Change Session

(•) No ( ) Yes

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

Order

3

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Pathways to a physics degree: A statistical story 5134

Paper Type: Contributed

Author: John M Aiken

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johnm.aiken@gmail.com

Michigan State University (MSU) has collected a wide body of data on students for over 10 years allowing for a robust, statistical picture to be painted of how students enter and exit the physics world. This data includes course grade, gender, ethnicity, student major choices, etc. and can help us paint a pathway of every student who has received a physics bachelor's degree at MSU. While this data set contains over 100,000 students who have taken math and physics courses at MSU only 2% of these students have declared a physics major and only 0.5% of students have gone on to graduate with a bachelors in physics. Students who declare physics and then move away from the major perform poorly in introductory courses and are demographically different from the typical physics graduate.

You have submitted comments on this item

Change Session

No Yes

PER: Topical Understanding and Attitudes--G

Order

Comment:

Identity cluster

Update

Abstract Title: Probing Indicators of Studio-mode Physics Student Success through Instructor Interviews 5317

Paper Type: Contributed

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As part of a project to explore successful strategies for using studio methods, such as SCALE-UP, we are investigating attitudes that students possess and actions they take that bolster or hinder success in their studio-mode physics courses. We interviewed SCALE-UP physics instructors at two large-enrollment research universities to explore their perspectives

on the student-level variables that influence students' chances of excelling in their algebra-based studio-mode physics courses. We developed a coding scheme to characterize the beneficial and detrimental student qualities instructors observe and the actions instructors take to encourage beneficial student attitudes/behaviors and discourage detrimental ones. We present a snapshot of the coding scheme used and discuss common ideas about studio-mode physics student success identified by our participants.

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

PER: Evaluating instructional strategies--G

Order

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Situated Self-efficacy in Introductory Physics Students 5223

Paper Type: Contributed

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Students' perceptions of self-efficacy in the general university environment have been extensively studied and findings suggest that self-efficacy plays a role in student success. The role of perceived self-efficacy in Science, Technology, Engineering, and Mathematics (STEM) student success is investigated in the current research. A survey measuring students' feelings of self-efficacy within multiple environments, including science, mathematics and physics classes as well as within their major department and intended future career, was developed based on Pintrich et al. "Self-Efficacy for Learning Performance" subscale of the Motivated Learning Strategies Questionnaire. The survey was administered over the fall 2015 and spring 2016 semesters and demographic data was gathered for the introductory, calculus-based physics classes. An analysis of student perceived self-efficacy and its relation to student success will be discussed. The effect of gender and major on perceived self-

efficacy and student success will also be explored.

You have submitted comments on this item

Change Session

No Yes

PER: Topical Understanding and Attitudes--G

Order

Comment:

Identity cluster

Update

Abstract Title: SPOTing Effective Teaching: An Engaging and Reflective Faculty Workshop Series 5510

Paper Type: Contributed

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Because so few physics faculty are formally trained in education and pedagogy, in-service faculty professional development workshops are important for improving teaching skills. While these workshops often address the importance of engaging students in active and reflective classroom activities, emergent research suggests that more can be done to engage faculty workshop attendees in active and reflective activities. In this presentation, we discuss analysis of data collected from implementation of the SPOTing Effective Teaching Workshop series, a professional development experience that integrates use of the Student Participation Observational Tool (SPOT) within a faculty community of practice. This experience incorporates interactive and reflective elements to guide faculty in a shared experience of analyzing their teaching and discussing alternative approaches. Results indicate that as a result of this experience, faculty articulate pedagogical discontentment and identify desired changes to their teaching practice that are more in line with active, student-centered approaches.

Footnotes: Research Funded in part by NSF

You have submitted comments on this item

Change Session

No Yes

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

Order

8

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: STEM workplace communication and implications for the physics curriculum 5442

Paper Type: Contributed

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Though communication is essential for success in STEM careers, it is typically a minor focus within the undergraduate physics curriculum. With the emphasis of argumentation in K-12 NGSS and key role of collaboration and discussion in active learning environments, it is important to more fully understand how such practices prepare students to communicate effectively in STEM careers. We conducted 30 semi-structured interviews with new hires and their managers in academia and industry, using the field of optics as a disciplinary focus. We coded these interviews using emergent and grounded theory approaches to better understand how communication skills were developed and used in the workplace. Findings include a taxonomy of diverse communication skills ranging from written (e.g. documentation), visual (e.g. interpreting diagrams), and oral (e.g. asking questions) communication. In each case there were unexpected situations where communication was necessary and inseparable from technical knowledge used in the workplace.

You have submitted comments on this item

Change Session

No Yes

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

Order

6

Comment:

Update

Abstract Title: Student feedback as a tool in physics course development 5187

Paper Type: Contributed

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The effects of instructional reforms in university physics are typically evaluated through formative assessment, standardized concept inventories and/or attitude surveys. In addition, student feedback is collected by many departments, but reports of its use in course development are rare. At the University of Helsinki, Finland, student feedback has been regularly collected at fundamental physics courses since 2007. Over the years, feedback has proven to be an invaluable source of information for course development. It has revealed characteristics of physics courses and effects of instructional reforms hardly found by other means. Key factors for success are that all students have been motivated to give their considered opinions and feedback is solely used for the purposes of course development (and not e.g. for faculty promotions). In the talk, the feedback procedure will be presented along with examples of findings.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Teaching method evaluation cluster

Update

Abstract Title: Supplemental Instruction leader development: A longitudinal study 5656

Paper Type: Contributed

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Supplemental Instruction (SI) is a program developed to target gateway courses with low passing rates. Students in these courses have the option to attend regular sessions outside of lecture where they are guided through problem solving and learning through group work. Each session is led by an SI leader, a student who has done well in the course and has applied for the position. Because student success is the primary goal of the program, much of the research focuses on student success. However, SI leaders also learn and grow significantly as a result of participating in the program. In this study, we have conducted longitudinal interviews with SI leaders in STEM disciplines to examine their experience in the program. We will present findings about the SI leaders' ideas about teaching and learning, their growth as content experts, and professionals in their fields.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: The Access Network: Working Towards More Equitable and Inclusive STEM 5504

Paper Type: Contributed

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The Access Network consists of six university-based programs co-working with graduate and undergraduate students from across the country towards a vision of a more diverse, equitable, inclusive, and accessible STEM community. To realize this vision, Access and its member programs empower students as co-leaders, giving them voice and ownership over local and national efforts. Access sites focus on fostering supportive learning communities, engaging students in authentic science practices, and attending to students' development as STEM professionals. Programmatically, sites offer a range of services from summer programs to academic year mentoring. In this talk, we will share preliminary evidence of our network's efforts: (1) building a community of student representatives committed to communicating across sites, celebrating local successes, and supporting each other through local struggles, (2) developing and implementing our first in-person gathering of student representatives from Access sites, and (3) fostering routines for sharing of ideas across sites.

You have submitted comments on this item

Change Session

No Yes

PER: Topical Understanding and Attitudes--G

Order

Comment:

Update

Abstract Title: The Effects of Grader Assessment Feedback on Student Self-Regulation 5564

Paper Type: Contributed

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Self-regulation is a self-initiated process through which students identify obstacles to their learning, find strategies that will allow them to overcome those obstacles, and finally exert the effort needed to succeed. Through collection of student responses to a web-based survey, we investigate what student self-regulation looks like across different undergraduate physics populations. Specifically, we examine how different styles of feedback on assessments correlate with students' self-regulation. We combine two models of self-regulation – (1) the Winne & Hadwin model which describes how external feedback influences student self-regulation and (2) Zimmerman's cyclical model of student self-regulation consisting of the phases forethought, self-control, and self-judgement – to create an a priori coding scheme. Informed by our theory of self-regulation, we also develop emergent, open codes from the data. We hypothesize that instructors can use particular feedback to influence subcomponents of student self-regulation, aiding students' knowledge construction.

You have submitted comments on this item

Change Session

( ) No (•) Yes

PER: Topical Understanding and Attitudes--G

Order

Comment:

Update

Abstract Title: The Evolution of Department-level Teaching Social Networks at One Institution 5391

Paper Type: Contributed

Author: Alexis V Knaub
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Social network analysis (SNA) provides a means of studying connections among entities. The information found through SNA has many uses, including identifying key leaders, demonstrating the current state of a system, or documenting change through collecting data at different time intervals. As part of a larger evaluation project related to institutional change, we have collected SNA department-level data related to teaching networks (teaching discussion and advice) in several departments at one institution. These data have been collected every 2 years for the past 6 years. This talk will discuss whether and how these networks have changed, striking trends, and ways these data have been used.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: The importance of student voice in partnerships: Examples from the CSU Learning Assistant Program 5329

Paper Type: Contributed

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The CSU Learning Assistant (LA) program has grown from three students, in one discipline, to nineteen students, in five disciplines. Central to this growth is the cultivation of teaching partnerships between LAs and faculty. In these partnerships, student ideas are valued and leveraged to improve the program, inform LA programs across the country, and publicize the program at the local and national level. In this talk we explore how recent interviews with LAs and the implementation of an LA Panel at CSU allows faculty and peers to get a glimpse of the LA Program that would not be possible without student voice. We also explore how the use of student voice to inform the program can create broad scale buy in for the LA Program and other types of instructional reform in the STEM classroom.

Footnotes: * supported by the National Science Foundation (DUE #1356523 & DUE#1524829) and the Department of Education.

Conflicts: Please do not schedule in parallel with Invited session: Leveraging strengths of diverse populations.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Using conceptual blending to analyze student inquiry in computer-based environments 5190

Paper Type: Contributed

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Modern digital technologies allow students to engage in inquiry-based activities in topics that have traditionally been out of experimental reach, such as astronomy and particle physics. An expert-like understanding of a topic requires recognition and awareness of the different roles of formalisms, computer simulations and physical experiments. Conceptual blending (also known as conceptual integration) is a framework for describing cognitive processes. We will illustrate how conceptual blending can be used to interpret how students make sense of the motion of stellar objects, as they explore them in an interactive whiteboard based investigative group activity. Main findings include that students quickly accept the idea of being able to throw planets into orbit in the interactive computer environment. For consolidation of learning and for building an expert-like understanding, experiences from this playful activity and from everyday life have to be projected onto formal physics theory.

You have submitted comments on this item

Change Session

No Yes

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

Order

7

Comment:

Update

Abstract Title: What happens after paired teaching? Continued use of research-based instructional strategies 5542

Paper Type: Contributed

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Paired (or co-)teaching is an arrangement in which two faculty are collaboratively responsible for all aspects of teaching a course. By pairing an instructor experienced in research-based instructional strategies (RBIS) with an instructor with little or no experience in RBIS, paired teaching can be used to promote the adoption of RBIS. We report on several examples of instructors who were the relative novices in such pairs. Using data from in-class observations, the Teaching Practices Inventory, and interviews with the instructors, we characterize the extent to which they have continued using RBIS in the courses they have taught after pair-teaching. Preliminary results indicate both a continued use of RBIS when teaching in the same course that they pair-taught in and some transfer of RBIS to new contexts.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: When buy-in is not enough: GTAs' RIOT profile in mini-studios 5222

Paper Type: Contributed

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Using the Real-time Instructor Observing Tool (RIOT) we observed six Graduate Teaching Assistants (GTAs) and coded for the amount of time they spent on various teaching actions to create an "action profile". The GTAs were teaching in a student-centered combined recitation and laboratory "mini-studio". At the end of the semester, we asked all GTAs to use the RIOT protocol to describe action profiles from several perspectives: 1) what the course designers want; 2) what the GTA thinks is most helpful; 3) what the students think is most helpful; and 4) what the GTA thinks his/her actual profile resembles. In this talk we compare the responses of an exemplary GTA to find a high amount of buy-in to the mini-studio method but an actual profile that more closely resembled what she believed her students wanted. These findings are supported by the GTA's other responses about her teaching experiences.

Footnotes: This work is supported in part by the U.S. National Science Foundation under grant DUE-1246024.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

Abstract Title: Who let the cold out? 5473

Paper Type: Contributed

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In the MainePSP*, we have observed students improve the way they analyze thermal energy after instruction, but that many of them continue to use the idea that "coldness" transfers. Past researchers have identified that cold is commonly perceived as a separate heat energy. Nevertheless, we have not found specific activities to address this idea. We present the analysis of a collaborative session among K-12 teachers who were trying to analyze how to address coldness in the classroom. During the sessions, teachers got to model the energy in two different scenarios which include an object in room temperature interacting with snow. Then, teachers interacted with two simulations that address thermal energy to consider their utility as an instructional tool. Engaging teachers in these activities led to additional insights and questions about how to convincingly address students' observable experience, that coldness transfers, using a thermal energy model.

Footnotes: *NSF MSP 0962805

Conflicts: I am the session organizer of PER findings related to Latin American Students, I would appreciate if this is not schedule at the same time.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Faculty/LA preparation cluster

Update

PER: Evaluating instructional strategies

Abstracts Submitted (# 23) | Abstracts You Have Reviewed: 22

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

Paper Type: Contributed

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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

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

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

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

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

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

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

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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

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

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

Author: Adam B Francis
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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

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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

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

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

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

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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ryan.badeau@gmail.com

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

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

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

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

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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7328220150 (p)
santanb1@apps.tcnj.edu

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

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

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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jvonkorff@gsu.edu

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

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

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
Florida International University
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Miami, FL 33199
8123258620 (p)
jianwang@fiu.edu

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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Box 351560
Seattle, WA 98195
(206) 543-4983 (p)
pedigo@phys.washington.edu

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
350 Spelman Lane
Atlanta, GA 30314
404-697-4911 (p)
coakley@spelman.edu

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

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

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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Chico, CA 95929-0202
8483910527 (p)
dtbrookes@gmail.com

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

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

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
Uppsala University
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jesper.haglund@physics.uu.se

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

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

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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Golden, CO 80401-1843
303-273-3029 (p)
kcallan@mines.edu

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

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

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

Author: Eric P. Kuo
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9788971977 (p)
erickuo@stanford.edu

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

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

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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bgutman2@illinois.edu

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

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

Order

20

Comment:

Teaching method evaluation cluster

Update

PER: Examining content understanding and reasoning

Abstracts Submitted (# 32) | Abstracts You Have Reviewed: 27

Abstract Title: Classical Physics Learning from Analysis of Modern Physics Data II 5450
Paper Type: Contributed

Author: Kenneth W. Cecire
University of Notre Dame
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Notre Dame, IN 46556
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574-631-3977 (f)
kcecire@nd.edu

Whether students are studying classical physics or cutting edge physics, many of the same principles apply. For example, the conservation of momentum is a time-honored classical topic that is absolutely necessary to understand the products of particle collisions in the Large Hadron Collider. The authors have created a pre- and post-study instrument to try to determine if students are more motivated to learn about classical principles from activities which employ authentic data from current, cutting-edge experiments and if such activities might enhance learning of such classical topics.

Conflicts: First author is chair of Committee on Modern Physics and must be available for related events; first author is also presider of Particle Physics Investigations by Students session.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

5

Comment:

Research-based assessment instrument cluster

Update

Abstract Title: Comparing Two Activities' Effectiveness Improving Reasoning with Multiple-

Variable Graphed Information 5364

Paper Type: Contributed

Author: Rebecca J. Rosenblatt
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Bloomington, IL 61701 United States
614-460-9502 (p)
rosenblatt.rebecca@gmail.com

Past findings show large differences in student ability to use, and reason with, certain graphed data. Namely, many students incorrectly assume there must be dependence between the axes of any graph whether-or-not the data suggests a relation and whether-or-not a controlled experiment was done. In addition, students have similar difficulties reasoning with multivariable data displayed on a graph in multiple trend-lines. A majority of the errors made are consistent with a failure to properly control variables and/or reasoning illogically about the data. We developed and pilot tested two different one-hour group work activities to improve student understanding. One activity was laboratory based and focused on control of variables and experimentation. The other was recitation based and focused on logical reasoning and data manipulation. Results show the relative effectiveness of the activities and suggest interesting facts about the importance of logical reasoning vs. control of variables when working with graphed data.

You have submitted comments on this item

Change Session

No Yes

PER: Problem Solving--G

Order

12

Comment:

Representations cluster

Update

Abstract Title: Concept Inventories and the Next Generation of Assessment 5341

Paper Type: Contributed

Author: James T. Laverty
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East Lansing, MI 48824-1046
419-944-5802 (p)

laverty1@msu.edu

In 2012, the National Research Council released A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. This report synthesized the literature on how students learn science into three dimensions that should be blended together in instruction, curriculum, and assessment. This "three-dimensional learning" is the basis for the Next Generation Science Standards and researchers have recently made calls to bring it to higher education as well. We have developed the Three-Dimensional Learning Assessment Protocol (3D-LAP), which can characterize assessments in introductory science courses as aligning (or not) with scientific practices, crosscutting concepts, and core ideas. In this talk, I apply the 3D-LAP to some commonly used concept inventories in physics to characterize their alignment with the three dimensions from the Framework. I will explore the potential utility of these concept inventories in the era of the Next Generation Science Standards.

