GIREP Newsletter

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IN THIS ISSUE

Editor's Section..... 1
GIREP vzw Board Activities 2
GIREP vzw Membership fees 2
GIREP-EPEC 2025 Conference in Leiden 3
GIREP Summer School, 2025 4
4th WCPE 2024 in Krakow: report 5
4th WCPE 2024 in Krakow: a personal view 9
INFN-INSPYRE International school 12
George Marx centenary 16
GIREP Thematic Groups 20
Focus on new GTGs 21
GIREP General Assembly 2024..... 23
GIREP publications 29
Show The Physics 31
GIREP membership renewal & fees..... 31
Future Conferences..... 31
Benefits for GIREP vzw Members 32

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EDITOR'S SECTION

Dear Colleagues,

We issue this Newsletter to provide information on activities related to GIREP as a Community and GIREP vzw as a legal organization.

Details of the GIREP-EPEC 2025 Conference hosted by the University of Leiden on June 30th to 4th July 2025 are presented. We are planning an inaugural GIREP summer school for PhD students to be held in Leiden 28th – 29th June 2025.

In this issue, we report on 2024 GIREP General Assembly, and the 4th WCPE conference organized by the Jagelloinian University, Krakow, 26-30 August 2024. We also focus on GTGs, which comprise an important activity of GIREP. It is intended that each newsletter will contain an in-depth article on one or two GTGs.

On behalf of the GIREP community we would like to invite you to contribute to the GIREP Newsletter Please, send contributions for the next GIREP Newsletter to GIREP Secretary, secretary@girep.org

We thank you all for your ongoing contributions and look forward to your continued support and collaboration.

Eilish McLoughlin
GIREP President

Since February 2013, the GIREP newsletter has been recorded permanently as online publication in the ISSN register:
ISSN 2307-0366

Key title: GIREP newsletter
Abbreviated key title: GIREP news

GIREP vzw BOARD ACTIVITIES

The GIREP vzw Board for the period 2024-2027 consists of seven members with the following roles and responsibilities:

- **GIREP President** - Eilish McLoughlin, with responsibility for GB meetings, relationship with cooperating bodies and editorial policy.
- **GIREP Vice-President** - Dagmara Sokolowska, with responsibility for activities aimed at teachers and schools and country representatives.
- **GIREP Vice-Presiden**t - Claudio Fazio, with responsibility for Universities and research, GIREP Thematic Groups.
- **GIREP Treasurer** - Paul Logman, with responsibility for financial management and membership.
- **GIREP Secretary** – David Sands, with responsibility for secretarial functions, newsletter and updating handbook.
- **GIREP Media Officer** - Stamatis Vokos, with responsibility for Media and communications.
- **GIREP Policy Officer -** Edit Yerushami, with responsibility for young researchers, educational policies, emerging issues, etc.

The GIREP Board meets monthly and has a standing agenda. Much of the time at recent meeting has been taken up with planning for next year's GIREP conference in Leiden and a new GIREP activity, the PhD research summer school. Regular items for discussion include:

- Preparation of post conference publications when relevant:
- Support and development of GIREP Thematic Groups and International Communities.
- GIREP vzw cooperation with partner organizations, eleven on the basis of signed agreements and with two without a signed agreement.
- GIREP agreements with Springer and IOP Journal of Conference Proceedings.
- Involvement of GIREP national representatives.
- Development of GIREP website and social media Channels.
- Preparation of GIREP newsletters (available at: ISSN 2307-0366).

GIREP vzw MEMBERSHIP FEES

GIREP had 218 full registered members as of 31st December 2023. At the moment we have 164 full registered members for 2024. We encourage everyone to pay GIREP membership fees and provide your support for GIREP activities. We remind you that GIREP members can attend GIREP events with a reduced rate! The membership fee is €40 to be valid for the calendar year. The GIREP Membership Fees webpage can be accessed at: https://www.girep.org/membership-fees/

GIREP-EPEC 2025: THE GIREP CONFERENCE IN LEIDEN, THE NETHERLANDS
Transforming physics learning via research and practice

June 30th to July 4th, 2025

Universiteit Leiden
Institute of Physics

Universiteit Leiden
ICLON

The **GIREP 2025 Conference (GIREP-EPEC)** will be held in **Leiden, The Netherlands**. The conference is organized from **30 June – 4 July 2025**, jointly by the International Research Group on Physics Teaching (**GIREP**), The Educational division of the European Physical Society (**EPS-EPEC**), and two institutes at Leiden University, The Netherlands: the Leiden Institute of Physics (LION) and the Leiden University Graduate School of Teaching (ICLON).

The live programme is planned from Monday morning until Friday afternoon and will consist of plenary talks, parallel oral sessions, symposia, workshops and poster sessions. In addition, social events will allow you to both network and experience Leiden and The Netherlands optimally.

