

PHYSICS DEPARTMENT
"ENRICO FERMI"



Mercoledì 20 Marzo 16.30-19.00
Aula 131 "Galilei" Ed. C– Polo Fibonacci



**Il Dipartimento di Fisica dell'Università di Pisa
e il Piano Lauree Scientifiche presentano**



16.30-17.30: COLLOQUIUM

***Improving Student Learning: The Dual Roles of
Conceptual Understanding and Reasoning Ability***

17.30-19.00: HANDS-ON WORKSHOP

***Improving Student Learning in Physics:
Tutorials in Introductory Physics***

Paula R.L. Heron
University of Washington
Department of Physics
Seattle USA

Il Colloquium sarà accessibile anche tramite questo [Zoom link](#)

Tutte/i le/i docenti interessate/i sono benvenute/i
Per ragioni organizzative è gradita la comunicazione di partecipazione al Workshop a
marilu.chiofalo@unipi.it

PHYSICS DEPARTMENT
"ENRICO FERMI"



Wednesday 20 March 16.30-19.00
Room 131 "Galilei"-Polo Fibonacci



The Physics Department of the University of Pisa
and the Piano Lauree Scientifiche present



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*Improving Student Learning: The Dual Roles of
Conceptual Understanding and Reasoning Ability*

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*Improving Student Learning in Physics:
Tutorials in Introductory Physics*

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All interested Professors are welcome
For organizational purposes, we kindly ask to acknowledge the Workshop attendance to
marilu.chiofalo@unipi.it



SINOSI

Perché gli e le studenti commettono, nella risoluzione di problemi di fisica, errori che contraddicono quanto è stato loro insegnato, e che non sono correlati a memoria imperfetta della formula corretta?



Nel Colloquio “Improving Student Learning: The Dual Roles of Conceptual Understanding and Reasoning Ability”, Paula Heron discuterà l’attuale stato di comprensione che la ricerca didattica in fisica ha raggiunto per rispondere a questa domanda e l’impegno in corso per migliorare le capacità di comprensione concettuale e di ragionamento in percorsi didattici nel primo anno di università.

Al Colloquio farà seguito il Workshop esperienziale “Improving Student Learning in Physics: Tutorials in Introductory Physics” destinato in particolare (ma non solo) a docenti di fisica generale del primo anno di tutti i Corsi di Studio, in cui Paula Heron illustrerà come la ricerca didattica possa migliorare l’apprendimento delle e degli student. Con un approccio pratico, Paula Heron discuterà in particolare strategie di insegnamento che incorporano l’uso dei Tutorials come strumenti utili a sviluppare il ragionamento qualitative e a connettere il linguaggio formale con le situazioni reali.

*Paula Heron è professoressa di fisica all’Università di Washington e una pioniera della Physics Education Research e in particolare dello sviluppo delle capacità di comprensione concettuale e di ragionamento per studenti di fisica. È autrice di **Tutorials in Introductory Physics (Pearson, 2006)**. Ha avuto ruoli di leadership in AAPT, GIREP e APS, di cui è Fellow. I suoi contributi sono stati oggetto di prestigiosi riconoscimenti internazionali, come l’APS Education award con Peter Shaffer e Lillian McDermott, la Homer Dodge Citation for Outstanding Service to the AAPT.*



SYNOPSIS

Why in solving physics problems do students make mistakes that contradict what they were taught, and that are not related to imperfect memory of the correct formula?



In the Colloquium "Improving Student Learning: The Dual Roles of Conceptual Understanding and Reasoning Ability", Paula Heron will discuss the current state of understanding that Physics Education Research (PER) has developed to answer this question and the ongoing commitment to improve conceptual understanding and reasoning skills in educational paths for first-year university-level physics.

The Colloquium will be followed by the Experiential Workshop "Improving Student Learning in Physics: Tutorials in Introductory Physics" intended in particular (but not only) for teachers of general physics in the first year of all Degree Courses. During the Workshop, Paula Heron will illustrate how research can improve students' learning. Providing an hands-on experience, Paula Heron will discuss in particular teaching strategies that incorporate the use of Tutorials as useful tools to develop qualitative reasoning and to connect formal language with real-world situations.