You have submitted comments on this item

Change Session

(•) No ( ) Yes

PER: Evaluating instructional strategies--G

Order

6

Comment:

Research-based assessment instrument cluster

Update

Abstract Title: Construction and interpretation of linear best-fit graphs in introductory labs 5623

Paper Type: Contributed

Author: Craig C. Wiegert
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Department of Physics and Astronomy
Athens, GA 30602-2451
706-542-4023 (p)
wiegert@physast.uga.edu

Instructional labs are an important element of undergraduate introductory physics. Many lab activities require students to construct graphs of their data and interpret their results, connecting their lab experience to underlying physics concepts. We investigated students' construction and interpretation of linear best-fit graphs in the context of two lab activities. Students' graphs were evaluated for overall quality as well as for the quality of the best-fit line. We then interviewed students to determine the strategies used in graph construction

and fitting, and to assess student understanding of the meaning of the graph. Our results indicate that undergraduate introductory physics students can successfully construct best-fit linear graphs while struggling to interpret graphs according to the physical concept under investigation. Furthermore we found, perhaps surprisingly, that the most challenging aspect of graph construction for students was establishing a correct and useful scale.

You have submitted comments on this item

Change Session

No Yes

PER: Problem Solving--G

Order

13

Comment:

Representations cluster

Update

Abstract Title: Developing metacognitive knowledge about productive reflection on salient distracting features* 5211

Paper Type: Contributed

Author: Thanh K. Le
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When students work on physics problems, certain problem features may cue specific lines of reasoning. In particular, salient distracting features (SDFs) are surface, situational, or contextual features of a problem that frequently cue incorrect lines of reasoning and inhibit the exploration of more productive reasoning approaches. A potential approach for addressing SDF-related reasoning difficulties is to target and enhance student metacognition. In the second semester of the calculus-based introductory physics sequence at the University of Maine, we developed and administered a flexible, web-based instructional intervention designed to help students construct metacognitive knowledge about productive reflection on the role of SDFs in influencing reasoning. In the intervention, students are asked to synthesize contrasting cases in which hypothetical students reflect upon physics problems containing SDFs. Preliminary data and emerging findings will be presented. *This material is based upon work supported by the National Science Foundation under Grant Nos. DUE-1245313 and DUE-0962805.

You have submitted comments on this item

Change Session

No Yes

PER: Problem Solving--G

Order

14

Comment:

Representations cluster

Update

Abstract Title: Early mathematization obstacles: Uncovering roots of student difficulties in majors' courses 5536

Paper Type: Contributed

Author: SUZANNE BRAHMIA
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brahmia@physics.rutgers.edu

Experts in physics create and communicate knowledge through mathematization, the mental practice of translating between the physical world and the symbolic world. While Physics Education Research at the upper division undergraduate level has uncovered many specific challenges that students understandably face with sophisticated mathematization, there is a growing body of evidence that even well prepared introductory college physics students struggle with the idiosyncratic ways that familiar mathematics is used in physics. This talk draws parallels between the published struggles that students have with mathematization in the upper division courses (1) and obstacles that we are beginning to uncover as we investigate trends in student reasoning with ratio and proportion, quantification, and symbolizing within the calculus-based introductory physics course.(2)

Footnotes: 1. Caballero, Wilcox, Doughty, and Pollock (2015) 2. Brahmia, Boudreaux and Kanim (under review)

You have submitted comments on this item

Change Session

No Yes

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

Order

1

Comment:

Math cluster

Update

Abstract Title: Examining student reasoning with multi-variable expressions* 5590

Paper Type: Contributed

Author: Mila Kryjevskaia
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(701) 231-9756 (p)
mila.kryjevskaia@ndsu.edu

It has been shown that students encounter significant reasoning difficulties when interpreting and applying multi-variable expressions. For example, students often argue that because the frequency of a periodic wave is expressed in terms of wavelength and propagation speed, the frequency must change when the speed changes. Similarly, many students think that the capacitance of a parallel-plate capacitor will change if the potential difference between its plates is varied. In this talk, we report on an investigation of the extent to which problematic reasoning approaches are related to (1) the level of abstractness of a presented situation and (2) the specific features of the task itself.

Footnotes: *This material is based upon work supported by the National Science Foundation under Grant Nos. DUE-1431857, 1431940, 1432052, and 1432765.

You have submitted comments on this item

Change Session

(•) No ( ) Yes

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

Order

2

Comment:

Math cluster

Update

Abstract Title: Examining students' abilities to follow and evaluate qualitative reasoning chains 5402

Paper Type: Contributed

Author: William N. Ferm
University of Maine
Physics and Astronomy 120 Bennett Hall
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(207)266-1613 (p)
william.ferm@maine.edu

While there has been a large body of work investigating the effectiveness of scaffolded, researched-based physics instruction, much less is known about the development of students' reasoning abilities in these instructional environments. As part of a larger collaborative project, we have been examining the ability of students to construct qualitative reasoning chains. In particular, we have been designing and implementing tasks to assess the extent to which introductory physics students are able to logically follow and characterize hypothetical student reasoning in a variety of physics contexts. In one task, for example, students are asked to infer the conclusions that would be drawn from different lines of reasoning articulated by hypothetical students. In this presentation, we will discuss the development of such tasks and share preliminary results. This material is based upon work supported by the National Science Foundation under Grant Nos. DUE-1431857, DUE-1431541, DUE-1431940, DUE-1432765, DUE-1432052, and DUE-0962805.

You have submitted comments on this item

Change Session

No Yes

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

Order

3

Comment:

Math cluster

Update

Abstract Title: Examining students' multi-step reasoning in energy contexts* 5525

Paper Type: Contributed

Author: Andrew Boudreaux
Western Washington University
516 High St
Bellingham, WA 98225-9164
360 314-8143 (p)
andrew.boudreaux@wwu.edu

As part of a multi-institution collaboration, we are examining students' multi-step, qualitative reasoning in physics. An important part of this work is developing methods for disentangling conceptual understanding from reasoning. In this talk, we present and analyze responses on tasks in which students apply energy concepts to simple situations. One such task involves a hand moving a book with changing speed through a uniform gravitational field. Most students struggle to coordinate the energy input (work done by the hand) and the energy changes (changes in kinetic energy and in gravitational potential energy). At the 2016 Winter AAPT meeting, Lindsey described the reasoning of introductory physics students at Penn State Greater Allegheny; this talk follows up by presenting results from interviews with preservice teachers and upper division physics students at Western Washington University.

Footnotes: *This work was supported in part by the National Science Foundation under Grant Nos. DUE-1432052 and DUE-1431541.

You have submitted comments on this item

Change Session

(•) No ( ) Yes

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

Order

4

Comment:

Math cluster

Update

Abstract Title: How Students Combine Knowledge Elements While Learning 5202

Paper Type: Contributed

Author: Alan Richards
The College of New Jersey
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aj.richards@tcnj.edu

We recorded preservice physics teachers learning about the physics of solar cells. Using a knowledge-in-pieces theoretical framework, we analyze their interactions in order to make inferences about the elements of prior knowledge they call upon as they build understanding of how these devices function. Of special interest are the instances when a student makes a significant conceptual breakthrough. We find that students who combine different aspects of their prior knowledge in specific ways may be more likely to make breakthroughs. We will discuss what instructors can do to prime learners to combine knowledge in productive ways so they are better able to achieve these breakthroughs.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Improving student understanding of degenerate perturbation theory in quantum mechanics 5043

Paper Type: Contributed

Author: Christof Keebaugh
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3941 Ohara st
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4126874764 (p)
4126874764 (f)
clsingh@pitt.edu

We investigate student difficulties with degenerate perturbation theory in quantum mechanics by administering free-response and multiple-choice questions and conducting individual interviews with advanced students. We find that students display many common difficulties related to this topic. To improve student understanding, we use these difficulties as resources and develop a Quantum Interactive Learning Tutorial (QuILT) along with a pre-

test and a post-test using an iterative approach. We will discuss the development and evaluation of the QuILT. We thank the National Science Foundation for support.

Footnotes: This session is being sponsored by Chandralekha Singh for Christof Keebaugh who is a student and is not yet an AAPT member. He will become a member of AAPT before attending the meeting.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Update

Abstract Title: Improving Student Understanding of Vector Fields in E&M 5578

Paper Type: Contributed

Author: Bert C. Xue
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bertxue@gmail.com

The Physics Education Group at the University of Washington has been developing tutorials for the junior-level electrodynamics courses. We have observed that most students enter these courses with a working knowledge of static electric and magnetic fields in simple systems. However, these students have significant difficulties in transferring this knowledge to other vector fields or to more complex systems. This talk will present results from our attempts at improving student understanding of vector fields and the physical interpretation of vector derivatives.

Conflicts: Both this talk and the talk by Ryan Hazelton involve junior-level E&M research at the University of Washington. If possible, this talk should be scheduled after Ryan Hazelton's talk, preferably immediately after.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Improving understanding of Gauss's law by replacing examples with reasoning 5513

Paper Type: Contributed

Author: Marshall J Styczinski
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mjstyczi@uw.edu

Gauss’s law is a fixture in introductory physics classes in part because the reasoning skills and fundamental physics knowledge required for its application represent important course goals. We have found that students struggle to apply Gauss’s law to conceptual questions as well as typical end-of-chapter problems, even after coverage in lecture and the relevant sections of Tutorials in Introductory Physics(1). To address persistent difficulties we are modifying tutorial curriculum to reduce the number of examples and emphasize the development of a conceptual framework around flux and Gauss’s law. The goal is to improve student performance on both conceptual questions and typical calculation questions. A summary of the student difficulties uncovered, details of modifications to the established curriculum, and preliminary results will be presented.

Footnotes: (1) McDermott, Shaffer, and the UWPEG (2012). Tutorials in Introductory Physics. Pearson Learning Solutions. * This material is based upon work supported by NSF Grant No. DUE-1022449.

You have submitted comments on this item

Change Session

No Yes

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

Order

Comment:

Update

Abstract Title: Influence of Language of Administration upon Physics Concepts Measuring Instruments 5310

Paper Type: Contributed

Author: Thomas Olsen
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Riyadh, Riyadh 13314 Saudi Arabia
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thomas@dau.edu.sa

The Force Concept Inventory (FCI) has become a world standard as an instrument to measure students' conceptual understanding of Mechanics. In particular, the Normalized Gain has proven to be a robust measure of the effect of pedagogy upon student learning. While the original FCI was developed in English, translations have been made. This study seeks to determine the effect, if any, of administering the FCI in different languages to different groups of students, taken from the same student population. As an English language university in Riyadh, Saudi Arabia, Alfaisal University would seem to be an excellent laboratory for such a study. The FCI has been administered to all introductory physics students at Alfaisal, at the beginning and the end of the first physics course Spring 2015 semester. The students were randomly assigned English and Arabic administrations. We will share some of the data from this study with some preliminary analysis. The prospects for subsequent study will also be discussed.

You have submitted comments on this item

Change Session

No Yes

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

Order

7

Comment:

Research-based assessment instrument cluster

Update

Abstract Title: Investigating student ability to reason in different directions* 5569

Paper Type: Contributed

Author: MacKenzie R. Stetzer
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mackenzie.stetzer@maine.edu

As part of a larger, multi-institutional effort to investigate and assess the development of student reasoning skills in the context of scaffolded physics instruction, we have designed and administered new tasks in order to examine student ability to reason in different directions in introductory calculus-based physics courses. In these reasoning reversal tasks, two different versions of a physics problem are randomly administered to students in the course. In one version, students are asked to predict how a modification to an experimental setup will change the outcome of the experiment; in the other version, students are asked to infer the modification to the experimental setup that led to a specified change in the outcome of the experiment. In this talk, we will present preliminary results from these reasoning reversal tasks.

Footnotes: *This material is based upon work supported by the National Science Foundation under Grant Nos. DUE-1431857, DUE-1431541, DUE-1431940, DUE-1432765, DUE-1432052, and DUE-0962805.

You have submitted comments on this item

Change Session

No Yes

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

Order

8

Comment:

Research-based assessment instrument cluster

Update

Abstract Title: Investigating Student Understanding Of Radioactivity With The Radiation

Conceptual Evaluation 5658

Paper Type: Contributed

Author: Brant E. Hinrichs
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bhinrichs@drury.edu

As part of developing a comprehensive package of classroom materials for radiation literacy, the Inquiry into Radioactivity (IiR) project has drafted a Radiation Conceptual Evaluation (Rad CE). This instrument detects major problematic categories of student thinking such as the "substance-like view" of radiation, and ionizing radiation as waves. Students with the substance-like view think of radiation as "bad stuff" that is emitted from radioactive objects and contaminates other objects when it gets on them, making them radioactive in turn. Students with this view typically do not distinguish radiation from the condition of being radioactive. Pre and post testing using the Rad CE at two different universities indicate that nearly all nonscience majors begin the IiR course with the substance-like view, but gradually transition to a "particles-in-motion" view over time. We compare data from both universities and draw implications for teaching radioactivity.

Footnotes: This project was supported by NSF DUE grant 0942699.

Conflicts: I am on two posters. I don't think poster times conflict with talk times, but just want to make sure.

You have submitted comments on this item

Change Session

(•) No ( ) Yes

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

Order

9

Comment:

Research-based assessment instrument cluster

Update

Abstract Title: Investigating Student Understanding of Vector Calculus in E&M 5572

Paper Type: Contributed

Author: Ryan L C Hazelton
University of Washington

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rlhazelton@gmail.com

Over the past several years the Physics Education Group at the University of Washington has been working to probe the difficulties students encounter in junior-level electrodynamics courses. A large proportion of these difficulties involve interpreting mathematical statements about physical systems. A major subset of these difficulties involve student understanding of the divergence and curl operators. This talk will discuss several examples of these difficulties in the context of Maxwell's equations.

Conflicts: Both this talk and the talk by Bert Xue involve junior-level E&M research at the University of Washington. If possible, this talk should be scheduled before Bert Xue's talk, preferably immediately before.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Investigating students' understanding of ac biasing networks* 5213

Paper Type: Contributed

Author: Kevin L. Van De Bogart
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As part of an ongoing effort to investigate the learning and teaching of bipolar junction transistor circuits (e.g., the common-emitter amplifier) in physics and engineering courses, we have begun to examine student understanding of ac biasing networks. These biasing networks are critical for signal processing via transistor circuits, yet the coverage of such networks in both courses and texts is typically sparse and frequently secondary to coverage of the amplifier circuits themselves. In this cross-disciplinary project, we have been examining the extent to which students are able to correctly predict the behavior of the biasing network under both dc and ac conditions. In this presentation, we will use specific

examples to highlight the most prevalent conceptual and reasoning difficulties identified. Implications for instruction emerging from this investigation will also be discussed.

Footnotes: *This material is based upon work supported by the National Science Foundation under Grant Nos. DUE-1323426 and DUE-0962805.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Investigating the Impact of Different Prompts On Student Reasoning * 5433

Paper Type: Contributed

Author: Cody Gette
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4214 9th Ave S
Fargo, ND 58103
7012305866 (p)
cody.gette@ndsu.edu

Prior research suggests that students who demonstrate conceptual knowledge on one task often fail to apply consistent thinking on closely related tasks. This is consistent with the dual-process theory of reasoning that suggests that some students tend to focus on surface features that often elicit intuitive ideas. As such, these students tend to provide answers based on their first reactions or gut feelings. We applied a paired-question methodology, in which screening and target questions required the application of the same concepts and skills. Three versions of screening-target sequences were designed in the context of friction. The sequences only differed in the level of abstractness that describe setups presented in the screening questions. The impact of these differences on student performance on the target question was examined. Results from introductory algebra-based physics class will be presented and discussed.

Footnotes: *This material is based upon work supported by the National Science Foundation under Grant Nos. DUE-1431857, 1431940, 1432052, and 1432765.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Overview of 50+ research-based assessments in physics and beyond 5073

Paper Type: Contributed

Author: Adrian M Madsen
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The PER community has produced 50+ research-based assessments (RBAs) which evaluate the effectiveness of different teaching methods, covering diverse physics topics (both introductory and upper-level) as well as beliefs about the nature of physics, problem solving, lab skills etc. Results on these tests show that PER-based teaching methods lead to dramatic improvements in students learning, so assessment can act as a gateway drug to better teaching. However, physics faculty often struggle with knowing which assessments are available and which to use in their course. We have written a resource letter in which we discuss the details of each research-based assessment, including the course-level, content, purpose, level of research validation and implementation details. We also compare relevant assessments and give recommendations on when to use each assessment. In our talk, we will give an overview of the categories of assessments, paying particular attention to those that are less well known.