The Local Organizing Committee:

- Paul Logman (Leiden University (LION & ICLON), The Netherlands) - chair
- Ed van den Berg (The Netherlands)
- Roeland van der Rijst (Leiden University (ICLON), The Netherlands)
- Michiel de Dood (Leiden University (LION), The Netherlands)
- Marije Boonstra (Leiden University (LION), The Netherlands)

For further information, please visit the GIREP 2025 conference site: https://indico.cern.ch/event/1175859/
Conference e-mail address: girep2025@physics.leidenuniv.nl

ABSTRACT SUBMISSION OPEN

The abstract submission for the conference has been opened and we invite you to propose abstracts for symposia, oral presentations, posters, and workshops according to the conference theme as described below. All the information about the conference, including abstract submission, is available on the conference website: https://indico.cern.ch/event/1175859/ .

The conference theme, Transforming Physics Learning via Research and Practice, reflects the need for research and practice to work together in developing physics education. The idea of the conference is to gather participants involved in physics education from different perspectives and at different levels and to put them together in a general discussion on various aspects of physics education - for better mutual understanding and revival of learning of the young generation and society as whole. **We strongly support and encourage physics teachers** worldwide to come to the GIREP 2025 conference to share their experiences and discuss the current problems of physics education with their teacher colleagues from other countries and researchers from all around the world.

Important dates:

Abstract submission	12 January 2025
Notification of acceptance	14 March 2025
Deadline early bird registration	28 March 2025
Deadline regular registration	25 April 2025
Deadline late registration	30 May 2025

We are looking forward to seeing you in Leiden, the home of Rembrandt and Huygens, full of surprises and places to visit!

THE INAUGURAL GIREP SUMMER SCHOOL

LEIDEN, THE NETHERLANDS, June 28th to June 29th, 2025

The inaugural GIREP 2025 SUMMER SCHOOL aims to embrace the collaborative and collegiate atmosphere among physics educators that is so apparent at physics education conferences like GIREP for the benefit of research students in physics education research (PER). The school will provide a safe environment in which to share and develop ideas and discuss the kind of difficulties and dilemmas that can arise in PER.

The Summer School will be held from June 28th to June 29th, 2025, in Leiden, The Netherlands, the weekend before the GIREP annual conference in order to facilitate attendance at both events. It is organized by the International Research Group on Physics Teaching – GIREP (Groupe International de Recherche sur l'Enseignement de la Physique), the Leiden Institute of Physics, and the Leiden University Graduate School of Teaching.

The Summer school is a PER-specific event that aims to create opportunities for developing an international community among young researchers. The programme is planned to run from Saturday lunchtime through to Sunday evening. Working in groups, PhD students will discuss their ideas and present their work and receive high-quality feedback from junior and expert researchers. Other workshops will focus on activities such as, peer review of sample writing, analysis of qualitative data with a coding scheme, analysis of coding scheme themselves, or an in-depth look at other difficult techniques used in PER but not in mainstream physics research. These workshops are intended to foster the development of essential research skills as well as a sense of community. Working groups will comprise PhD students as well as more experienced researchers. The sessions will each last 90 minutes and give participants plenty of time to share their work and reflect on the group activities.

The approximate cost per participant is estimated to be around 200 Euro. Breakfast, lunch and dinner will be provided. **Please complete the survey to express your interest in attending the 2025 SUMMER SCHOOL**.

Organizing Committee:

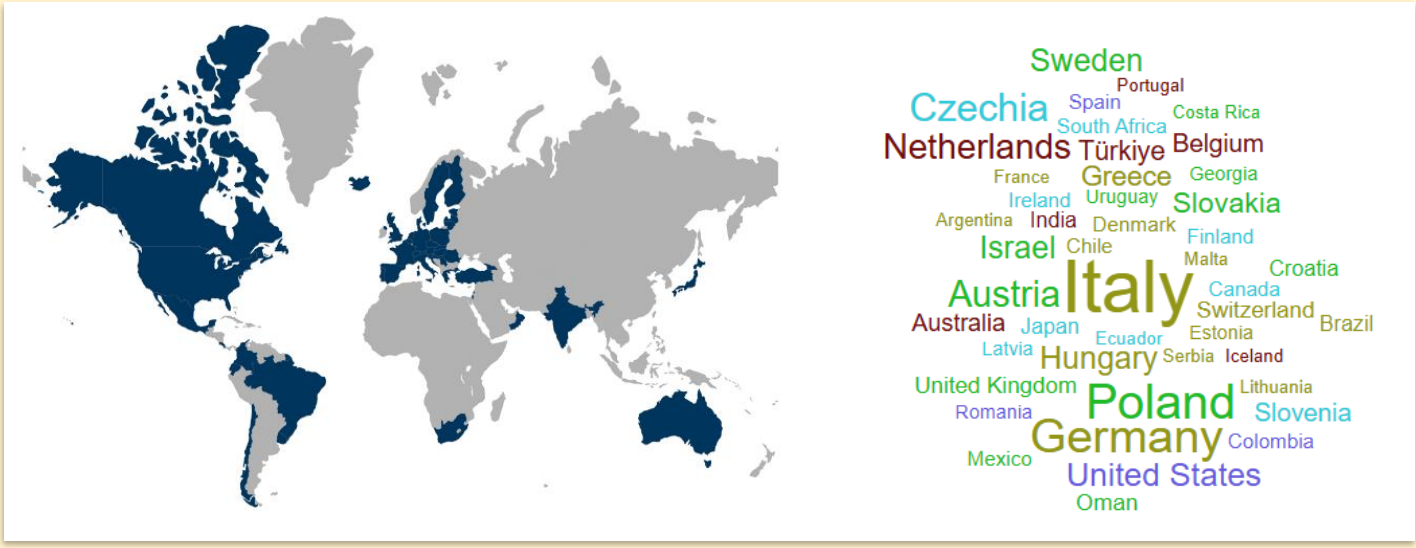
Stamatis Vokos, California Polytechnic State University, USA.
Edit Yerushalmi, Weizmann Institute of Science, Israel.
Paul Logman, Leiden University, The Netherlands.