Paula Heron is professor of Physics at the University of Washington and a pioneer of Physics Education Research, with special reference to the development of conceptual understanding and reasoning skill for physics students. She is author of Tutorials in Introductory Physics (Pearson, 2006). She has acted leadership roles in AAPT, GIREP and APS, which is Fellow of. Her contributions have been recognized with prestigious International Awards, including the APS Education Award with Peter Shaffer and Lillian McDermott, and the Homer Dodge Citation for Outstanding Service to the AAPT.

Paula R.L. Heron is a Professor of Physics at the University of Washington. She holds a Ph.D. in physics from the University of Western Ontario.

Dr. Heron's research focuses on the development of conceptual understanding and reasoning skills. She has given numerous invited talks at international meetings and in university science departments.

Dr. Heron is co-Founder and co-Chair of the biannual "Foundations and Frontiers in Physics Education Research" conference series, the premier venue for physics education researchers in North America. She has held leadership roles in the American Physical Society (APS), the American Association of Physics Teachers (AAPT), and the European Physics Education Research Group (GIREP). She co-chaired an APS/AAPT joint task force that produced the report Phys21: Preparing Physics Students for 21st Century Careers and co-edited the first International Handbook on Physics Education Research (AIP, 2023). She also serves as an Associate Editor of Physical Review – PER.

She is a Fellow of the APS, a co-recipient of the APS Education award with colleagues Peter Shaffer and Lillian McDermott, and recipient of the Homer Dodge Citation for Outstanding Service to the AAPT.

Dr. Heron is a co-author on the upcoming 2nd Edition of Tutorials in Introductory Physics, an influential set of research-based instructional materials.



Paula R.L. Heron



COLLOQUIUM

Improving Student Learning:

The Dual Roles of Conceptual Understanding and Reasoning Ability

Paula Heron

University of Washington, Department of Physics, Seattle USA

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Why do students make errors on physics problems? Errors that directly contradict what they have been taught? Errors that don't arise from the failure to remember the correct formula? For the past several decades, physics education researchers have focused on one compelling explanation: students arrive in the classroom with pre-formed ideas about how the world works. Even though they may blend these ideas with those presented in formal instruction, the prior conceptions often win out. According to these accounts, students' prior knowledge has been built through rational, if imperfect, processes of observation and analysis, and any new or different ideas presented in the classroom must likewise be built, not simply received. Figuring out what ideas students bring with them to the classroom, and how to take them into account, has proven to be a complex, multi-faceted program of research that has significantly influenced physics teaching. However, it is not always the case that students produce incorrect answers through logical inferences based on incorrect or inappropriate premises – often they don't know why they chose a particular answer, just that it seems right. “Dual-process” theories suggest that their answers might not be based on so-called “slow” thinking, which is deliberate and laborious. Instead, they might be based on so-called “fast” thinking, which is automatic and effortless. The basic idea is that students immediately and effortlessly form a first-impression of a physics problem. If this impression is found to be satisfactory, it will be adopted. Otherwise, a deliberate and analytical process ensues. It is believed that this sequence cannot be “turned off.” That is, a first impression will always be formed. If it is attractive, and the benefits of engaging in more effortful thinking are not obvious, then a student may answer incorrectly, masking their conceptual knowledge. In this talk, I will discuss recent efforts to improve both conceptual understanding and reasoning skills. Examples will be chosen from first-year university-level physics.

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UNIVERSITÀ DI PISA

WORKSHOP

Improving Student Learning in Physics: Tutorials in Introductory Physics

Paula Heron

University of Washington, Department of Physics, Seattle USA



Piano Lauree Scientifiche

This workshop will illustrate how research can help improve student learning in introductory university physics courses. *Tutorials in Introductory Physics* (Pearson, 2006) is a set of instructional materials intended to supplement the lecture, textbook, and laboratory of a standard introductory university course. The tutorials emphasize qualitative reasoning and connecting formalism to real-world situations. They address specific conceptual and reasoning difficulties that have been identified through research. In addition to providing hands-on experience with the tutorials, the workshop will include discussions of instructional strategies incorporated into the materials and results from assessments of student learning.