You have submitted comments on this item

Change Session

No Yes

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

Order

10

Comment:

Research-based assessment instrument cluster

Update

Abstract Title: Probing Student Ability to Construct Reasoning Chains: A New Methodology 5426

Paper Type: Contributed

Author: J. Caleb Speirs
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Students are often asked to construct qualitative reasoning chains during scaffolded, research-based physics instruction. As part of a multi-institutional effort to investigate and assess the development of student reasoning skills in physics, we have been designing tasks that probe the extent to which students can create and evaluate reasoning chains. In one task, students are provided with correct reasoning elements (i.e., true statements about the physical situation as well as correct concepts and mathematical relationships) and are asked to assemble them into an argument that they can use to answer a specified physics problem. In this talk, the task will be described in detail and preliminary results will be presented.

Footnotes: *This material is based upon work supported by the National Science Foundation under Grant Nos. DUE-1431857, DUE-1431541, DUE-1431940, DUE-1432765, DUE-1432052, and DUE-0962805.

You have submitted comments on this item

Change Session

No Yes

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

Order

6

Comment:

Math cluster

Update

Abstract Title: Sense-making with Inscriptions in Quantum Mechanics 5264

Paper Type: Contributed

Author: Erin Ronayne Sohr
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In this presentation, we focus on students' sense-making with a graphical representation commonly used in quantum mechanics textbooks; that of overlaid potential energy and wavefunction plots in the context of quantum well(s) and barriers. Previous research has pointed to a conflation of the energy and wavefunction axes as leading to common student difficulties in understanding phenomena such as tunneling. The existence of this difficulty has influenced QMCS survey items and design choices in several PhET simulations. We add to this research by investigating how students use and interact with this graphical representation while sense-making. Through fine-timescale analysis of video data from clinical interviews with engineering majors in a modern physics course, we document that the inscription can play both communicative and generative roles in the student's reasoning. We report the different ways in which the inscription gets embedded in students' reasoning and potential instructional implications.

Footnotes: This work is supported by NSF-DUE1323129

You have submitted comments on this item

Change Session

(•) No ( ) Yes

PER: Problem Solving--G

Order

15

Comment:

Representations cluster

Update

Abstract Title: Student ability to use complex numbers in quantum mechanics 5386

Paper Type: Contributed

Author: Tong Wan
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The Physics Education Group at the University of Washington has been investigating student ability to use complex numbers in quantum mechanics. Complex numbers are essential to quantum mechanics. In particular, the relative phases of quantum states, which can be represented by complex numbers, are critical to understanding quantum concepts such as interference and time dependence. We present data from sophomore and junior-level quantum mechanics courses to illustrate some of the errors that students encounter in using complex numbers.

You have submitted comments on this item

Change Session

(•) No ( ) Yes

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

Order

7

Comment:

Math cluster

Update

Abstract Title: Student Construction and Use of Three-Dimensional Coordinate System Differential Elements 5381

Paper Type: Contributed

Author: Benjamin P. Schermerhorn
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As part of an effort to examine students' understanding of the structure of non-Cartesian coordinate systems and the differential elements associated with these systems when using vector calculus in electricity and magnetism (E&M), students in junior E&M were interviewed in pairs. In one task, students were asked to determine differential length and volume

elements for an unconventional spherical coordinate system. While all pairs eventually arrived at the correct differential elements, some students unsuccessfully attempted to reason by recalling and/or mapping from elements in spherical or Cartesian coordinates, only to recognize their error later when checking their work. We have documented several ideas that students use, and certain actions they undertake, while working through the task. Across-interview comparisons allow for characterization of student successes and difficulties in terms of whether these ideas are present and how they are grouped and ordered.

Footnotes: This work was supported in part by NSF Grant PHY-1405726.

You have submitted comments on this item

Change Session

(•) No ( ) Yes

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

Order

8

Comment:

Math cluster

Update

Abstract Title: Student difficulties with expectation values in quantum mechanics 5029

Paper Type: Contributed

Author: Chandralekha Singh
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4126874764 (f)
clsingh@pitt.edu

To investigate the difficulties that upper-level undergraduate and graduate students have with expectation values of physical observables in the context of Dirac notation, we administered free-response and multiple-choice questions and conducted individual interviews with students. We find that advanced students display common difficulties with expectation values. Results will be discussed. We thank the National Science Foundation for support.

Conflicts: I am giving an invited talk so please make sure there is no overlap. Also, please ignore my earlier abstract since I forgot to acknowledge NSF support. Thank you so much!!!

You have submitted comments on this item

Change Session

No Yes

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

Order

9

Comment:

Math cluster

Update

Abstract Title: Student Difficulties with Quantum Operators Corresponding to Observables 5048

Paper Type: Contributed

Author: Emily M. Marshman
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To investigate the difficulties that upper-level undergraduate and graduate students have with quantum operators in the context of Dirac notation, we administered free-response and multiple-choice questions and conducted individual interviews with students. We find that students display common difficulties with these topics. Results will be discussed. This work is supported by the National Science Foundation.

You have submitted comments on this item

Change Session

No Yes

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

Order

10

Comment:

Math cluster

Update

Abstract Title: Student ideas about coordinate systems in the upper division 5451

Paper Type: Contributed

Author: Brian D. Farlow
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brian.farlow@ndsu.edu

As part of a broader study on student thinking about mathematics in the undergraduate physics curriculum, we report on students' ideas about coordinate systems in the upper division. Early evidence suggests that upper-division physics students struggle to answer conceptual and pictorial questions requiring the use of Cartesian and non-Cartesian coordinate systems. Specifically, students have difficulty identifying the motion of objects using plane polar coordinates. Not recognizing that both radial displacement and polar angle change with respect to time for motion along non-circular paths is a specific example of this difficulty. We report findings from one-on-one interviews that used a think-aloud protocol designed to shed light on student thinking within this domain.

You have submitted comments on this item

Change Session

No Yes

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

Order

11

Comment:

Math cluster

Update

Abstract Title: Student reasoning with vectors through the physics curriculum 5659

Paper Type: Contributed

Author: Michael E. Loverude
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mloverude@fullerton.edu

The vector concept is used in physics instruction beginning in the introductory level. While initial encounters with vectors are firmly grounded in experience, (e.g., a displacement vector in two- or three-dimensional space, with magnitude and a direction), the vector concept grows to include far more abstract ideas. As part of an NSF-supported research and curriculum development project, we have studied student reasoning across several upper-division physics courses, including mathematical methods. For this presentation, we describe theoretical and empirical views of the development and expansion of the vector concept, with examples of student responses and a discussion of implications for instruction.

Footnotes: Supported in part by NSF grant PHYS-1405616.

You have submitted comments on this item

Change Session

No Yes

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

Order

12

Comment:

Math cluster

Update

Abstract Title: Targeted Student Feedback Using Transition Matrices 5288

Paper Type: Contributed

Author: Paul J. Walter
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We introduce a new tool for adoption by high school and college level physics teachers who use a common assessment such as the Force Concept Inventory (FCI). The tool uses a

spreadsheet application to create a simple matrix that identifies the percentage of students that who select each possible pre-/post-test answer combination on each question of the diagnostic exam. From this, it determines changes in students' understanding of concepts and common misconceptions. For those students that selected the wrong answer to a question on both of the pre-/post-tests, we also determine whether they are moving toward a "better" wrong answer. Feedback from the tool allows instructors to close the loop on assessment and tailor instruction in an informed way.

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: Teacher Knowledge of Student Difficulties: "Collectively, We're a Genius!" 5495

Paper Type: Contributed

Author: Michael Carl Wittmann
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In a teacher professional development meeting of the MainePSP, teachers were asked a question about potential energy and then to discuss why students might give a particular response to it. Collectively, they came up with a rich, nuanced description of student reasoning, touching on multiple ways of thinking about energy, and how these might affect student responses. Where PD organizers (...the talk authors) had predicted 3 or 4, teachers came up with 6 explanations of a particular answer. These included ideas in the literature (related to time, effort, and work, for example) and ideas not in the literature (a wonderfully compelling reverse deficit model of energy). We find that bringing teachers together and sharing student data within a facilitated community lets teachers arrive at surprising insights about how their students think about energy.

Footnotes: Funded in part by NSF MSP 0962805 and DRL 1222580.

Conflicts: There is a talk by Carolina Alvarado about the same project (but different format and content, probably a different session). I would hope that our sessions are not scheduled in parallel!

You have submitted comments on this item

Change Session

No Yes

Teacher Training/Enhancement--G

Order

Comment:

Update

Abstract Title: Thinking quantum mechanically: introducing students to reasoning in modern physics 5228

Paper Type: Contributed

Author: Jessica Hoy
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3035220601 (p)
jessica.hoy@colorado.edu

Learning quantum mechanics requires students to develop new conceptual understanding and mathematical skills, and to reason differently about the nature of systems (i.e. an electron is no longer a point-like particle). We present a broad view of our research in a Modern Physics course at CU Boulder where second year physics and engineering students learn the foundations of quantum mechanics. In this work, we focus on classically unfamiliar or unusual cases, such as tunneling and delayed choice experiments, and look at the nature of student reasoning in these situations. We present both qualitative (recorded focus group discussions) and quantitative (conceptual and epistemological survey) data and demonstrate that students are capable of engaging in sophisticated reasoning about quantum phenomena. By explicitly attending to applications and interpretation within instruction, we foster an environment in which students negotiate and grapple with quantum concepts.

Footnotes: Work supported by NSF

You have submitted comments on this item

Change Session

No Yes

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

Order

11

Comment:

Upper division topics

Update

Abstract Title: Words vs. graphs: Tracking shifts in students' understanding of forces 5559

Paper Type: Contributed

Author: Trevor I. Smith
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smithtr@rowan.edu

Many studies have shown that students often struggle to interpret and generate graphs of various physical quantities. This can be seen in students' responses to the Force and Motion Conceptual Evaluation. When analysing consistency on questions asking students to select graphs of force vs. time to accompany a described motion compared to questions asking them to choose verbal descriptions of forces, we have previously used consistency plots to show that students are more likely to improve on the graph questions than the natural language questions. This suggests that students may have developed a formal understanding of the relationship between force and motion but do not apply it when reasoning about situations related to their daily lives. We expand on these results by incorporating data from multiple colleges and universities and show how these results relate to other analyses of the data.

Conflicts: Please schedule this talk before the poster titled "Tracking shifts in students' understanding: Forces, acceleration, and graphs" by authors T.I. Smith, N.J. Wright, and I.T. Griffin.

You have submitted comments on this item

Change Session

No Yes

PER: Problem Solving--G

Order

18

Comment:

Representations cluster

Update

PER: Exploring problem solving approaches and skills

Abstracts Submitted (# 16) | Abstracts You Have Reviewed: 16

Abstract Title: Can analogical reasoning help students learn to solve synthesis problems? 5456

Paper Type: Contributed

Author: Daniel R. White
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Improving students' skills in solving synthesis problems, which are problems requiring the application of multiple concepts such as energy conservation and kinematics, is typically a key instructional goal. We have previously found that students struggle with some synthesis problems more than their single-concept counterparts in part because of difficulty recognizing all the relevant concepts or that multiple concepts are needed. Analogical reasoning, which involves practice activities that guide students through comparisons of the deep structure of physics problems, is a promising technique for helping students recognize relevant concepts in novel problems. We report on a couple experiments testing simple implementations of analogical reasoning and show that these activities can be effective in improving student performance on synthesis problems. However, we also show evidence that these activities may not be as useful in cases where concept recognition is a less significant bottleneck.

You have submitted comments on this item

Change Session

No Yes

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Order

5

Comment:

Representations cluster

Update

Abstract Title: Elective Recitation Sections in Freshman E&M Courses 5273

Paper Type: Contributed

Author: Steve McCauley
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Students from twenty-three departments on the Cal Poly Pomona campus are required to take Freshman physics service courses. Many of them struggle to succeed. Introductory physics courses at Cal Poly Pomona do not normally include any recitation sections focused on concepts and problem solving skills. We present data that we used to assess the effectiveness of elective recitation sections designed to accompany our Freshman E&M course.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Update

Abstract Title: Eye gaze patterns while viewing visual cues and video solutions 5468

Paper Type: Contributed

Author: Tianlong Zu
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zutianlong@gmail.com

Transfer of learning is a valued educational goal, but it is usually hard to achieve. Visual cues and video solutions have been shown to facilitate this process. Students from an algebra-based physics class participated in our study. Each participant solved two different sets of tasks. In each set students solved one initial task, completed an intervention depending upon condition, and then solved a near transfer and far transfer task. Students were randomly assigned to one of three conditions. The visual cue condition completed four isomorphic training tasks with visual cues. The video solution condition was shown multimedia solutions of two isomorphic tasks. The third condition completed two isomorphic training tasks with visual cues and were shown one multimedia video solution. We compared the eye movements on the initial, near transfer and far transfer tasks in the three conditions.

Footnotes: Supported in part by NSF grant 1348857.

You have submitted comments on this item

Change Session

No Yes

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Order

1

Comment:

Tech cluster

Update

Abstract Title: How do Multimodal Hints Affect Conceptual Physics Task Solving? 5351

Paper Type: Contributed

Author: Xian Wu
116 Cardwell Hall
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xian@phys.ksu.edu

Students' visual attention on conceptual physics tasks with diagrams can provide us insight into how multimodality hints affect students' task performance on conceptual physics tasks. We conducted a 2 (visual hint or not) × 2 (text hint or not) × 2 (audio hint or not) full factorial experiment design. One hundred sixty-two subjects from a conceptual physics class were recruited to participate in individual clinical interviews with randomly assigned multimodal hints according to the condition. All of the interviews were video and audio recorded. An eye tracker was used to record the subjects' eye movements. The data were analyzed to compare how the experimental conditions affected performance on conceptual physics tasks and their visual attention in relevant areas on the task diagram.

Footnotes: This research is supported in part by the U.S. National Science Foundation under Grants 1348857 and 1138697. Opinions expressed are those of the authors and not necessarily those of the Foundation.

You have submitted comments on this item

Change Session

No Yes

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Order

2

Comment:

Tech cluster

Update

Abstract Title: Identifying Student Difficulties In Causal Reasoning 5121

Paper Type: Contributed

Author: Lindsay Owens
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There has been an increasing push for the refinement of curricula in university level algebra-based and calculus-based physics classes to focus on scientific reasoning skills. There are nine recognized domains of scientific reasoning, and this study focused on the causal reasoning domain. Quantitative data were gathered from selected items given as part of the Inventory of Scientific Thinking and Reasoning (iSTAR) assessment at the beginning and end of two semesters. The focus of this analysis was to identify student difficulties in making causal judgements. Initial results from the data suggested that students entangle forward and reverse causality statements; they often selected a forward causal statement "X causes Y" and a reverse causal statement "Y causes X" simultaneously to explain some observed result.

You have submitted comments on this item

Change Session

No Yes

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Order

6

Comment:

Representations cluster

Update

Abstract Title: Introductory Physics Students' Perception of Worked-Out Problem Solutions 5349

Paper Type: Contributed

Author: Shih-Yin Lin
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hellosilpn@gmail.com

Worked examples are common instructional tools used in the teaching and learning of problem solving. As part of a larger study to explore how worked examples could be designed and used effectively to facilitate student learning, we investigate how students perceive features in worked examples that are designed to model expert-like problem solving strategies. Thirty students enrolled in an introductory physics course were provided with different instructor solutions for the same physics problem and asked to discuss the features they noticed from these solutions. They were also asked to discuss how important each of these features was when solving physics problems as well as whether they would like to see these features included in worked out examples provided to them. We will present the findings.

You have submitted comments on this item

Change Session

No Yes

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Order

7

Comment:

Representations cluster

Update

Abstract Title: Probing students' mathematical difficulties in introductory physics 5307

Paper Type: Contributed

Author: David E. Meltzer
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david.meltzer@asu.edu

Instructors often report apparent difficulties among introductory university physics students with mathematical skills and concepts normally taught in high school or earlier. As part of a systematic effort to identify and address such difficulties, we have begun to investigate skill levels with trigonometry, basic algebra, symbolic manipulation, and vector concepts, among students in algebra- and calculus-based introductory physics. We will present a summary of our initial results, and outline a strategy for addressing these difficulties within the context of physics classes themselves.

Footnotes: Supported in part by NSF DUE #1504986.

You have submitted comments on this item

Change Session

No Yes

PER: Examining content understanding and reasoning--G

Order

Comment:

Update

Abstract Title: Prompted evaluation in calculus based introductory physics 5617
Paper Type: Contributed
Author: MacKenzie Lenz
310 Weniger Hall
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5036795071 (p)
lenzm@oregonstate.edu
Physics instructors generally expect students to think about the correctness and reflect on the meanings of their answers. This answer evaluation process may include a variety of considerations, including checking units, looking at limiting cases, and thinking about the reasonableness of numbers. In order to encourage answer evaluation, instructors explicitly prompt for it in class assignments. We examine students' responses to such a prompt on homework and exam problems in a large enrollment first term calculus-based physics course. We will discuss the distribution of strategies students used, student performance with these strategies, and the extent to which the development of answer evaluation skills was supported throughout the course.