For further information, please contact: Edit.Yerushalmi@weizmann.ac.il or svokos@calpoly.edu

REPORT OF 4TH WORLD CONFERENCE ON PHYSICS EDUCATION

The 4th WCPE 2024 was organized in Kraków, Poland, from 26 to 30 August 2024 under the theme: ***Embracing changes together***. The conference was hosted in blended form and included, both on-site and online participation. It was organized by the Faculty of Physics, Astronomy, and Applied Computer Science of the Jagiellonian University in Kraków, Poland, in cooperation with the International Research Group on Physics Teaching – GIREP (Groupe International de Recherche sur l'Enseignement de la Physique), the International Conference on Physics Education (ICPE), and the Faculty of Physics and Astronomy, University of Wrocław, Poland.

The 4th WCPE 2024 attracted over 800 contributors from 46 countries worldwide, among which 389 participated in live (344) or hybrid sessions (45). Most of the participants descended from the higher education staff (239) and other institutions (7); however, the conference also hosted a considerable number of teachers (54) and a substantial group of students and PhD students (89).



During the conference, two international organizations co-hosting the 4th WCPE presented two medals for outstanding contributions to research in physics education.

Prof. Marisa Michelini from the University of Udine received the GIREP 2024 medal in recognition of her long-term contribution to the growth of physics education and her work on the development of GIREP.

Prof. Paula Heron from the University of Washington received the ICPE 2024 medal in recognition of her sustained efforts in physics education in past decades, both nationally and internationally.

The Sara Barbieri Award 2024 was presented by GIREP to **Joanna Biel-Kiepura**, a teacher from Poland, for her work *Be like Izaac Newton", a science project as a method of introducing students with special educational needs to work in a new class in the first year of secondary school during physics lessons.*

The seven plenary speakers contributed to the theme of the 4th WCPE.

(1) **Marisa Michelini**, University of Udine, Italy. *What I've Learned in 48 Years of Research in Physics Education (PER)*
(2) **Paula Heron**, University of Washington, USA. *Does How We Teach Match How Students Learn? The Evolving Relationships Among Theory, Experiment, and Teaching Practice in PER*
(3) **Claudio Fazio**, University of Palermo, Italy. *Enhancing Physics Education through Dimensions of Learning: Examples from Research*
(4) **Lama Jaber**, Florida State University, USA. *Cultivating a Feeling for Physics: The Importance of Epistemic Empathy and Responsive Teaching*
(5) **Magdalena Kersting**, University of Copenhagen, Denmark. *Teacher Professional Development in Transformative Times: Three Collaborative Visions for the Future of Physics Education*
(6) **Andreas Mueller**, University of Geneva, Switzerland. *Digital Competences and Physics Education – A Rich Field for Classroom Practice and Teacher Education*
(7) **Thomas Schubatzky**, University of Innsbruck, Austria. *Climate Change in Physics Education: Why, What and How?*

The conference was organized around 14 thematic strands:

CUR: Physics Curricula
CPE: Competence-based physics education

TLP: Teaching and Learning Physics Concepts
MMP: Multimedia, AR, VR and AI in Physics Education
REM: Remote Physics Teaching and Learning
EPW: Experiments and Practical Work in Physics Education
EAD: Evaluation and Assessment of Student Learning and Development
PTE: Physics Teacher Education and Professional Learning
MPE: Metacognition in Physics Education
PSI: Physics for Environment and Social Issues
MDR: Contemporary Physics, Modern Physics in Schools and Universities
STM: Physics in STEM Education and Interdisciplinary Approaches
IBP: Identity and Belonging in Physics
OUT: Outreach of Physics

All contributions were scheduled in five formats: discussions, symposia, workshops, oral presentations, and poster presentations, divided into live and hybrid sessions.

Type	Live	Hybrid	Total
Discussion workshops	5	-	5
Symposia	8	1	9
Workshops	23	2	25
Oral presentations	153	23	176
Posters	63	10	73
Total	***251***	***36***	***288***

The most frequently selected thematic strands were Experiments and Practical Work in Physics Education (EPW) and Physics Teacher Education and Professional Learning (PTE) with 47 contributions each, followed by Teaching and Learning Physics Concepts (TLP) with 43 contributions. The least populated strand was Remote Physics Teaching and Learning (REM), with only 3 contributions.