You have submitted comments on this item

Change Session
No Yes
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Order
7
Comment:
Representations cluster

Update

Abstract Title: Purpose of Representation Use in Modeling Instruction Physics 5458
Paper Type: Contributed

Author: Daryl McPadden
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Representations (i.e. graphs, equations, pictures) are the foundational tools that students use to understand and solve physics problems. This study aims to understand the purpose with which students use particular representations. In the Modeling Instruction courses, representation use is a primary focus with explicit class time spent on introducing, practicing, coordinating, and applying multiple representations. Consequently, we conducted pre/post think-aloud, problem-solving interviews with groups of students in the Modeling Instruction – Electricity and Magnetism (MI-E&M) course. In each recorded interview, students were asked to solve three physics problems, which varied by context (mechanics and E&M), difficulty, and familiarity with the topic to show the breadth of how students use representations when problem solving. From video analysis and coding, we will present the common themes and purposes with which students use various representations.

Conflicts: Cannot be scheduled with the Graduate Student Topical Discussion or Graduate Student Professional Development Session as I am co-organizing these sessions.

You have submitted comments on this item

Change Session

(•) No ( ) Yes

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

Order

8

Comment:

Representations cluster

Update

Abstract Title: Reading between the lines: lab reports help develop scientific abilities 5188

Paper Type: Contributed

Author: Danielle Bugge
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Science practices are an integral part of learning science. Over the course of the 2015-2016 school year, high school physics students, initially unfamiliar with an inquiry-based environment, engaged in ISLE labs that focus on the development of student scientific abilities. Based on the last year's investigations, we know that factors such as time, ability type, student grouping, and instructor influence student development of scientific abilities. This year, we are continuing to examine student lab reports in order to better understand the process students go through when they write these reports. The revision history feature of the Google Documents provides insight into development of discourse as well as collaboration amongst students. We also continue to investigate differences in individual and group reports and students' self-assessments and reflections of their progress in development of these different abilities.

You have submitted comments on this item

Change Session

No Yes

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

Order

11

Comment:

Update

Abstract Title: Students learning to coordinate mathematical and physical models in biology 5522

Paper Type: Contributed

Author: Matthew E. Lira
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melira42@gmail.com

In science, mathematics facilitates theory building and experimental design. In science education, however, learning with mathematics can degenerate into students memorizing equations and algorithms without connecting these formalisms to meaningful representations of science concepts. By leveraging the theory of Knowledge-in-Pieces, I will present a study that illustrates how students learn to coordinate conceptual knowledge of mathematical and physical models in biology education. I report on how undergraduate physiology students used a multi-representational learning environment to coordinate their knowledge and how an innovative assessment reveals their learning through a pre-/post- design. Analysis of

students' talk and eye-movements provided contrasting cases—some students learned to coordinate the physical quantities and others did not. Despite the cases contrasting, students' performance on the written assessment revealed similar growth. These finding suggests that multiple pathways to success exist. At the same time, these findings call our attention to the role that modality plays in assessment.

Conflicts: I will be traveling from another conference that ends on July 17th; I will therefore arrive on the 17th.

You have submitted comments on this item

Change Session

No Yes

PER: Problem Solving--G

Order

16

Comment:

Representations cluster

Update

Abstract Title: The impact of students' epistemological framing and beliefs on a task requiring representational consistency 5038

Paper Type: Contributed

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mariesau@ucmail.uc.edu

The ability to flexibly transform between different representations (e.g., from mathematical to graphical representations) of the same concept is a hallmark of expertise. This ability is often lacking in many introductory students as evidenced by the lack of consistency in students' representations (i.e., students construct two representations for the same concept in the same situation that are not consistent with one another). In this study, we asked students to construct two representations for the electric field for a situation involving spherical symmetry (charged conducting sphere surrounded by charged conducting spherical shell). This type of problem has been found to result in many students constructing representations that are not consistent with one another. Here, we present findings from individual interviews with students which suggest that students' lack of consistency may partly be attributed to the type of knowledge that the graphical and mathematical contexts trigger. Using the epistemic games framework terminology, the two representations students

are asked to construct (mathematical vs. graphical) may lead them to play two different epistemic games. We discuss how students' epistemological framing and beliefs may contribute to their lack of representational consistency.

Footnotes: Work supported by the National Science Foundation

You have submitted comments on this item

Change Session

No Yes

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

Order

9

Comment:

Representations cluster

Update

Abstract Title: Using phenomenography to better understand student development with computational physics 5516

Paper Type: Contributed

Author: Michael J. Obsniuk
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obsniukm@msu.edu

In Projects and Practices in Physics -- a highly interactive and technologically modern introductory physics classroom with a strong pedagogical foundation -- students are exposed to fundamental physics phenomena with the aid of computation. Within the context of this classroom, we have conducted a phenomenographic investigation of a small cohort of students. This cohort was exposed in-class to a "suite" of three scaffolded computational physics problems focusing on the fundamental physics phenomenon of force and motion. Over the three week duration of this "suite," we invited the cohort to repeated semi-structured interviews, one for each problem, in order to observe their development in approach to computational problems. From an analysis of the students' perceived variation in the computational features discerned to be critical, we have observed several qualitatively different categories of student development with modeling motion computationally.

You have submitted comments on this item

Change Session

No Yes

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

Order

3

Comment:

Tech cluster

Update

Abstract Title: Using Spaced Recall to Encourage Expert Practice 5259

Paper Type: Contributed

Author: Eugene T. Torigoe
Thiel College
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Introductory physics students were shown an example problem and asked to recall the solution from memory over a period of weeks, with feedback after each attempt. The structure of this activity was designed to reward expert practices that benefit the long-term retention of information. For example, reasoning with a diagram to form the proper equation, rather than just memorizing the equation. This talk will discuss the performance of a class of 15 students throughout an entire semester, as well as the analysis of four videotaped interviews.

You have submitted comments on this item

Change Session

No Yes

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

Order

10

Comment:

Representations cluster

Update

Abstract Title: Using the C3PO interface to develop and modify computing coaches. 5653

Paper Type: Contributed

Author: Susan M. Kasahara
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Improving students' problem-solving skills is a basic goal of many college-level introductory physics courses. At the University of Minnesota, investigators have developed computer programs designed to provide students with coaching to help them become better at solving problems in an introductory college physics course. As a physics instructor at Normandale Community College, I am participating in a study to test the feasibility of using this computer coach interface to modify existing coaches and create new coaches suitable for students enrolled in the introductory physics classes at Normandale and to assess their usability and educational impact with Normandale students. In this talk I will report on my initial experience with using C3PO: Customizable Computer Coaches for Physics Online to create and modify physics computing coaches.

You have submitted comments on this item

Change Session

No Yes

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

Order

4

Comment:

Tech cluster

Update

Abstract Title: Using the Cognitive Reflection Test to investigate student reasoning inconsistencies* 5457

Paper Type: Contributed

Author: Nathaniel C Grosz
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701-471-0998 (p)
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Students who demonstrate correct conceptual knowledge and formal reasoning approaches on one physics question often abandon these approaches in favor of more intuitive reasoning on an isomorphic question. The heuristic-analytic theory of reasoning suggests that the intuitive approaches used by these students stem from the heuristic process and are cued by salient, distracting features of the isomorphic problems. This apparent failure to engage the analytic process productively may stem from a lack of metacognition. We speculate that the students who continue to use formal reasoning on the isomorphic problems tend to be more reflective, analytical thinkers. In order to investigate this possibility, we have been using the Cognitive Reflection Test (CRT) in conjunction with a pair of isomorphic questions to examine the extent to which students' reflection abilities impact performance.

Footnotes: *This material is based upon work supported by the National Science Foundation under Grant Nos. DUE-1431857, 1431940, 1432052, and 1432765.

You have submitted comments on this item

Change Session

No Yes

PER: Problem Solving--G

Order

17

Comment:

Representations cluster

Update

PER: Modeling student engagement

Abstracts Submitted (# 12) | Abstracts You Have Reviewed: 12

Abstract Title: "Stupidity in Science" - NOS Lesson or Balm for Inquiry Angst?* 5361

Paper Type: Contributed

Author: Andy P. Johnson
Black Hills State University
CAMSE, 1200 University

Spearfish, SD 57799-9005
605-642-6508 (p)
andy.johnson@bhsu.edu

Students in research-and-inquiry-based physics courses tend to feel uneasy with the lack of answers from the professor or textbook. Years of traditional schooling teach students to seek answers outside of their own reasoning. Also, students tend to bring to our classrooms unproductive views of science as being about "right answers" and they discount sense-making. Despite our efforts to encourage students to take risks and rely on their wits, many students feel unease about their ideas because they are not from authorities. Martin Schwartz addressed a similar concern among scientists in his essay "The importance of stupidity in scientific research". In this article Schwartz frames ignorance or stupidity as the essential driver of scientific research. We have investigated changes in student affect that result from reading this article as a homework assignment and find that, while students often misunderstand the point of the article, their feelings about the course improve considerably.

Footnotes: *The Inquiry into Radioactivity Project has been supported by NSF DUE grant 0942699. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

You have submitted comments on this item

Change Session

No Yes

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

Order

5

Comment:

Update

Abstract Title: Assessing difficult to assess learning goals - formative feedback in P3 5241

Paper Type: Contributed

Author: Paul W. Irving
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1310A Biomedical and Physical Sciences Building
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paul.w.irving@gmail.com

P3 is a transformed introductory mechanics course at Michigan State University that focuses on the development of scientific practices. The design team, as part of the P3 course design made explicit attempts to assess learning goals that can often be perceived as being a part of the hidden curriculum or considered difficult to assess (for example: learning to work productively in a group). This assessment is in the form of formative feedback with students receiving a numbered grade and reflective commentary based around their interactions in the classroom for the week. In this presentation, case studies formed from student interviews conducted at the beginning and end of the semester are discussed to highlight how the formative feedback received, effected changes in student interactions in class. The presentation also highlights students' reflections on the feedback and how the effect it had on them changed over time.

You have submitted comments on this item

Change Session

No Yes

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

Order

4

Comment:

Group cluster

Update

Abstract Title: Characterizing how students group themselves for group exams 5215

Paper Type: Contributed

Author: Joss Ives
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When using ad hoc student groups for group exams, how do students group themselves? Are there clear preferences for grouping by sex, ability in the course or years in university? In courses with multiple opportunities to form these ad hoc groups, do these preferences change as the course proceeds? This research is part of a larger study investigating the factors that contribute to group success, both in terms of the group's performance on that group exam as well as the performance of individuals on later assessments.

You have submitted comments on this item

Change Session

No Yes

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

Order

1

Comment:

Group cluster

Update

Abstract Title: Group formation on physics exams 5430

Paper Type: Contributed

Author: Steven F. Wolf
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wolfs15@ecu.edu

As our classrooms become more active and collaborative, we need to consider ways that our assessments can take on the same active and collaborative spirit that our classes have. One way that has come into practice is through the use of group exams. We hypothesize that student groupings are embedded within exam response data giving us an assessment of our students' social profiles. This makes group exam response data an untapped resource which can tell us more about our students than their score on an exam. Using a duplicate exam format, we are developing a method for analyzing group formation for a particular exam using the framework of network analysis. This method will be compared to self-reported student grouping data for verification. Looking forward, we will consider questions such as, "Who do I need to work harder to include in the class?" and "Who might make a good LA?"

You have submitted comments on this item

Change Session

No Yes

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

Order

2

Comment:

Group cluster

Update

Abstract Title: Longitudinal study of students' participatory habit in active learning classrooms 5591

Paper Type: Contributed

Author: Binod Nainabasti
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7863043125 (p)
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Students' interactions can be an influential component of their success in an interactive learning environment. From a participation perspective, learning is viewed in terms of how students transform their participation. However, many of the seminal papers discussing the participationist framework are unclear on specific details about how students change their level of engagement in an active learning environment over time. As part of a larger project to understand the role of student participation in learning, we have gathered data that allowed us to quantify students' participation in active learning introductory physics classes structured around the Investigative Science Learning Environment (ISLE) philosophy. Using classroom observations, and students' self-reported network data of collaboration, we quantified students' participation in two settings of the class throughout two semesters. We examined how students change their participative behavior throughout two consecutive semesters and found that active learning without other intervention is insufficient for transforming students' participation.

You have submitted comments on this item

Change Session

● No ○ Yes

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

Order

6

Comment:

Group cluster

Update

Abstract Title: Performance and Active Engagement through the Lens of Classroom Networks 5384

Paper Type: Contributed

Author: Eric A Williams
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Theories developed by Tinto and Nora identify academic performance, learning gains, and student involvement in learning communities as important facets of student engagement that support student persistence. Collaborative learning environments, such as those employed in the Modeling Instruction (MI) introductory physics course, are considered especially important. Due to the inherently social nature of collaborative learning, we examine student social interactions in the classroom using Network Analysis methods to analyze a survey administered periodically in class. We then calculate centrality, a family of measures that quantify how connected or "central" a particular student is within the classroom social network. Building on previous work indicating relationships between classroom interactions and performance, we investigate this relationship further to better understand how student engagement manifests in the context of a large-scale MI course at Florida International University.

You have submitted comments on this item

Change Session

No Yes

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

Order

3

Comment:

Group cluster

Update

Abstract Title: Research on Identity Trajectories in Undergraduate Research Experiences 5087

Paper Type: Contributed

Author: Gina M. Quan
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4088230123 (f)
gina.m.quan@gmail.com

In this talk, we analyze shifts in students' identity trajectories as undergraduate physics majors participating in their first research experiences. Students in the study participated in an elective seminar in which they were paired with graduate student and faculty mentors on physics research projects and participated in a weekly discussions about research. Using video data from student interviews, classroom observations, research mentor interviews, and research observations, we study the development of students' identity trajectories. Relational dynamics between students and other members of the physics community contributed to the legitimization and delegitimization of students' physics identities. We highlight shifts in how students positioned themselves, and were positioned by others as more and less central members of the physics community. Finally, we draw out connections between student trajectories, and discuss implications for future research and programmatic design.

You have submitted comments on this item

Change Session

No Yes

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

Order

8

Comment:

Update

Abstract Title: Splits in students' attitudes toward classical and quantum physics 5342

Paper Type: Contributed

Author: Benjamin William Dreyfus
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Department of Physics
College Park, MD 20742-2421
917-821-2405 (p)

dreyfus@umd.edu

Instruments that measure students' attitudes and epistemological beliefs about physics often assume implicitly that "physics" is monolithic. That is, while there are multiple dimensions to student attitudes, physics itself is treated as a single discipline. We administered a survey in modern physics courses for engineering students, with modified CLASS (Colorado Learning Attitudes about Science Survey) survey items in which "physics" was changed to "classical physics" and "quantum physics," and found significant splits between students' self-reported attitudes toward classical and quantum physics, both pre- and post-instruction. Specifically, students display greater evidence of real-world connections and problem-solving sophistication with classical than with quantum physics. We also found that, under some conditions, quantum physics instruction was associated with a pre/post shift in attitudes toward classical physics.

Footnotes: This work is supported by NSF-DUE 1323129 and 1322734.

You have submitted comments on this item

Change Session

No Yes

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

Order

7

Comment:

Update

Abstract Title: Student positioning in an inquiry-based physics content and methods course 5127

Paper Type: Contributed

Author: Enrique A. Suarez
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School of Education
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This PER study focuses on university students in the physics content and pedagogy course, Energy and Interactions (formerly Physics and Everyday Thinking). By design, this course prepares future teachers and fulfills an undergraduate science requirement, thus enrolling students from a wide range of experiences and comfort with science content, from confident

to struggling. The course is driven by students as they co-construct principles from lab-based evidence. This study asks how students describe and position themselves as learners in this environment, and how their positioning changes as they engage with different kinds of activities. We analyze students' weekly reflections and conceptual assessment scores. Preliminary results indicate that students are at first resistant to this student-driven model, but quickly start reporting feeling more confident in their abilities and reasoning, and begin valuing co-constructing knowledge with peers. We will present results and make inferences about how course components influence this shift in positioning.

You have submitted comments on this item

Change Session

No Yes

PER: Modeling student engagement--G

Order

Comment:

Update

Abstract Title: Students' problem solving in an upper division Electromagnetic Field course 5295

Paper Type: Contributed

Author: Hai D. Nguyen
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As part of their upper-division electromagnetic fields course, students work in small groups to solve physics and mathematics problems during class. We categorize their epistemological framing along two orthogonal axes -- physics to math and algorithmic to conceptual -- to determine how shifts in students' framing interact with the instructor's framing and the problem at hand. Drawing from observational video data of classroom interactions, we characterize framing shifts over 50 episodes throughout two iterations of the course, seeking both diversity of student responses and diversity in problem type and duration. In this talk, we present our framework and some preliminary results.