STRAND	DISCUSSION WORKSHOPS	SYMPOSIA	WORKSHOPS	ORAL PRESENTATIONS	POSTERS	TOTAL
CUR		1		4	2	**7**
CPE	-	-	2	6	2	**10**
TLP	1	1	1	31	9	**43**
MMP	-	1	2	12	3	**18**
REM	-	-	-	2	1	**3**
EPW	1	-	9	20	17	**47**
EAD	-	1	1	24	6	**32**
PTE	1	2	7	26	11	**47**
MPE	-	-	-	1	-	**1**
PSI	1	3	-	7	4	**15**
MDR	1	-	2	17	4	**24**
STM	-	-	-	8	4	**12**
IBP	-	-	1	10	2	**13**
OUT	-	-	-	8	6	**14**
TOTAL	***5***	***9***	***25***	***176***	***73***	***288***

The contributions that were presented were targeted at four levels: (1) Early science/Primary Education, (2) Secondary Education, (3) University Education, and (4) General Education.

Target	No. of contributions
Early science/Primary	15
Secondary Education	132
University Education	89
General Education	52

Most of the contributions were related to formal education (253), while only 21 were related to non-formal education, and 15 were related to informal education.

Category	Number of contributions
Formal education	253
Non-formal education	21
Informal education	15

Contributions were scheduled according to their strands and target education levels into 103 slots. The 4th WCPE timetable was organized each day in 7-9 parallel sessions with different timeslots dedicated to (1) oral presentations, (2) discussion workshops, symposia, and workshops, and (3) poster sessions.

During the 4th WCPE, the physics education network was developed during the scientific sessions and less formal events. On Monday, the Conference Cocktail was organized at the Mayor of Krakow Palace in Old Town. On Wednesday, participants had the opportunity to select one of five thematic excursions: (1) Auschwitz-Birkenau Concentration Camp, (2) Salt Mine in Wieliczka, (3) Ghetto and Schindler's Factory in Kraków, (4) Jewish District in Kraków and (5) Old Town. On Thursday, the Conference Dinner was organized for all participants in Mogilany.

The 4th WCPE website provides further details about the entire conference, including :

- The Book of Short Abstracts: https://indico.cern.ch/event/1162407/page/35383-book-of-short-abstracts
- The Book of Extended Abstracts: https://indico.cern.ch/event/1162407/page/35382-book-of-extended-abstracts (this volume also includes an ISBN and an author index with active links for easy navigation and reference)
- The album of photos (only for logged-in participants): https://indico.cern.ch/event/1162407/page/35441-photos
- Conference timetable: https://indico.cern.ch/event/1162407/timetable/#20240826

The call for papers was opened on the 15 November 2024. The deadline for the paper submission expires on the 31st December 2024.

- Proceedings of the 4th WCPE will be published in **IOP *Journal of Physics: Conference Series*** (JPCS). JPCS is indexed in Scopus, as well as EI Compendex and Inspec. IOP Conference Series is **not** covered by Science Citation Index (proceedings journals are not indexed in SCI, they are indexed within a separate database, the CPC-I); this means that JPCS is not issued with an Impact Factor.

- Between 10% and 20% of the best papers will be selected for chapters in the Springer book series ***Challenges in Physics Education***

The editors plan to finalize both publications in Autumn 2025.

Special thanks are expressed to the **Scientific Advisory Board Members** for their substantial and constant support before and during the conference:

- Tetyana Antimirova, Canada
- Claudio Fazio, Italy
- Angela Fösel, Germany
- Jenaro Guisasola, Spain
- Christiano Mattos, Brazil
- Eilish McLoughlin, Ireland
- Paul Logman, the Netherlands
- David Sands, UK
- Manjula Devi Sharma, Australia
- Stamatis Vokos, USA
- Edit Yerushalmi, Israel

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The LOC would like to thank all the participants for their presentations, fruitful discussions, and active collaboration at the 4th WCPE. It would not have been possible without you!

The Local Organizing Committee:

- Dagmara Sokołowska (UJ),
- Witold Zawadzki (UJ),
- Mirela Kaczmarek (UWr),
- Tomasz Greczyło (UWr),
- Roman Rosiek (UKEN)

The World Conference on Physics Education – a personal view

by David Sands

The 4th WCPE took place in the historic city of Krakow, Poland, from 26-30 August 2024. Krakow has many tourist attractions, not least of which are the impressive salt mines, but Krakow is also located not far away from the infamous Auschwitz concentration camp, which has recently established a more formal visitor centre in order to preserve what remains of the camp and to pass on the story of the atrocities to the next generation. I was at the GIREP conference in Krakow in 2016 and on that occasion I chose to visit the salt mines on one of the conference excursions. This time around, I visited Auschwitz-Birkenau, and I recommend it.

Auschwitz itself did not seem that intimidating. Even the famous sign, “Arbeit Macht Frei” seemed somewhat small and quite ordinary. The camp was at one time a Polish army barracks and the place itself is therefore limited in size. There were nonetheless reminders of the atrocities that occurred there on view as we toured the site: piles of human hair, shoes, spectacles, empty cans of the poison used in the killing chamber, and of course a gas chamber and accompanying oven.