You have submitted comments on this item

Change Session

No Yes

PER: Problem Solving--G

Order

Comment:

Update

Abstract Title: Traditional physics vs IPLS: Comparing student experiences 5608

Paper Type: Contributed

Author: Haley Gerardi
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At Swarthmore College, we recently introduced a first-semester Introductory Physics for the Life Sciences (IPLS) course that draws on authentic biological examples relating to kinematics, Newtonian mechanics, and thermodynamics. Because the course is offered only every other year, we are uniquely situated to compare the experiences of those students who take the IPLS course to a similar set of students who take a traditional first-semester introductory physics course that covers the same topics but does not foreground biological connections. In this talk we draw on conceptual and attitudinal survey data, as well as a series of case-study interviews, to describe the conceptual, epistemological, and affective differences that we observe between the two student populations. We identify the features of the IPLS experience that were most salient to students, and suggest how particular course structures may have been especially important in supporting students' ability to do well in the IPLS environment.

Conflicts: This talk is one of two paired talks contributed to the "PER: Modeling student engagement" session. The other talk is: Geller et al., "The source of student engagement in IPLS." Please, if at all possible, place these two talks back-to-back during the session. Thank you.

You have submitted comments on this item

Change Session

No Yes

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

Order

9

Comment:

Update

Abstract Title: Using Clickstream Analysis to Understand Student Peer Evaluation 5425

Paper Type: Contributed

Author: Scott S. Douglas
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Peer grading of student work has been used extensively in large-enrollment courses, but this evaluative practice has not yet been deeply explored in the context of student work submitted as videos. Georgia Tech has run three semesters of an introductory mechanics course in which students were required to create lab reports as videos and post them online. We investigate student grading behaviors by comparing students' ratings of peer-produced lab reports with the students' online (clickstream) interactions with those lab reports during the grading process. We discuss particular features of the peer-grading process which may influence student ratings and engagement.

You have submitted comments on this item

Change Session

No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Update

Physics Majors: High School to Doctorate

Abstracts Submitted (# 0)

Pre High School

Abstracts Submitted (# 0)

Science and Society

Abstracts Submitted (# 2) | Abstracts You Have Reviewed: 0

Abstract Title: Experiments with a New Wind Delivery System 5644

Paper Type: Contributed

Author: Charles F. Niederriter
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Traditional wind turbines are considered by many to be an excellent way to turn energy from the sun into electricity. But, there are a number of problems that increase the expense of installing and maintaining them and reduce their effectiveness. Many of these can solved by using the Involex wind delivery system to bring moving air down to the surface and increase its velocity in a venturi system before some of its kinetic energy is extracted with a small turbine. While this new approach continues to be developed, students at Gustavus Adolphus College have built a demonstration system which is being used to conduct experiments and explore the system's effectiveness. The authors will describe the wind delivery system, the experiments that have been developed, and preliminary results.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Solar Lantern Camp in Guatemala 5521

Paper Type: Contributed

Author: Mary M. Brewer Sherer
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A team of physics faculty and students from William Jewell College spent four days with Mayan students in Guatemala teaching them to build solar lanterns for homes without electricity. The students developed the lanterns to be inexpensive, low maintenance, easy to assemble, and built form components that were either available in country or easily brought in. In conjunction with Xela AID, physics students held a four day science and technology camp that included teaching the Mayan students to build the lantern, including teaching electronics, soldering, and the basics of solar energy. Each student built their own lantern to take home.

Change Session

No Yes

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

Order

Comment:

Submit

Teacher Training/Enhancement

Abstracts Submitted (# 8) | Abstracts You Have Reviewed: 0

Abstract Title: A New Online Master's Program in Physics for High School Teachers 5494

Paper Type: Contributed

Author: William G. Newton
Texas A&M University-Commerce
Department of Physics and Astronomy
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William.Newton@tamuc.edu

In Spring 2014 we began to develop a new Master's in Physics with Teaching Emphasis aimed at in-service high school teachers. We have developed 6 brand new Master's level courses in physics aimed specifically at teachers, and are in the process of transferring them online. The aim is to support physics teachers for whom physics was not their major subject by reinforcing their content knowledge, giving them access to physics education research, teaching them the background necessary to discuss with their students the current hot physics topics that make the popular media, and providing a forum for teachers to share teaching strategies and material. In this talk we discuss the strategies employed in the classes so far, their content, and early outcomes.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Design and evaluation of campus-wide professional development program in STEM 5366

Paper Type: Contributed

Author: Alistair G. McInerny
North Dakota State University
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Fargo, ND 58102
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Alistair@Mcinerny.org

A North Dakota State University team of faculty is designing, implementing, and evaluating a sustainable campus-wide professional development program to help faculty maximize instructional effectiveness by building expertise in student-centered practices. As part of the program, we are developing a sequence of workshops that is helping create faculty learning communities and provide support for ongoing collaborations. A variety of instruments are being used to assess the effectiveness of our efforts. Pre-post-retrospective surveys are being used to probe how attitudes, subjective norms, and perceived self-efficacy predict faculty intentions to implement active learning pedagogy. Four repeated-measures ANOVAs are determining differences between each construct across the three time points. In addition, linear regression is being used to determine the ability of attitudes, norms, and self-efficacy to predict intentions. Preliminary results will be presented and implications for the design, implementation, and evaluation of professional development programs will be discussed.

Change Session

(•) No ( ) Yes

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

Order

Comment:

Submit

Abstract Title: Discovering and eliminating flaws in physics test questions 5158

Paper Type: Contributed

Author: Jesse J. Miner
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A physics test should measure a student’s content knowledge and problem solving skills. However, a student’s performance on a poorly-constructed test may actually measure, e.g., reading comprehension, socioeconomic status, or equation matching. In large-scale assessment, standard practice for test development includes several levels of independent reviews that look beyond test content to find possible distractions within test questions that could skew results. I will present sample test questions that, while appearing to be reasonably well-written, have subtle flaws that could potentially disadvantage some students, and describe strategies for eliminating such flaws. I will also discuss basic methods

for interpreting statistical performance of test questions, specifically addressing correlation between performance on a specific question to overall test performance to flag potentially flawed questions. This glimpse into the test development process will help teachers create robust tests that accurately measure student understanding.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Framework for Evaluating Teacher Discourse during Professional Development 5476

Paper Type: Contributed

Author: Alice M. Flarend
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High quality professional development activities tend to involve teachers actively engaged in small group discussions. A question remains about what professional development providers (and classroom teachers) should look for as their “students” work in these groups in order to assess the success of these discussions. Discourse analysis is a promising methodology for gathering evidence of productive conversations. This presentation will provide a framework for classifying the discourse of small group talk into increasing levels of learning potential. Findings about the structure of professional development activities that lead to productive discourse will also be discussed.

Conflicts: I am really not sure what topic this belongs in. It could also go in a PER category

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Hands-on Physics Demos - a new approach. 5209

Paper Type: Contributed

Author: James Lincoln
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LincolnPhysics@gmail.com

Physics Demos must now be in the hands of students. Current Physics Education Research Demands Interactive Learning! But, how can we change our old demonstrations to make this possible? In this talk, I outline how to do this effectively, and how to get the most out of Physics Demos, which help blur the line between laboratory and activity, making the classic demos more engaging and active in order to reach more students, while at the same time highlighting new demos that you probably don't know about.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Integrating a Learning Community of Learning Assistants and Teaching Assistants 5544

Paper Type: Contributed

Author: Manher Jariwala
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At Boston University, the physics department supports both a robust undergraduate Learning Assistant (LA) program as well as the formal professional and pedagogical development of graduate students through participation in the CIRTL (Center for the Integration of Research, Teaching, and Learning) Network. We describe our recent efforts to integrate the pedagogical training of undergraduate LA's and graduate student TA's and to promote partnership in teaching between LA's and TA's, leveraging best practices from both the LA and CIRTL programs. We also provide examples of individual change agents that have emerged from each group and discuss the common elements and shared values between undergraduate and graduate students efforts.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Teaching Physics in a Blended Online Course for Science Teachers 5597

Paper Type: Contributed

Author: Vesal Dini
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This presentation describes in-service teachers' engagement and progress in scientific inquiry in a blended online learning environment. We analyze the shift that took place, from teachers following instructions to animating their own inquiry, and we characterize it at two levels: first, in how teachers engaged in sense-making; and second, in how they oriented to

the online community as a space for collaboration. Our findings illustrate that the teachers' entrance into and stability within disciplinary engagement was made possible by a shift in how they "framed" the course ? i.e., in how they understood and interpreted the purpose and activities of the course. This, we argue, was facilitated by a "responsive teaching" approach, which entailed attending to and building on learners' ideas and questions, caring for and responding to their emotions, and involving them in the design of the course.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: The OK PhysTEC Collaborative 5518

Paper Type: Contributed

Author: Steven J. Maier
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Alva, OK 73717-2799
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The OK PhysTEC Collaborative consists of the four PhysTEC member institutions of Oklahoma. The goal of the project is to increase the number of physics education candidates statewide over a three-year span. To do this, high school and undergraduate students are being recruited into physics and science education programs. In addition, support for travel to physics education conferences is offered to high school teachers, undergraduate physics students, and in-service physics teachers. Participating institutions include Northwestern Oklahoma State University (lead institution), East Central University, Oklahoma State University, and Southwestern Oklahoma State University. Recruitment efforts to date will be reported, along with summaries of enrollments, program changes motivated by the project, and challenges that remain.

Footnotes: The OK PhysTEC project is supported by a PhysTEC Recruitment Grant

Conflicts: Please do not schedule at the same time as Peter Wesley Odom's poster/paper.

Change Session

No Yes

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

Order

Comment:

Submit

Technologies

Abstracts Submitted (# 6) | Abstracts You Have Reviewed: 0

Abstract Title: An Optimized Garden Hose Horn. 5485

Paper Type: Contributed

Author: Daniel E. Beeker
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A common musical acoustics demonstration is to play a tune using a garden hose with an attached funnel. But determining which tube and funnel geometries work best is not a well defined task. To better understand the differences between the "real" instrument and the hose horn we model the acoustic input impedance of a simple tube with conical horn attached using discrete acoustic elements. We then search for a geometry that best matches the impedance of a typical orchestral horn. Ultimately, to determine if our efforts are successful, we build and play a hose horn based on our models.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Electronic Lab Notebooks using Blackboard, Microsoft Word, and Livescribe Pens. 5060

Paper Type: Contributed

Author: Adam C Lark
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In this new digital age, students are far more accustomed to typing documents than writing documents by hand. Despite this, laboratories have typically had difficulty moving to electronic documents. Equations and diagrams are simultaneously an essential part of a lab notebook and difficult to generate digitally. I propose a way of using Blackboard, Microsoft Word, and Livescribe pens to implement electronic lab notebooks in a lab setting. Blackboard is used to administer the electronic documents, Microsoft Word to compose the document, and Livescribe pens to easily digitize equations and diagrams. With this system, the introductory physics laboratories at Hamilton College have accomplished electronic lab notebooks successfully through the past year.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Preference Voting and Clickers 5452

Paper Type: Contributed

Author: Stephen C. Parker
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The use of clickers in the classroom has become a ubiquitous presence in many Physics departments. The ability to poll students and receive instant feedback histograms has helped to guide the discussions in many of our classes. Instead of just voting for a single choice, we have explored the idea of using "preference voting" to rank the various options from worst to least. A computer program has been created to help compile the responses from the clicker software. It then uses a variety of different vote counting schemes to attempt to select the overall winner. In a cruel twist of the mathematical pen* though, the "winner" can vary depending on the method used to actually count the votes. With the use of clickers and the computer program, we can see this effect happen "live" with real time voting situations.

Footnotes: *Excursions in Modern Mathematics, 5th Edition, Peter Tannenbaum

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Use of Arduino Mega 2560 R3 Board in the Automation of a Green House
5481

Paper Type: Contributed

Author: Mahmoud M. Al-Kofahi
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In this work, an Arduino Mega 2560 R3 is used to automate the green house of Baker University, Kansas. This includes monitoring and controlling soil moisture and PH, light intensities, and temperature. Growth of plants are monitored by video/ image capture at preset periods of times, and recorded on a Data Logging Shield equipped with its own memory card. A copy of the logged data is transmitted wirelessly by XBee Pro 60mW Antenna to the base computer at the Biology Department. The system focuses on monitoring and controlling of all parameters of interest and on data collection. It allows for watering the plants using electromechanical solenoid valves controlled by the Arduino board; and also allows for controlling light intensities and temperature inside the green house. Complete documentation of algorithms, materials used, methods, programming, and integration of the whole project is reported here in this paper.

Conflicts: Please use the following for the header of the paper: Authors: C. Chapman1, B. Edison1, E. Johnson1, M. Harman1, N. Zayyad1, J. Seybert1, C. Watters1, R. Emme1, T. Sylva1, E. Vila1, R. Sivron1, W. Miller2, D. Russell2, and M. Al-Kofahi1, 1) Department of Physics, Baker University, Baldwin City, KS 66006, USA. 2) Department of Biology, Baker University, Baldwin City, KS 66006, USA.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Video Analysis for Physics Experiments 5197

Paper Type: Contributed

Author: Kerem Ekinci
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2819063934 (p)
kekinci@harmonytx.org

Video Physics brings automated object tracking and video analysis to iPhone, iPod touch, and iPad. Capture video of an object in motion, then tap to track the object automatically. Video Physics instantly creates trajectory, position, and velocity graphs for the object. Video Physics is perfect for science students and instructors. Perform on-the-go analysis of interesting motion. Measure the velocity of a child’s swing, a roller-coaster, or a car. Or, take a video of a basketball free throw shot. Video Physics will display the path of the ball and

provide graphs of y vs. x as well as the x and y position and velocity as a function of time.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Wave Shaping by Guitar Amplifier Tubes 5061

Paper Type: Contributed

Author: David Keeports
Mills College
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Oakland, CA 94613
(510) 430-2162 (p)
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It is commonly claimed that overdriven tube guitar amplifiers produce sound superior to transistor amplifiers because tube amplifiers produce prominent second harmonics while transistor amplifiers produce prominent third harmonics. In my previous talk, I provided evidence for the validity of this claim by inputting sine waves and examining overdriven tube and transistor output in the frequency domain. In this talk, I will consider tube output in the time domain. Surprisingly, output wave shapes at speakers for tubes are often considerably more complex than wave shapes predicted from tube function. Output from a very simple tube preamp built by one of my students provides a convincing explanation of this difference.

Change Session

No Yes

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

Order

Comment:

Submit

Two Year Colleges

Abstracts Submitted (# 3) | Abstracts You Have Reviewed: 0

Abstract Title: Assessing a Course Text Book 5419

Paper Type: Contributed

Author: Heidi Wainscott
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USAF Academy, CO 80840
719-460-1424 (p)
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At the university where I teach we reevaluate our course text about every five years to make sure that it is meeting the needs of both the students and instructors. I will walk you through our most recent review of several standard introductory physics texts. The discussion will cover; our review criteria, the scope of the review, how we involved both students and faculty in the review, and our results. If you are considering a new course text, our recent work in this area may be of use to you.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: New York Times Automotive Article Applications which help teach physics 5667

Paper Type: Contributed

Author: John P. Cise
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Since 2007 I have been using New York Times articles with physics applications to help teach physics. The New York Times has many sections (Sports, Automotive, Science, Space, Astronomy, etc.) with articles containing physics applications. Articles & related graphics are placed in WORD then edited to fit on one web page. More graphics are added. Also added are: Introduction, questions, hints, and answers. The one page WORD document is saved as a pdf file and uploaded to the authors N Y Times application site. About 800 physics applications can be found at: http://CisePhysics.homestead.com/files/NYTCisePhysics.pdf The site specific to this paper on "NY Times Automotive Article Applications which Help Teach Physics" is: http://CisePhysics.homestead.com/files/NYTAuto.pdf The author uses the N Y Times Applications for: Introduction to new concepts, quizzes, extra credit, and test questions. Students and author enjoy these current physics news applications.

Conflicts: Sorry this is submitted 6 hours later than deadline Date February 18. I hope you can still add my talk to main part of meeting please. Thanks John Cise

Change Session

(•) No ( ) Yes

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

Order

Comment:

Submit

Abstract Title: Successful STEM Student Pathways: A two- and four-year partnership 5554

Paper Type: Contributed

Author: Charles J DeLeone
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Physics Dept
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cdeleone@csusm.edu

Many geographically related two- and four-year institutions share a large percentage of their students. However, most two- and four- year institutions have weak STEM-specific linkages between the institutions despite the benefits of such linkages to the students. We have been engaged in a multi-year effort to strengthen the partnership between STEM programs at two regional institutions, California State University, San Marcos and Palomar College, with the goal of creating more coherent STEM pathways for students. This talk will focus on how the partnership has improved outcomes for students, including increases in the number of two-year students prepared in STEM domains, number of transfers, and the success of transfers within CSUSM STEM programs. An associated poster will provide more detail on the processes that brought about this change.

Footnotes: Supported in part by NSF-DUE#1068477

Conflicts: We have an associated poster (same author set). If possible, could that poster be scheduled after this talk?

Change Session

No Yes

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

Order

Comment:

Submit

Upper Division Undergraduate

Abstracts Submitted (# 11) | Abstracts You Have Reviewed: 6

Abstract Title: Classical Dynamics of a Particle in a One-dimensional Exponential Potential
5482

Paper Type: Contributed

Author: Satinder S. Sidhu
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Chestertown, MD 21620

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ssidhu2@washcoll.edu

Surprises lurk in the seemingly simple situation of a particle moving in one dimension, with potential energy increasing exponentially with distance from the origin. Force on such a particle also depends exponentially on the position coordinate. Since the magnitudes of potential and restoring force increase monotonically with distance from the origin, the time a particle released from rest takes to reach the origin is expected to show a similarly monotonic dependence on initial distance. The problem can be solved analytically, with the closed-form expression for this travel time involving only elementary transcendental functions. Surprise lies in the fact that this time first grows with the initial distance, reaches a maximum, and then declines for release points farther away. Implications of such a point-of-slowest-return for a classical non-linear oscillator consisting of a particle moving in a symmetrical potential well will be described via computational and analytical models.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Divergence of a vector field: Teaching strategies and learning difficulties 5278

Paper Type: Contributed

Author: Ricardo A. S. Karam
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It is quite well known that using vector differential operators in physics is challenging for students. In this work, we present an empirical study conducted at the University of Copenhagen that focused on didactic and cognitive aspects of the divergence of a vector field. Our data consist of videotaped lectures from the introductory course on vector calculus and interviews designed to identify students' main difficulties with understanding divergence. The results show that students struggle to connect the two most common definitions of divergence (partial derivatives in Cartesian coordinates and limit of a shrinking volume),

rarely associate divergence with flux density and provide several images from fluid mechanics when asked explain the meaning of divergence. Not surprisingly, this is clearly related to the instruction they had.

Conflicts: If possible, please schedule my talk for July 19 or 20.

You have submitted comments on this item

Change Session

No Yes

PER: Student Reasoning--G

Order

Comment:

Update

Abstract Title: Entanglement isn't just spin 5480

Paper Type: Contributed

Author: Daniel V. Schroeder
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8016266048 (p)
dschroeder@weber.edu

Schroedinger coined the term "entanglement" in 1935, but it took another 70 years for this vivid and useful word to make its way into most quantum mechanics textbooks. Even today we typically teach entanglement only in the context of spin systems, rarely mentioning the word when we discuss spatial wave functions. Meanwhile, when discussing wave functions of more than one variable, we almost always focus on those that factor into a product of single-variable functions, with no more than a passing mention of the vast variety of nonseparable wave functions. Yet for a two-particle system, these nonseparable wave functions are none other than the entangled states! Therefore, with only a minor modification to our teaching we can accomplish two important goals: avoid the common misconception that all wave functions are separable, and give students a more accessible introduction to entanglement.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Faraday Isolators and the Second Law of Thermodynamics 5162

Paper Type: Contributed

Author: Carl E. Mungan
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Physics Mailstop 9b
Annapolis, MD 21402-1363
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410-293-3729 (f)
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Consider a Faraday isolator: two optical linear polarizers whose transmission axes are oriented 45 degrees relative to each other, between which is located a magnetic rotator that turns the plane of polarization of a beam of light by 45 degrees in the same direction regardless of the direction of propagation of the light. That constitutes a one-way light valve, used to protect lasers from harmful back-reflections. Now place a sample inside a cavity whose walls are made of this stuff. Light gets out but not back in, right? If so, the sample would radiate away all its energy and cool down to absolute zero! How do we save the second law from this catastrophe?

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Framing Difficulties in Quantum Mechanics 5394

Paper Type: Contributed

Author: Bahar Modir
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Manhattan, KS 66506
7853209066 (p)
bahar@phys.ksu.edu

Researchers in student understanding of quantum mechanics have used the Difficulties framework to assess student reasoning, creating long lists of difficulties that span many topics in quantum mechanics. We seek an underlying structure to these difficulties. Using the lens of epistemological framing, we mapped descriptions of published difficulties into errors in epistemological framing and resource use. We analyzed descriptions of students' problem solving to find their frames, and compared students' framing to framing (and frame shifting) required by problem statements. We found three categories of error: mismatches between students' framing and problem statement framing; inappropriate or absent transitions between frames; and insufficient resource activation within an appropriate frame. Given this framework, we can predict the kinds of difficulties that will emerge for a given problem in quantum mechanics: a possible deeper structure to student difficulties.

You have submitted comments on this item

Change Session

No Yes

PER: Student Reasoning--G

Order

Comment:

Update

Abstract Title: Highlighting Two Prevalent Student Difficulties in Graduate Level Quantum Mechanics 5322

Paper Type: Contributed

Author: Christopher D Porter
The Ohio State University
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porter.284@osu.edu

In our work with Physics graduate students at The Ohio State University, we have examined several prevalent misunderstandings that persist well into graduate level quantum mechanics. Here we focus on two difficulties: drawing bound states in an asymmetric well, and the confusion between symmetry under particle exchange and reflection symmetry (parity). Difficulties in drawing bound states were noted at the graduate level as early as 2008. But we find the asymmetric well reveals a new class of misunderstandings, including the fundamental misuse of axes and symmetry. We note also that students have difficulty interpreting drawings of bound states. The confusion between exchange symmetry and parity is demonstrated with multiple types of student data including quizzes and conceptual assessments. Our efforts suggest that simple awareness of the issue and precision of language may be sufficient to correct the problem.

You have submitted comments on this item

Change Session

No Yes

PER: Student Reasoning--G

Order

Comment:

Update

Abstract Title: Is There Room for Computation in Undergraduate Physics Courses? 5413

Paper Type: Contributed

Author: Kelly R Roos
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3096772997 (p)
rooster@bradley.edu

In making the case for the integrated inclusion of computation into virtually every undergraduate physics course (I think it should be done!), I am often confronted with the (very reasonable) protest that there is critically important material that would have to be dropped in order to accommodate computer problem-solving and all the attending programming platform baggage. I believe that there is, in reality, much that can be dropped from the traditional typical undergraduate physics course, especially upper level ones, to

make room for the important marketable skill-building benefits of computation, without profoundly betraying the students' undergraduate physics preparation. Indeed, computation can, in many cases, provide better access to physical principles than a purely analytical approach. I will briefly describe a prototypical example, from the realm of quantum mechanical scattering, of a topic whose traditional mode of instruction should be dropped in favor of a computational treatment.

You have submitted comments on this item

Change Session

No Yes

Technologies--G

Order

Comment:

Update

Abstract Title: Learning About Liouville's Theorem with ODE Solver Algorithms 5230

Paper Type: Contributed

Author: Todd K. Timberlake
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706-368-5622 (p)
ttimberlake@berry.edu

In this talk we will discuss a way to teach students about algorithms for solving systems of ordinary differential equations while also teaching them about Liouville's Theorem. One way of stating Liouville's theorem is that in conservative systems the dynamics of the system preserves the area of a region of phase space. Liouville's theorem can be illustrated by using the Maxima computer algebra system to implement the non-symplectic Euler algorithm and the symplectic Euler-Cromer algorithm for the case of a 1D simple harmonic oscillator. The Euler-Cromer algorithm preserves the phase space area occupied by an ensemble of particles, while the Euler algorithm results in an increasing phase space area. This result is closely connected to the fact that the Euler-Cromer algorithm conserves the average energy over each oscillation while the Euler algorithm results in an increasing average energy. The numerical errors in the Euler algorithm behave like a driving force, effectively adding energy to the system and making the algorithm unstable. These examples help students learn that not all ODE solver algorithms are equally good while also helping students develop a qualitative understanding of Liouville's theorem.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Modeling heat transfer in undergraduate Thermal Physics 5218

Paper Type: Contributed

Author: Larry Engelhardt
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8436011452 (f)
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Students learn early on that Q=mc Delta T; the EFFECT of heat transfer is to change the temperature of an object. It is not unreasonable to also expect students to learn that the conduction of heat is CAUSED by a temperature difference between two objects; Fourier's law of heat conduction, dQ/dt = k A dT/dx. By combining these two equations, I will describe how students can build and use models of increasing sophistication--starting with paper and pencil and ending with computer simulations--in order to understand the phenomenon of heat transfer.

Footnotes: This project is funded by NSF IUSE grant DUE-1525062.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Multiple-Choice Assessment for Upper-division Electrodynamics 5352
Paper Type: Contributed

Author: Qing Xu Ryan
California State Polytechnic University, Pomona
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xuqing12357@gmail.com

Multiple-choice assessments are a standard tool for achieving reliable measures of certain aspects of students' conceptual learning in large introductory physics courses. It is harder to develop a multiple-choice assessment for upper-division physics because it involves greater emphasis on assessing students' reasoning in addition to their conceptual knowledge. A coupled-response format employed by the multiple-choice CUE (Colorado Upper-division Electrostatics) diagnostic has achieved great success. We further investigate this new testing format in upper-division electrodynamics content. Our goal is to preserve the insights afforded by the existing open-ended assessment, the CURrENT (Colorado UppeR-division ElectrodyNamics Test), while exploiting the logistical advantages of an objectively gradable instrument. We present the development, scoring, and preliminary analysis of validity and reliability of this multiple-response version of the CURrENT.

You have submitted comments on this item

Change Session
No Yes

PER: Evaluating instructional strategies--G

Order

Comment:

Update

Abstract Title: The Effectiveness of “Pencasts” in undergraduate curriculum 5397

Paper Type: Contributed

Author: Nandana J. Weliweriya Liyanage
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nandee122@ksu.edu

Pencasts are videos of problem solving with narration. Pedagogically, instructors can use pencasts to model problem solving for their students, uploading the videos for students to watch outside of class. Alternately, students can create pencasts to illustrate their own problem solving to the instructor or to their peers. In this talk, we describe the use of pencasts in an upper-division Electromagnetic Field course usually taken by junior or senior physics majors. For each homework students created and submitted pencasts of ordinary homework problems several days before the problem set was due. We compare students' performance in the class (grades for pencast submission excluded) with the pencast submission rate. Students who submit more pencasts do better in the course. We conclude with some practical suggestions for implementing pencasts in other courses.

You have submitted comments on this item

Change Session

No Yes

PER: Student Reasoning--G

Order

Comment:

Update

Upper Division/Graduate Courses

Abstracts Submitted (# 7) | Abstracts You Have Reviewed: 0

Abstract Title: A Novel Analog of the Double-Cone problem, Only Better 5263

Paper Type: Contributed

Author: Asim Gangopadhyaya

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agangop@luc.edu

We introduce a new example of a system which slides up an inclined plane, while its center of mass moves down. The system consists of two identical masses connected by an ideal string symmetrically placed over a corner. This system is similar to the double-cone rolling up the inclined V-shaped rails. The double-cone's motion, while easy to demonstrate, is rather difficult to analyze. Our example is relatively easy to follow, and the experimental observations are in good agreement with the theoretical predictions.

Conflicts: It would be helpful to have the talk on Monday morning, so that I can be back in Chicago the day after. Thank you.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Application of Statistical Mechanics and Neural Networks for Large Databases 5382

Paper Type: Contributed

Author: Prabhakar Misra
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pmisra@howard.edu

We have explored the application of statistical mechanical and thermodynamics aspects of neural networks to detect patterns in a large database POICN developed by START, a DHS Center of Excellence at the University of Maryland. The Hopfield Network consists of a fully connected cyclic array of neurons, where the output of each neuron is fed into other neurons. The neurons continuously transmit signals back and forth to one another until a stable equilibrium is reached. We have generated a plot of an activation map of the input

data used in the creation of the Hopfield net based on POICN data, which can be displayed in the form of a heat map, where each pairwise unit of data likely to be a type B event (Possession/Use of CBRN) weapon is shaded in one color, and type A events (Attempted Acquisition of CBRN weapon) shaded a different color.

Footnotes: Financial support from the Department of Homeland Security MSI SRT program and the Howard University Graduate School are gratefully acknowledged.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Comparing Chinese and American students' understanding of quantum mechanics 5044

Paper Type: Contributed

Author: Jue Wang
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wangjue-jane@foxmail.com

This talk discusses a comparative study on American and Chinese students' conceptual understanding of quantum mechanics. We administered the Quantum Mechanics Survey (QMS) to two hundred students in China and the United States. The results show that the students in the top-ranking US universities outweigh their peers in the top-ranking Chinese universities. However, those in medium-ranking universities in both China and the US have similar performance in QMS.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Developing and Assessing Quantum Tutorials: Time Dependence and Measurements 5373

Paper Type: Contributed

Author: Paul J. Emigh
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The Physics Education Group at the University of Washington has developed a comprehensive set of tutorial curriculum for quantum mechanics at the sophomore and junior levels. The tutorials, which serve as a supplement to lecture instruction, are designed to improve student understanding of quantum mechanics by directly addressing common student difficulties identified by prior research. We will discuss the development and evolution of a particular sequence of tutorials focusing on concepts associated with quantum measurements and time dependence. We will also discuss the methods we have used to assess the effectiveness of these tutorials and compare our results over a period of several years.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Development of a Physics of Sustainability Course for Upper Level Students 5523

Paper Type: Contributed

Author: D. Blane Baker
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Over the past three years, we have been teaching a required upper-level course entitled Physics of Sustainability to our physics majors. We begin with questions related to sustainability and climate change. We then proceed with topics including electronics, wind and solar energy, nuclear energy, and solid state physics. A portion of the course also involves connecting with a community either in country or internationally to develop a collaborative project. Students participate in these projects and often travel to these locations to implement solutions developed in the course. A complete overview of the course will be presented.

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Guidelines for a new laboratory course for underrepresented students in a graduate bridge program in South Africa 5156

Paper Type: Contributed

Author: Christine Lindstrøm
Oslo and Akershus University College
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Oslo, Oslo NO-0475 Norway
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christine.lindstrom@hioa.no

The National Astrophysics and Space Science Programme (NASSP) is a graduate program

established in 2003 to educate the next generation of South African astrophysicists and space scientists. Due to high initial attrition rates for black South African students in NASSP, a yearlong Postgraduate Bridging Program (PGB) was established in 2008. The PGB, however, is heavily theoretical and does not help students develop research skills. Our project is to create a laboratory course to better prepare the students for their future research projects. We analyzed interviews with NASSP project supervisors and former NASSP/PGB students with the lens to understand who the PGB students are, estimate their level of prior knowledge, identify previous challenges students have faced, and determine the type of support students need in the PGB. This analysis resulted in a set of guiding principles for how to design the laboratory course.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Teaching Research in Traditional Classrooms: Why Make Graduate Students Wait? 5399

Paper Type: Contributed

Author: Lincoln D. Carr
Colorado School of Mines
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Physics graduate programs tend to divide the degree into (1) theory, taught in classes, almost totally divorced from the lab setting; and (2) research, taught in the research group, through hands-on lab experience and mentorship. In contrast, we begin research instruction in the classroom in the very first semester of graduate school. Students build their knowledge from hands-on projects, get immediate experience in the machine shop and electronics lab, and there are no formal lectures. They develop and present their own problems, teach and challenge each other in the classroom, and give conference-style presentations instead of exams. In contrast to polished lectures, both the instructor and the students together learn from their many public mistakes. As a result, students not only excel in analytical skills, but they also learn to tie theory to measurement, identify statistical and

systematic errors, simulate computationally and model theoretically, and design their own experiments.

Footnotes: Funded by NSF

Change Session

No Yes

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

Order

Comment:

Submit

Upper Division/Graduate Labs

Abstracts Submitted (# 0)

Astronomy Poster

Abstracts Submitted (# 7) | Abstracts You Have Reviewed: 0

Abstract Title: (Don't) Hit my Planet! - Periapsis from Instantaneous Position and Velocity 5131

Paper Type: Poster

Author: Philip R. Blanco
Grossmont College
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philip.blanco@gcccd.edu

Long-range radar detects an unidentified space object at an altitude of 6.53 Earth radii heading towards us at a radial velocity of 3.86 km/s, and traveling across the sky at 1.54 km/s (corrected for the Earth’s rotation). What is its origin? Possibilities include a ballistic missile launched from another continent, an Earth-orbiting satellite, an asteroid or comet.

Will it hit us, and if so, what velocity change is required to deflect it? This poster presents a physics-based method for students to determine the closest-approach (periapsis) distance of any unpowered space object, without having to calculate its detailed orbit. We apply this method to a few examples of the many possible astrodynamics problems that are accessible to introductory physics and astronomy students familiar with conservation laws.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Exploring Temperature in Astronomy Demonstration Videos 5615

Paper Type: Poster

Author: Kevin M. Lee
University of Nebraska
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klee6@unl.edu

AU is a series of short videos of physical demonstrations appropriate for use in introductory astronomy classes. Considerable effort is made to make the videos interactive through embedded peer instruction questions and accompanying worksheets. This poster will illustrate recently developed videos involving temperature and their interactive mechanisms. These materials are publicly available at http://astro.unl.edu and on YouTube on the UNL Astronomy Channel. They are funded through NSF grant #1245679.