Auschwitz lies very much in the centre of Europe and people were transported there from all over the continent. It wasn’t just Jews, but anyone the Nazis considered undesirable, including Russian prisoners of war and Gypsy and Roma people. The limited size of the place meant that it was unsuitable for the purpose for which it became most famous, as a death camp. Therefore, the Nazis built two other sites close by, one of which is Birkenau just a short bus ride away. We could only see about a third of the site, but as far as the eye could see there were rows and rows of now derelict barrack blocks which housed the prisoners. The scale and stark simplicity make this a much more disturbing place and looking round it, seeing the utterly appalling conditions in the still surviving barrack blocks and the railway lines leading directly to the gas chambers, brings home the utter barbarity of what happened there like nothing else can. Read as many books or watch as many films or documentaries as you like, somehow what happened still seems somewhat abstract, appreciated by the mind but not the heart. However, to stand in Birkenau is to begin to appreciate the scale of the atrocity and sheer inhumanity of it all and for that reason alone, it is worth a visit.

Back to conference, the theme of which was, “Embracing changes together”. Some of the keynote speakers, seven in all, took this as their inspiration. Marisa Michelini, well known to the GIREP community, was presented with the GIREP medal and gave a talk entitled, “What I've Learned in 48 Years of Research in Physics Education (PER)”**,** in which she remembered the many people who had either influenced her or with whom she had collaborated over the years. Some of those she remembered have now sadly departed this world, but others are still very much around.

Paula Heron gave a very personal view on the role of cognition in learning with a talk entitled, “Does How We Teach Match How Students Learn? The Evolving Relationships Among Theory, Experiment, and Teaching Practice in PER”. Paula, along with others, is very much interested in dual processing theories of reasoning, which posit that we have two ways of reasoning. In some accounts these are called different systems, but as yet we don’t know either the cognitive or neuroscientific basis for the phenomenon of dual processing. This is something I have been deeply interested in for many years and as far back as 2004 I was very interested in the links I had observed between cognitive psychology and physics education research. These links were by no means explicit. Many physics education researchers at that time avoided any association with the cognitive sciences, but over the years it has become apparent that we cannot ignore the way students think and reason about physics.

This recalls Edward “Joe” Redish, a towering figure in PER whose death was announced at the conference. Joe was an early advocate of a neuroscientific or cognitive approach as the only way to put physics education research on a firm theoretical footing. This was a view I also adopted around 2004. It struck me that the focus on misconceptions in much of PER at that time was limited in scope. Whilst it might provide useful information on a specific topic that had been researched, it could tell you very little about teaching other topics. I was interested in how we could use PER more generally to inform the way we might teach other topics, but my approach was very different from Joe’s. In truth I found it difficult to grasp the idea of epistemic framing and resource theory, which was the essence of Joe’s approach, but his contribution to PER and to physics education in general went much further than simply an attempt to put PER on a sound cognitive footing. The conference held a minute’s silence in honour of Joe and Stamatis Vokos, who knew him personally, remembered his friend and colleague to the assembled audience.

Other keynote presenters included Claudio Fazio, who presented on cognitive effects in learning, Lama Jaber, who spoke on “Cultivating a Feeling for Physics: The Importance of Epistemic Empathy and Responsive Teaching”, Andreas Mueller, speaking about “Digital Competences and Physics Education”, Thomas Schubatzky, on “Climate Change in Physics Education: Why, What and How?” and Magdalena Kersting, who really embraced the theme of

change and spoke about “Teacher Professional Development in Transformative Times: Three Collaborative Visions for the Future of Physics Education”.

The oral and poster sessions were organised into 14 different strands and for me the highlight was the symposium organised by Mieke de Cock and Paul van Kampen on quantitative literacy. This could also be called qualitative mathematics because it denotes the ability to infer mathematical relationships from diagrammatic or verbal representations. It was at this symposium that I became acutely aware of the limitations of working memory in this process. Working memory has three dimensions: the phonological loop, the visuo-spatial sketch pad, and the executive function, which controls attention, and the cognitive resources directed at particular tasks. The other two aspects are largely independent, but act like limited capacity storage systems. In effect, we can hold a very limited amount of information in our head and operate on it at the same time.

This limitation is especially relevant for the kind of tasks described in the symposium on quantitative literacy. Trying to interpret a diagram that represents a dynamic situation involves the visuo-spatial sketchpad as it constitutes a spatial arrangement that must be envisaged mentally. This arrangement might be static, but it might also be dynamic, but a dynamic arrangement probably puts more load on the working memory. If, at the same time, we are trying to arrive at a qualitative relationship between two or more of the parameters, say in the form of a graph, this adds to the load on working memory because it is also a spatial representation. It might simply be that we cannot hold that amount of information in our heads and the task cannot be done. This does not mean that the physics is not understood or that we cannot in general interpret spatial relationships in terms of mathematics, but simply that the task is too complicated for the limitations of working memory.

Working memory capacity varies between individuals and some people will be able to tackle problems that others might struggle with, but if a task requires that too much information be held in the working memory the task will be beyond the person attempting it. This could explain the enormous variability seen in the ability to perform different tasks, but more importantly suggests that, somehow, we have to teach our students to be flexible in their approach and to recognise that the inability to do something does not necessarily mean that the physics is not understood. This is a significant challenge.