Conflicts: I have a workshop on "Submitting Competitive Proposals to the NSF S-STEM Program", a topical discussion on "Web Resources for Teaching Astronomy", am organizing an invited session on "The Physics of the NSF IUSE Program", and am receiving a Distinguished Service Award. A lot to avoid!

Change Session

No Yes

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

Order

Comment:

Submit

Abstract Title: Incorporating Exoplanet Radial Velocity Detections to Teach Simple Harmonic Motion 5490

Paper Type: Poster

Author: Jordan K. Steckloff
Purdue University - Department of Earth, Atmospheric, and Planetary Science
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2482279413 (f)
jstecklo@purdue.edu

All planets and stars orbit about their mutual center of mass (barycenter). Although, most planetary systems cannot be directly imaged using current technologies, the orbital motion of the host star induces a detectable doppler shift in its emitted light. Because the star's circular motion is generally unresolvable, its motion instead appears to be a mass undergoing simple harmonic motion along the line of the observer. Thus, this radial velocity method (RVM) of detecting exoplanets is an excellent method to be understood as a simple harmonic oscillator. However, whereas most harmonic oscillators are understood by detecting the change in their position, the RVM instead directly detects the velocity of the oscillator. We describe how the mass and orbital radius of the orbiting planet can be determined by measuring the harmonic velocity of the star, and understanding the forces that contribute to its acceleration. Suggestions for instruction will also be provided.

Conflicts: we kindly request that this poster be placed next to my other poster titled "Incorporating the Asteroid Light Curve Database into Introductory Mechanics"

Change Session

● No ○ Yes

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

Order

Comment:

Submit

Abstract Title: Incorporating the Asteroid Light Curve Database into Introductory Mechanics 5594

Paper Type: Poster

Author: Jordan K. Steckloff
Purdue University - Department of Earth, Atmospheric, and Planetary Science
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jstecklo@purdue.edu

Elementary Mechanics is typically motivated with examples on the Earth that are familiar to students. However, such examples are subject to nonideal conditions (e.g. air drag, rolling friction, noninertial reference frames), and their use may unintentionally reinforce incorrect schema that students have on their underlying physical processes (e.g. moving objects naturally come to rest without a driving force). Asteroid motion is not subject to friction, representing an ideal situation for applying Newton's Laws. Additionally, students are typically unfamiliar with asteroid mechanics and therefore possess fewer preconceived notions of how asteroids should behave. Here we present how we incorporated the Minor Planet Center's most recent published dataset of asteroid spin periods and radii (obtained from asteroid light curve studies) into an activity on gravitation and circular motion. We guide students through the scientific process: collecting data, identifying a trend and hypothesizing its cause, and making and testing a prediction.

Conflicts: We kindly request that this poster be placed next to my other poster entitled "Incorporating Exoplanet Radial Velocity Detections to Teach Simple Harmonic Motion"

Change Session

No Yes

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

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Comment:

Submit

Abstract Title: Influence of Authentic Astronomical Data on Student Confidence and Understanding 5297

Paper Type: Poster

Author: Kimberly Coble
Chicago State University
9501 South King Dr.
Chicago, IL 60628-1598
773-203-5363 (p)
kcoble@csu.edu

This study investigates the extent to which students learn about the nature of scientific research as a result of participating in authentic scientific research in astronomy. Participants were enrolled in introductory science courses at one of four universities: a large state university, a minority-serving institution, a liberal arts college, and a community college. Participating in the process of scientific research ranged from several weeks to an entire semester using the RBSE curriculum developed at the University of Alaska Anchorage. Open-ended essays, interviews, and a confidence survey were used to assess students' understanding and confidence.

Footnotes: Supported by National Science Foundation CCLI Grant # 0920293, as well as additional funding from the Illinois Space Grant Consortium.

Change Session

(•) No ( ) Yes

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

Order

Comment:

Submit

Abstract Title: Preliminary Evaluation of a New Cosmology Curriculum 5294

Paper Type: Poster

Author: Kimberly Coble
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kcoble@csu.edu

Informed by our research on student understanding of cosmology, The Big Ideas in Cosmology is an immersive set of web-based learning modules that integrates text, figures, and visualizations with short and long interactive tasks and real cosmological data. This enables the transformation of general education astronomy and cosmology classes from primarily lecture and book-based courses to a more engaging format that builds important STEM skills. During the spring 2014 semester, we field-tested a subset of chapters with the general education astronomy and cosmology classes at Sonoma State University in a flipped-classroom format. We administered pre and post content and attitude assessments in the two flipped classes as well as two lecture classes. When switching to an active mode of learning, students reported some dissatisfaction with "having to do more work" but made greater learning gains.

Footnotes: Module development was supported by NASA ROSES E/PO Grant #NNXl0AC89G, the Illinois Space Grant Consortium, the Fermi E/PO program, Sonoma State University’s Space Science Education and Public Outreach Group, and Great River Technology/Kendall-Hunt Publishing.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Teaching Inquiry in Nigeria: The West African International Summer School for Young Astronomers 5305

Paper Type: Poster

Author: Linda E. Strubbe
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Vancouver, BC V6T 1Z1 Canada
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The West African International Summer School for Young Astronomers (WAISSYA) is a week-long introduction to astronomy for science undergraduates and teachers from West Africa, held twice so far in Nigeria (2013 and 2015), and organized by astronomers from Canada, Nigeria, Germany, and Gabon. Goals of the school are to exchange ideas about teaching and learning science in West Africa and North America, and to increase interest in astronomy in West Africa. We design and lead activities to teach astronomy content, promote students' self-identity as scientists, and encourage students to think critically and figure out solutions themselves. Prior to the 2015 school, we held a 3-day workshop for WAISSYA instructors to learn about evidence-based teaching strategies. Here we describe the school's curriculum, share results from evaluations of the effectiveness of the program, and discuss longer-term plans for future schools and collaboration.

Change Session

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Labs/Apparatus

Abstracts Submitted (# 19) | Abstracts You Have Reviewed: 0

Abstract Title: Advanced undergraduate biophysics lab on fluid-fluid phase separation 5348

Paper Type: Poster

Author: Ryan McGorty
University of San Diego
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rmcgorty@sandiego.edu

Compartmentalizing biomolecules is a necessary task for life to exist. Often cells use lipid membranes for such tasks. Cells are encapsulated within a membrane and within the cell exists the nuclear envelope, vesicles, and other lipid-membrane bound organelles. Intriguingly, a new way for cells to partition molecules has recently emerged. A few years

ago, liquid-like bodies were observed within cells. These liquid-drops are the result of fluid-fluid phase separation within the cell. I will describe experiments done in an undergraduate biophysics lab course that explore fluid-fluid phase separation using colloidal and polymer solutions. Students use microscopy techniques including bright-field, differential interference contrast, laser-scanning confocal and light-sheet microscopy. Analysis of acquired images yield capillary times and lengths and students learn how those time and length scales relate to surface tension and other parameters. Students also construct a phase diagram to demark the concentrations of polymers or colloids required for phase separation.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: An easily assembled spectrograph for the intermediate lab 5201

Paper Type: Poster

Author: Timothy Todd Grove
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We have been using low-cost spectrographs called shoebox spectrographs for a few years. In the process of our study, we decided to make a spectrograph using the same basic optical design (as the shoebox spectrograph) but with quality optical parts. This spectrograph was found to be easily aligned by students and enables intermediate and advanced students to study molecular spectral lines as well as the spectral line differences between hydrogen and deuterium.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Arduino Explorations in the Physics Classroom 5666

Paper Type: Poster

Author: Brian C. Huang
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Boulder, CO 80305
303-596-8163 (p)
huang.brian.c@gmail.com

Arduino is a low-cost 8-bit micro-controller. It is not really a new technology, but it has grown rapidly in the open-source hobbyist and "maker" community. Because of it's popularity, a wealth of community generated resources are available. I have compiled a series of investigations and lab experiments that can be integrated into a variety of physics classrooms -- from the traditional mechanics to studying capacitance and RC time constants. These labs bring the “DIY” and student ownership into the lab exploration by integrating engineering, electronics, programming, and physics.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Arduino in electronics course leads to Arduino and FPGA student research projects 5598

Paper Type: Contributed

Author: Michele McColgan
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Students are introduced to programming the Arduino with Matlab, Simulink, and the Arduino IDE in a sophomore level electronics course. Students continue with independent studies and summer research projects using the Arduino and the Xilinx Zedboard FPGA. Examples of student projects will be presented.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Best Practices for Intermediate Physics Laboratory Experiences Using E-CLASS 5497

Paper Type: Poster

Author: Patricia E. Allen
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Undergraduate physics majors are often take an introductory lab sequence and a capstone lab experience, usually during their last year. Many in the PER (Physics Education Research) community have analyzed best practices to improve experiences at each end of a physics major’s education. At institutions like Appalachian State University, majors are required to take an intermediate lab course. However, little guidance is available to instructors on best

practices for an intermediate lab experience to bridge intro and advanced lab courses. Efforts are under way at Appalachian State to determine best practices for such an intermediate lab course. E-CLASS (Colorado Learning Attitudes about Science Survey – Experimental) has been found to provide effective and informative feedback for both lab activities and pedagogical approaches. The authors present E-CLASS results for multiple sections of an intermediate lab course and how these results are used to identify best practices and areas for improvement. The impact of E-CLASS-inspired modifications will also be presented and discussed.

Change Session

No Yes

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Comment:

Submit

Abstract Title: Dynamic Simulation Of The Induced Polarization Effects By Mirrors 5603

Paper Type: Poster

Author: Sarah J. Knudsen
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sknudsen1@mail.csuchico.edu

We designed a dynamic simulation to promote students' understanding of the induced polarization effects by mirrors for the practical case of a beam scanner. The state of polarization (SOP) of the reflected light strongly depends on the design of the mirrors (thickness, index of refraction, and order of the thin film layers) and their azimuthal orientation. Motivated by our research of an azimuth-over-elevation beam scanner for atmospheric polarization lidar we also incorporated a quarter waveplate to correct for the total induced polarization. The simulation is constructed by applying the Fresnel equations and Jones calculus and allows the user to adjust the parameters of the mirrors and the geometry of the included optical elements. This simulation is intended to be used for in-class demonstrations and for validating experimental results.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Electron Charge-to-Mass Ratio: Laser Focused on Perfection 5628

Paper Type: Poster

Author: Peter W. Odom
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podom@oru.edu

The charge-to-mass ratio of an electron was measured using J.J. Thomson's method. An electron gun generated and accelerated a beam of electrons inside a helium filled vacuum bulb. The bulb was surrounded by a Helmholtz coil producing a magnetic field to force the electron beam into a circular path. By measuring the current through the Helmholtz coil, voltage across the electron gun and diameter of electron path, the charge-to-mas ratio of electrons was calculated. By using various methods to measure the diameter of the path (visual versus laser), values were found between 7% and 0.8% of the accepted value. A decrease in the standard deviation of measurements when using lasers was predicted and confirmed. Methods by which measurements were improved are discussed, chiefly among them being the implementation of aforementioned lasers. The unprecedented success resulted from being permitted more freedom and being allowed deviation from specific lab manual instructions.

Footnotes: I am an undergraduate student being funded by a PhysTEC supported sight for this specific conference.

Change Session

No Yes

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Submit

Abstract Title: Improving Students' Understanding of Lock-In Amplifiers 5025

Paper Type: Poster

Author: Seth T. DeVore
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A lock-in amplifier is a versatile instrument frequently used in physics research. However, many students struggle with the basic operating principles of a lock-in amplifier which can lead to a variety of difficulties. To improve students' understanding, we have developed and evaluated a research-based tutorial which utilizes a computer simulation of a lock-in amplifier. The tutorial is based on a field-tested approach in which students realize their difficulties after predicting the outcome of simulated experiments involving a lock-in amplifier and check their predictions using the simulated lock-in amplifier. Then, the tutorial guides and helps students develop a coherent understanding of the basics of a lock-in amplifier. The tutorial development involved interviews with physics faculty members and graduate students and iteration of many versions of the tutorial with professors and graduate students. The student difficulties and the development and assessment of the research-based tutorial are discussed. Supported by the NSF.

Change Session

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Submit

Abstract Title: Instrumented Trebuchet 5152

Paper Type: Poster

Author: Joel C. Berlinghieri
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A trebuchet is a siege engine used in the Middle Ages to frustrate a castle's defenses. A trebuchet's design is focused on the efficient transfer of potential energy stored in a counter weight to kinetic energy in a projectile which is launched at a chosen angle. Projectile maximum range or maximum height might be a goal. For the past six years The Citadel with Google sponsorship has hosted a trebuchet event called "Storm The Citadel". Elementary, middle, high school, college, and corporate teams compete in various categories at accuracy, precision, and distance events. The Physics Department hosts workshops on the physics of the trebuchet with an explanation of each element of the various trebuchet designs and why they are needed. High school and corporate teams usually use phenomenological data to characterize their engine. That is adjust one variable repeatedly and shoot holding other variables constant. We have taken one design and instrumented the unit to measure angular position, velocity, and acceleration and linear position, velocity, and acceleration and forces at strategic points on the trebuchet. The data collected are used to develop insight into the connection between trebuchet settings and engine dynamics and projectile kinematics.

Change Session

No Yes

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Abstract Title: Introductory Physics Laboratory Writing Conferences 5440

Paper Type: Poster

Author: Dwain M. Desbien
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The Introductory Physics Laboratory Writing Conferences (IPLWC) is one of the two major components of the ATE Workshop for Physics Faculty project. Since 2011, nine IPLWCs conferences were conducted. The invited participants to the IPLWCs were experienced two-year college and high school physics faculty. Some of the IPLWCs were dedicated to types of laboratory activities, such as computational activities, conceptual activities, video activities, and others. Many of the developed activities were tested (and later modified) at the institutions of the IPLWC participants that developed them. In this poster, we will display information about the IPLWCs and some of the developed activities.

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Submit

Abstract Title: Ionizing Radiation Experiments as a Mobile Lab 5097

Paper Type: Poster

Author: Jan D. Beks
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Initiated by the Dutch Ministry of Education, the Ioniserende Stralen Practicum at the Freudenthal Institute, Utrecht University, developed a mobile lab around 45 years ago. While currently equipped with three mobile labs, students from the tenth through twelfth grades throughout the Netherlands familiarize themselves with radionuclides, the produced ionizing radiation and some of the processes involved. We describe the unique character of the experiments in their simple and easy to troubleshoot set-ups. The schools are offered closed lab instructions or open lab instructions, in which students design experiments using the limitations as given by the provided lab equipment. We will discuss (i) how the experiments support a Physics curriculum, (ii) our unique approach of offering labs regarding ionizing radiation, and (iii) evidence of their positive impact on student concepts. In addition, we will share some early plans for implementing the use of smartphones and tablets to acquire and

process data.

Footnotes: Keywords: radionuclides, ionizing radiation, experiments, physics curriculum

Change Session

No Yes

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Comment:

Submit

Abstract Title: LEDs go to school 5020

Paper Type: Contributed

Author: Gorazd Planinsic
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LEDs are becoming a ubiquitous feature of our life. Our students are surrounded by LEDs and yet there is almost no LED presence in a physics course. Although the detailed understanding of operation of these devices exceeds introductory physics curriculum, students can understand several fundamental physics ideas behind LEDs and these ideas might help them learn required traditional physics better. In the series of four papers we described how LEDs can be used in active learning units across the introductory physics curriculum so that students not only learn the physics underlying the LED operation but also to deepen their knowledge in other areas of physics and learn how to think like scientists. In this talk we will present examples of the experiments and related activities and share our experiences using LEDs with different student populations.

Conflicts: Please, schedule this talk so it does not conflict with the time of E. Etkina's invited talk in the session "The art and science of teaching".

Change Session

No Yes

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Comment:

Submit

Abstract Title: Measuring and Visualizing Fields and Current Flow 5526

Paper Type: Poster

Author: Scott Dudley
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scottcolton@msn.com

Using a sheet of current we show how to measure and visualize the electric and magnetic fields around the sheet, and the flow of current in the sheet.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Mini-Lab Implementation to Enhance the Undergraduate Experience in Experimental Physics 5585

Paper Type: Poster

Author: Colleen L. Countryman
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After three introductory-level classes (with traditional labs) and before a project-based senior lab course, physics majors take seven physics lecture courses that have no lab component. Over the last few terms, we have worked towards addressing this issue in several of these courses by providing a single lab experience per course, innately connected to the classroom work. These mini-labs replace traditional homework assignments for one week in the term. They are developed and taught by a teaching assistant associated with a department-wide shared user research facility where the experiments are also housed, thus minimizing the effort needed by the instructor. Ultimately our goal is to have each student experience one or two mini-lab activities per term. From these experiences we intend to systematically strengthen student confidence in their experimental ability and demonstrate real world connections with the material in the classroom. We will present promising attitudinal results from the study.

Footnotes: Instructional materials were designed by Theodore Brzinski, Karen Daniels, Hans Hallen, Paul Huffman, Hong Wang, and Keith Weninger (North Carolina State University).