Education in general, not just in physics, is facing a huge challenge with the emergence of AI. If we think ahead to the next WCPE in 2028, AI will no doubt have advanced significantly and will probably be able to do many of the things that we have traditionally asked students to do. It was clear from some of the questions at the plenary sessions that AI is exercising several people, but it was not a topic that featured extensively. No doubt that will change at the next WCPE in 2028, but for the present it remains a very challenging change that must be embraced. We don’t yet know exactly what skills students will have to acquire to deal with AI in both their studies and their later professional lives, but we can be sure they will need to be skilled not only in asking the right questions but also in using the answers. The question that strikes me is, how will students acquire a deep understanding when many of the things they currently do to acquire and develop their knowledge will themselves be done by AI? This is a challenge for the next WCPE.

2025 INFN-INSPYRE International School on Modern Physics

Applications for the 2025 edition of the INFN-INSPYRE International School on Modern Physics are now open

INSPYRE (*INternational School on modern PhYsics and REsearch)* is the INFN international school for students aged 16-18 years held at Frascati National Laboratory (LNF) of INFN. The school has been organized annually since 2011, lasts one week, and involves participants in three types of activities: seminars, debates and laboratory-based activities on the topics of Modern Physics. Since 2004, the school, organized by the Italian National Institute for Nuclear Physics (INFN), has collaborated with GIREP. An account of the 2024 School is presented below this announcement.

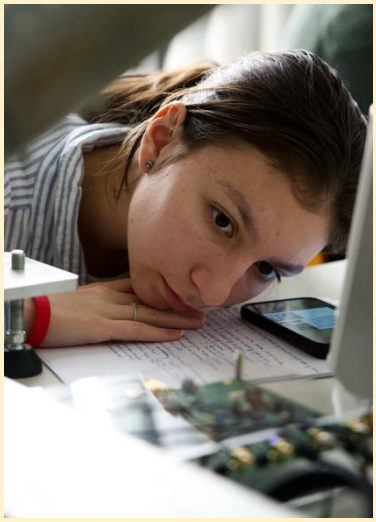
The INFN-INSPYRE International School on Modern Physics is dedicated to Italian and foreign high school students 16 years of age or older who will **experience a full immersion in physics and the world of scientific research** through lectures, discussions and experimental working groups led by passionate and competent researchers. The school opens its applications for the 2025 edition.

This year, for the first time, the School will have two editions: from 7 to 11 April 2025 at INFN Frascati National Laboratory and from 14 to 18 July 2025 at the INFN Legnaro National Laboratory. The Frascati School will host 40 students; the Legnaro School will host 28 students. The two 2025 Schools will have different scientific programs and speakers, but the same application form.

The deadline for application is November 30th, 2024. The application form is accessible from: https://agenda.infn.it/e/inspyre-2025 and more information about the School is accessible from: https://comedu.lnf.infn.it/inspyre-2025/

About the INSPYRE school

Due to its international dimension, INSPYRE represents a highly significant initiative in the physics educational panorama. From its first edition in 2011, INSPYRE has reached more than 600 students from 18 countries.



From 2024 a cooperation between INFN- INSPYRE and GIREP has been formalized by a **cooperation agreement** which followed a discussion between the various parties.

Thanks to this agreement:

- the INSPYRE Scientific Committee welcomed the GIREP representative **prof. Marisa Michelini.**
- The CS built the **scientific program** of the school and decided the speakers to be involved
- GIREP supported the **promotion of the school**, through the GIREP newsletter, the GIREP website and the possibility of presenting an informative poster about INSPYRE during GIREP conferences
- GIREP proposed during INSPYRE an **educational proposal** on quantum mechanics (QM)

The agreement is fully in line with INSPYRE objectives:

- transfer knowledge and build skills in **modern physics research**;
- offer participants the unique opportunity to significantly **interact with science professionals**, and thus learn more about the work of a scientist; therefore, this initiative can be seen as a career orientation activity towards STEM (as recently demonstrated by the experiences of former participants);

- **raise awareness** towards the latest scientific issues as well as application in everyday life and the social impact of science
- offer a **training experience** in the context of a public research institution;
- **improve soft skills** (such as communication and interaction among peers, sharing best practices)

These objectives are pursued by allowing participants to experience a **full immersion in physics** and in the world of scientific research. They, in fact, attend plenary lectures, discuss with researchers, socialize, and perform laboratory-based activities, while experiencing a real laboratory environment.

The personnel involved in the School comprise:

National Leaders:
Catalina Curceanu, Adriana Postiglione (INFN-LNF)

Scientific Committee
Susanna Bertelli (INFN – LNF)
Fabio Bossi (INFN – LNF Director)
Catalina Curceanu (INFN – LNF)
Alessandra Filippi (INFN – Torino)
Tommaso Marchi (INFN – LNL)
Marisa Michelini (Udine Univ, GIREP)
Adriana Postiglione (INFN – LNF)
Sascha Schmeling (CERN Section Leader for Teacher and Student Programmes)

Organizing Committee
Sara Arnone
Susanna Bertelli
Debora Bifaretti
Elena Patrignanelli
Adriana Postiglione
Sara Reda
Elisa Santinelli

Report on the 2024 INFN - INSPYRE International School in cooperation with GIREP

Adriana Postiglione, INFN-LNF

INSPYRE 2024 was held **from 8 to 12 April** at INFN Frascati National Laboratory, with **39 students from 7 countries** (Italy, France, Germany, Romania, Spain, Serbia, Slovakia). The following **INFN sections** were also involved: Catania, Firenze, LNF, LNL, Roma1, Roma2, Torino, Trieste and the following other Institutes: CERN, GIREP, Universities: Padova,

Roma Tor Vergata, Trieste e Udine. The program of the School covered several topics, including accelerators, particle detectors and the application of particle physics to society. Special attention was given to fundamental QM topics, but also to the latest scientific and technological applications, such as quantum computing and artificial intelligence.

The GIREP educational proposal

The GIREP QM proposal began with a seminar held by Marisa Michelini introducing problematic issues of QM (properties, state, superposition principle, measurements, entanglement and non-locality).

This was followed by 4 hours of IBLS which combined experimental labs with theory on the polarization state of light which allowed students to explore the concept of polarization by making use of polarizing filters and bi-refringent crystals and building some hypothesis on single photon polarization state and properties.

In the theoretical part of the Lab, led by Lorenzo Santi of Udine University, students played the role of theoretical physicists planning and analyzing ideal experiments using a simulation open environment based on JQM software.

A seminar on the second quantum revolution and on quantum computing held by Angelo Bassi from Trieste University and Trieste INFN Section then offered another context and perspective.

The session concluded with a debate where students discussed the concepts they encountered with the tutors of the previous seminars.

The debate was an opportunity to bring out the fundamental aspects of the quantum way of thinking and second quantum revolution through stimulating questions.

Learning results were analysed by means of tutorials and pre- tests. A specific test was dedicated to exploring participants' engagement in the proposal. The results were shared at WCPE in August [1] and SIF in September [2]

References

[1] «*A quantum mechanics educational proposal implemented in the INSPYRE School*» by Adriana POSTIGLIONE, Catalina CURCEANU, Marisa MICHELINI, Lorenzo SANTI, Angelo BASSI, Susanna BERTELLI

[2] «*Una proposta di meccanica quantistica realizzata alla Scuola Internazionale INFN-INSPYRE*» by Adriana POSTIGLIONE, Catalina CURCEANU, Marisa MICHELINI, Lorenzo SANTI, Angelo BASSI, Susanna BERTELLI

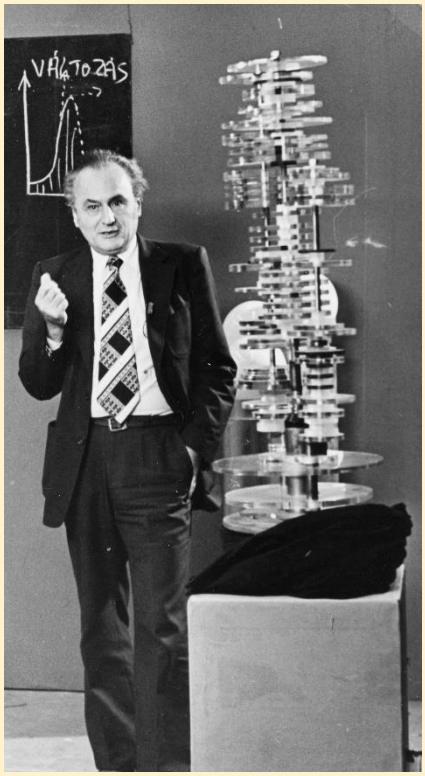
Help us to prepare George Marx's Centenary!

Csaba Sükösd

Budapest University of Technology and Economics, Hungary

Editor's note: *This is an abridged version of an article that first appeared in the December 2023 edition of the newsletter. Csaba Sukosd is requesting your help to celebrate the centenary of George Marx, who played a significant role in GIREP during his lifetime. George was an outstanding educator as well as a noted scientist who made many contributions to particle physics, not least of which were the proposal in 1952, at the age of 25, for the conservation of lepton number as well as the inauguration of a series of international meetings on neutrinos that have continued to this day.*

Whilst recognising these contributions, the scientific aspects of George Marx's career have been reduced to focus instead on his educational activities, both within Europe and without.



George Marx lecturing

George Marx (1927-2002) was an outstanding Hungarian physicist, a worldwide renowned educator and a brilliant communicator. He was member of GIREP from the early days to his death and was also a member of GIREP Board for several years. He served as president of GIREP from 1992-1995. In Hungary, some of his earlier co-workers plan to celebrate the centenary of George Marx's birthday by editing and publishing a festschrift based on some contemporary documents.

George's published scientific and educational papers are widely available, but there may be other documents, such as minutes of meetings, personal letters, photos, which have not been published yet, but which could shed light on the way George was thinking about problems and how he was working. Publication of these documents could illustrate not only his way of living but the world and the era in which he lived. The organizing committee have placed the main emphasis on the documents, but short flashbacks from the "ever-young" colleagues would be welcome. It Is clear that this celebration cannot be complete without involving GIREP, because GIREP played an important role in George Marx's life and therefore plays an important role in his heritage.