Conflicts: I am presenting a talk during the "Innovative Uses of Technology Enabled Students" session.

Change Session

No Yes

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Comment:

Submit

Abstract Title: Normal modes for loaded string: Accounting for the string's mass 5034

Paper Type: Poster

Author: Alan J. DeWeerd
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The normal modes of a string loaded with evenly spaced masses are analogous to the modes of one-dimensional lattice vibrations, if the mass of the string is negligible. However, experiments show slight deviations from the idealized behavior because of the string's mass. Methods of accounting for the mass of the string are discussed. Theoretical predictions are compared with experimental data for the "monatomic" and "diatomic" strings.

Change Session

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Order

Comment:

Submit

Abstract Title: Single Photon investigations using a low-cost coincidence counter 5178

Paper Type: Poster

Author: Mark F. Masters
IPFW
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Single photon investigations are very popular for a variety of experimental investigations in quantum mechanics. These investigations vary from Grainger’s experiment to demonstrate that the photon is a particle, to Bell’s inequality, to single photon interference. Unfortunately, these investigations are not low-cost, the chief expense being the single photon detectors, followed by a lot of optical components. One area in which there has been some cost savings has been the coincidence counting units. As our start to driving down the costs of these investigations, we present the development and testing of a low-cost coincidence counter (less than $40). This coincidence counter is based upon a Cypress PSoC 5 prototyping kit (CY8CKIT-059) and can have up to 10-24 bit counters, more than four input channels, have built in Digital to Analog for use in interferometry. The tests will include Bell’s inequality, Grainger’s experiment and single photon interference.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Speed of Light: Practice Makes Almost Perfect 5619

Paper Type: Poster

Author: Peter W. Odom
7777 South Lewis Ave.
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In this experiment, the speed of light is measured using the Foucault method. A laser is focused through a beam splitter onto a rotating mirror that directs the beam onto a fixed mirror reflecting it back toward the rotating mirror and back through the beam splitter. By rotating the mirror at a known angular velocity first CW, then CCW, while measuring the displacement of the image produced by the reflected beam, the speed of light is measured at 3.02 x 108 m/s—a value only 0.7% larger than the accepted value of 2.998 x 108 m/s. Modifications of experimental setting show significant progress in the accuracy of the measurements. The initial attempt resulted in roughly 32% error; the second iteration narrowed accuracy to roughly 5% error; the last iteration yielded the above mentioned result. Factors contributing to the improvements in accuracy (i.e. freedom, creativity, and persistence) are discussed.

Footnotes: I am an undergraduate student being funded by a PhysTEC supported site for this specific conference.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Student research projects with Arduino and the Xilinx Zedboard FPGA 5610

Paper Type: Poster

Author: Michele McColgan
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mmccolgan@siena.edu

Examples of student research projects using the Arduino and Xilinx's Zedboard FPGA will be presented. Projects include a processing system to detect the difference between neutrons and gamma rays, a beacon system to transmit unique signals, a weather station to collect and display weather data in real time, and PID controller projects for different applications.

Change Session

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Order

Comment:

Submit

Abstract Title: Teaching Fluid Dynamics using a Transparent Circulatory System Model 5231

Paper Type: Poster

Author: Bradley Moser
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Students have substantial difficulties applying physics concepts to anatomy and physiology (and vice versa). We have developed a mature kinesthetic learning circulatory system model, which requires students to apply multiple concepts (conservation of mass, the Hagen-Poiseuille principle, Reynolds Number and basic circuit theory) to understanding how the cardiovascular system functions. Kinesthetic learning allow students to manipulate different aspects of the simulated system. We have designed an inexpensive circulatory system model made from transparent plastic tubing, branched connectors, balloons, and pumps that enabled students to see the fluid travel at different speeds (visually) and pressures (through pressure sensors) simulating the cardiovascular system. The speeds and pressures are in reasonable agreement with theory. Noticeably absent from this discussion is the Bernoulli Principle, often misapplied and can be demonstrated to play little role in the observed behavior of the pressure changes in our model system.

Footnotes: Supported by NSF DUE grants 0737458 and 1044154

Change Session

No Yes

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Lecture/Classroom

Abstracts Submitted (# 17) | Abstracts You Have Reviewed: 0

Abstract Title: A New IPLS Course at UNC – Fluids, E&M, Optics, Nuclear* 5543

Paper Type: Poster

Author: Alice D. Churukian
The University of North Carolina at Chapel Hill
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This is the second of two posters describing the complete transformation of our large-enrollment introductory physics course for life science (IPLS) majors. All sections of the course are now offered in the new format, utilizing the lecture-studio model with content focused on aligning introductory physics concepts with authentic biological applications. In this poster, we will provide an overview of what the second-semester course now looks like and our assessment of its implementation. Specifically we will highlight materials that we have developed in many topics that are important for life science majors, but are not part of the traditional introductory physics curriculum, including life at low Reynolds number, absorption and fluorescence, and DNA diffraction.

Footnotes: *This work has been supported in part by the National Science Foundation under Grant No. DUE-1323008 and AAU Undergraduate STEM Education Initiative.

Change Session

No Yes

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Abstract Title: A New IPLS Course at UNC – Mechanics, Energy, Thermodynamics 5574

Paper Type: Poster

Author: Duane L. Deardorff
University of North Carolina at Chapel Hill
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Chapel Hill, NC 27599-3255
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This is the first of two posters describing the complete transformation of our large-enrollment introductory physics course for life science (IPLS) majors. All sections of the course are now offered in the new format, utilizing the lecture-studio model with content focused on aligning introductory physics concepts with authentic biological applications. In this poster, we will provide an overview of what the first-semester course now looks like and our assessment of its implementation. Specifically we will highlight materials that we have developed in many topics that are important for life science majors, but are not part of the

traditional introductory physics curriculum, including scaling, stress and strain, diffusion, and chemical energy.

Footnotes: This work has been supported in part by the National Science Foundation under Grant No. DUE-1323008 and AAU Undergraduate STEM Education Initiative.

Conflicts: This poster should be next to our other IPLS poster with Alice Churukian as the lead author.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Active Learning and Learning Assistant Support Predictors of Student Success 5448

Paper Type: Poster

Author: Leanne Doughty
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We are currently engaged in a project designed to investigate how active learning methods and undergraduate Learning Assistant (LA) support contribute to the learning gains, achievement, retention, and persistence of students enrolled in introductory and upper-division biology, chemistry, and physics courses. As part of this work, we aim to build quantitative models which will help to parse the relative contribution of different activities and other predictors on student outcomes. Independent predictor variables will exist at both the class level (e.g. nature and amount of active learning employed in the class, nature of LA support, and size of class) and student level (e.g. gender, ethnicity, major, and perceived value of active learning). We will present some preliminary models based on initial data collection and the results will be interpreted and backed with qualitative descriptions of the different observed active learning methods.

Conflicts: If possible, we would like this to be scheduled on the Tuesday or Wednesday due to the fact that a group member is getting married on the Monday.

Change Session

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Comment:

Submit

Abstract Title: Comparison between Two Active Methodologies: Hands-on Experiments and Interactive Simulations 5170

Paper Type: Poster

Author: DIANA BERENICE LOPEZ TAVARES
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The use of active learning methodologies in science has demonstrated its effectiveness. But, is there any advantage if we use hands-on experiments or interactive simulations? How much of any physical concept is learned if they do an experiment or if they use an interactive simulation? Present work tries to take us closer to the answers of these questions. We designed two learning sequences combining hands-on experiments and interactive-simulation activities. These sequences were applied in two groups of high school students, one group used hands-on experiments and another group used interactive simulations. The Electric Circuits Concept Evaluation (ECCE) was applied as pre-test and post-test for analyzing the concepts learned using normalized gain and concentration factor tools. Preliminary results shown that the concepts were acquired similarly by students, even we applied a retention test three weeks after instruction and the simulations group obtained a bigger gain than hands-on experiments group.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Geometric Constructions as Mnemonics in Classical Physics 5486

Paper Type: Poster

Author: Satinder S. Sidhu
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Although some of the most original minds in physics are reputed to have been geometrical thinkers, the results obtained by them are today most compactly and elegantly expressed in the language of algebra and analysis. Yet, these same results can often be encapsulated in easily-remembered geometric constructions. Students find these re-expressions particularly helpful, not only in memorizing but also in understanding quantitative interrelationships. Examples from familiar results in oscillations, waves, electromagnetic fields and special relativity will be used to illustrate the methods.

Change Session

No Yes

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Order

Comment:

Submit

Abstract Title: Periodic Roads and Quantized Wheels 5537

Paper Type: Contributed

Author: Eduardo De Campos Valadares

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A simple approach to determine all possible wheels that can roll smoothly without slipping on a periodic roadbed while keeping their center of mass at a constant level is proposed. The inverse problem of obtaining all quantized wheels by determining the roadbed profile compatible with a specific wheel is also addressed(1-5). It is highlighted the role of symmetry, which might preclude the center of mass to be at a constant level. Illustrative examples highlight counter-intuitive aspects of the world of non-conventional wheels and potential applications. References 1 Eduardo C. Valadares, "Physics on sale – Brazilian style", Physics World 12, p. 64 (1999). 2 Jeffrey R. Regester, "A Long and Bumpy Road", The Physics Teacher 35, 232-233 (1997). 3 Eduardo de Campos Valadares, "Physics, Fun, and Beyond", Prentice Hall, 2006, pp. 45-48. 4 Leon Hall and Stan Wagon, "Roads and Wheels", Mathematics Magazine, Vol. 65, No. 5. (Dec, 1992), pp. 283—301. 5 Nelson H. Klein, "Square Wheel", Am. J. Phys. 61, 893-896 (1993).

Change Session

(•) No ( ) Yes

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

Order

Comment:

Submit

Abstract Title: Power Boxes: A New Tool for Understanding Circuits 5593

Paper Type: Poster

Author: Daryl McPadden
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In order to clarify and provide a conceptual understanding of energy use in circuits, we introduce a new representation for analyzing DC circuits – Power Boxes. Although DC circuits are not generally considered to be the most insidious topics in introductory physics courses,

understanding the role of energy in such circuits can be deceptively challenging. Oftentimes, students see circuits as an infinite source of energy and many mechanical energy analogies only further this idea. Instead, Power Boxes allow us to discuss and illustrate the role of electric potential energy in circuits at a given time, while simultaneously building upon (rather than competing with or writing over) representations of energy established in mechanics. Power Boxes can provide an intermediate, conceptual step between drawing a circuit diagram and writing equations.

Conflicts: I cannot present at the same time as the Graduate Student Topical Group or the Professional Skills for Graduate Students sessions.

Change Session

No Yes

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Abstract Title: Serving our students, measuring learning instead of teaching 5668

Paper Type: Contributed

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How do we know if we are doing a good job in a physics course or program? Quantitative measures can seem impractical with small numbers of majors. Introducing innovative classroom techniques is not a guarantee of learning. Yet, there are concrete (if somewhat time consuming) measures that can allow us to improve our programs and demonstrate to our administrations that we are being effective. This sort of assessment can be very valuable in securing resources at your institution. The types of data every department should be keeping and how it impacts program development will be discussed.

Footnotes: This work was partially supported as a part of a number of NSF-funded projects.

Change Session

No Yes

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Abstract Title: STEM Connections: A Cohort Model for First Year Students 5600

Paper Type: Poster

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The Lewis University STEM Connections Program is a cohort program for first year students planning to major in a program offered by the Departments of Physics and Chemistry. First year students take a common curriculum of Chemistry, Physics, and Calculus designed to bring out the interconnectedness of these disciplines. The laboratories are inquiry-based with an emphasis on developing students' experimental skills. Students also have the opportunity to explore real-world research problems in their first year. An overview of the program's goals and of the first year STEM Connections experience will be discussed.

Footnotes: Supported in part by NSF S-STEM award 1458353.

Conflicts: Presiding the Lab Guidelines Focus Area 3: Modeling session

Change Session

No Yes

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Abstract Title: Stochastic simulations and finite-difference models for the life sciences 5194
Paper Type: Poster
Author: Peter Hugo Nelson
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Life-science students are introduced to modeling and simulation using a simple kinetic Monte Carlo (kMC) simulation of diffusion. The model is first introduced as a physical "marble game" and then implemented as a kMC simulation. Students work through a self-study guide introduction to Excel and write their own simulation from scratch in a blank spreadsheet. In a guided-inquiry exercise students discover that Fick's law of diffusion is a consequence of Brownian motion. Subsequent activities introduce students to: algorithms and computational thinking; exponential decay in drug elimination and radioactive decay; half-life and semi-log plots; finite difference methods (and calculus); the principles of scientific modeling; model validation and residual analysis; and osmosis. Analysis of published clinical data and Nobel Prize winning osmosis research is featured in an active learning environment. Because the materials are self-contained, they can be used in a flipped-classroom approach. Sample chapters are available for free at http://circle4.com/biophysics/chapters/

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Abstract Title: Study Habits, Observed Habits, and Performance in a Physics MOOC 5642

Paper Type: Poster

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Standard surveys of student's study habits generally correlate with overall GPA at the 0.20 – 0.45 level. 246 questions from several such surveys were condensed to 17 online questions in four categories: motivation, concentration, time management, and study methods. 122 students (18 female, 113 male, mean age 33) who received certificates answered these 17 questions in our Advanced Introductory Classical Mechanics MOOC. The four categories typically correlated significantly with each other, and with other course/student related variables (most from the exit survey) typically at around 0.2 – 0.3. Moreover time management correlated with several measures of effort in the course. Most noteworthy is that we see no statistically significant correlation between MOOC performance and any of the four categories, although performance correlated with some individual questions. However, students who finished 60% of their first homework a day prior to the deadline did 41% percent better in the course than those who didn't.

Conflicts: Not Wed PM

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Abstract Title: TAPIR (Teaching Activities for Physics Inclusion Resources): Enhancing Diversity in Introductory Physics 5461

Paper Type: Poster

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Even among STEM disciplines, physics stands out as unusually white- and male-dominated. AIP reports that only 14% of physics faculty are women, and 6% are underrepresented minorities. Rachel Ivie of AIP has studied the pipeline for women in physics, and has identified the transition from high school to college as the most important "leak point" for women. We are approaching this problem by addressing inclusiveness in the calculus-based introductory physics course, the gateway to the undergraduate physics major. While most physics books have a plethora of problems at the end of each chapter, they are focused on contexts like sports and the military, which are not of particular interest to women or students of color, and send the message that physics is not for them. Many young faculty who are interested in diversity would like to present a broader variety of contexts. But, pressed for time, they too often fall back on already prepared topics. We are preparing a database of materials that illustrate the important concepts of introductory physics, but in different contexts that we intend will interest a broader range of students. These might include problems, in-class activities, test problems, paper and discussion topics. We intend these materials for use in the calculus-based physics class, but they will be adaptable to algebra-based and high school classes as well. By making these available to faculty at Colorado College and elsewhere, we hope to encourage women and students of color to major in physics, and eventually increase the diversity of the physics community.

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Abstract Title: The Impact of Language on Learning Physics 5445

Paper Type: Poster

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One difficulty in learning physics is that many physics terms have precise meaning but are used casually in conversation like acceleration, velocity, and speed. Other subjects, including chemistry and biology, have new language that students actively spend time learning on their own, sometimes using notecards or other techniques. The important point is that they make it a point to learn the terminology so that they understand the material. I get the impression that they feel they know the physics vocabulary well enough and do not make the effort learning the terminology they do in other classes. One of the things I would like to determine is if there is a noticeable difference in other languages that do not casually interchange some of the physics terminology. I would also like to look at the amount of time students spend learning the vocabulary in physics compared to other courses.

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Abstract Title: Two Stage Exams: Designing Effective Questions 5630

Paper Type: Poster

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The process of peer instruction is crucial in helping students to identify and confront their misconceptions and to critically apply the fundamental principles learned in lecture to different and more complex situations. In most cases, though, peer learning ends at exam time. I have recently begun implementing two-stage exams in my courses under the premise that learning can and should take place throughout the entire semester, not just in compartmentalized chunks; hence, exams can both be an opportunity for students to demonstrate what they have learned and an opportunity for students to continue to increase their understanding of the course material. In this poster, I will outline what I have learned about writing effective collaborative exam questions.

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Abstract Title: Using Blocks and Money to Understand Temperature 5454

Paper Type: Poster

Author: Gerardo Giordano
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I describe the implementation of a class activity and discussion that uses blocks and money to explain temperature in a one-semester, introductory, conceptual physics class. The activity and subsequent conversation attempt to explain temperature as a measure of the average translational kinetic energy per particle, its role in heat flow direction, its lack of dependence on the quantity of a substance, how a thermometer measures it, and why it has a lower limit but no upper limit. I expect that the addition of the group activity to the clicker-question lecture discussion will give students a better feel for temperature's part in thermodynamics. I investigate the effects of the activity on the students' comprehension by means of a survey and related course exam results across several semesters.

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