Therefore, we ask those from the GIREP community who worked with him if they have some, as yet, unpublished documents or pictures they would be willing to share or if they would like to write a short recollection about their work with George. Please contact Csaba Sükösd by email at sukosd@reak.bme.hu

For those who had not the chance to know him personally, we summarize his scientific achievements very shortly, and provide a bit more detail about his work as an educator.

George Marx, the educator[1]

Let me start with a quotation from him, which shows how important he considered education:

> *"In a foreign country go and see the banks to know how people like their money, go in the restaurants and bars to know how they like themselves, visit the schools to know how they like their children and their future.*"

During my university years I had the chance to follow several courses delivered by G. Marx: Quantum Mechanics, Cosmology and others. Looking back over more than 50 years, I still remember some of his lectures, which charmed us to a point that the whole audience spontaneously broke out in loud applause when the lecture finished. This kind of reaction is more common nowadays, but that time it seldom happened. I don't remember having heard that about any other professor of the university. He had a rare talent and skill in communication.

His activities for public education in Hungary

George Marx was an outstanding scientist who gave the same importance to education as he did to research. This was rooted deep in his vision of life; he was persuaded that only science can guide society to make wise decisions. Therefore, the general public should also be educated in science – be it physics, chemistry, biology, medicine, or even social sciences. He did not focus only on the university education, but also acted to improve science education program in schools.

He started lecturing to students who were studying to become teachers of physics, chemistry and biology at the Eötvös University, Hungary. He took the view that the young people in the 20th century cannot be motivated toward science with the "conventional" way that physics was taught. His leading idea was that the talented young people can be guided towards a scientific or technical career by teaching them about the amazing world of modern physics, modern chemistry and modern biology. The school curriculum had to be reformed in this direction.

Structure of Matter – Chinese edition

George Marx was well ahead of his time with promoting the teaching of modern physics and quantum physics in schools. Even today, as illustrated during the 2019 GIREP conference, one of the main issues under discussion was how quantum physics can be taught in schools. The almost 400 participants of the international conference paid tribute to the early achievements of George Marx.

It is also worth mentioning that, although the whole program was not generally introduced in the Hungarian educational system, some parts of it are still recognizable in the curricula of the different scientific subjects. For example, part of school physics still deals with nuclear energy and radiation protection, which was first introduced by this project. This had already some influence on the population during the Chernobyl accident and contributed also to the fact that the majority of the Hungarian population are more accepting of nuclear energy than the population of other European countries.

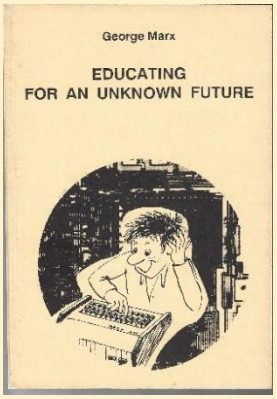
Prof. Marisa Michelini, president of GIREP, remembering George Marx during the GIREP2019 Conference

George Marx's activity in Hungarian education was not restricted only to the educational reform outlined above. He kept a strong relationship with the physics teachers' community. His lectures

[1] This text is based on the article that appeared in the Special Issue of the Fizikai Szemle – Hungarian Physical Review [1]

were always the most awaited highlights of the annual National Conferences of Physics Teachers. Together with Eszter Tóth (1947 – 2022) they organized a country-wide program of measuring the radon-concentration in homes. Schoolchildren were taught how to place small solid-state radon-detectors in their rooms, which later were collected and analysed.

George also organized several upgrading programs in modern and nuclear physics for physics teachers. He led groups of physics teachers on visits to several interesting sites, including CERN in Switzerland, Chernobyl in Ukraine, Paks Nuclear Power Plant in Hungary, Cernavoda in Romania.



G. Marx: Educating for an unknown future

George Marx was also fascinated about everything new. When the personal computers started to become available, he was among the first in Hungary to purchase one, and he started developing science educational games and simulations. It is telling that there is a student with a computer on the cover of his book "Educating for an unknown future". When many people were still sceptic, he was strongly in favour for the introduction of computers into schools.

He founded and led the Leo Szilárd Physics Competition for high school children, for which the 26th competition was organised in 2023. This physics competition not only chooses its problems uniquely from modern physics, but also it comprises an experimental and a computer simulation step, as George Marx had suggested many years ago.

International educational activities

George Marx knew that being in the flow of the international events is as important in education as in the research. He served the international physics education community in many ways: as a member of ICPE (International Commission on Physics Education) in 1975-1981, becoming Vice-Chair in 1987-1993, and Editor of the ICPE Newsletter from 1988-1994. He had a long involvement with GIREP, and was also its President in 1992-1995. During his membership and his presidency he organized many conferences, seminars and meetings about teaching physics in schools. It started with the "Danube Seminars". Jon Ogborn (UK) remembered those times [2].

> *"I well remember standing with George Marx in Visegrád, where the Danube makes its huge bend to the south, looking across to what was then Czechoslovakia. George had chosen this historic place for the second Danube Seminar, the first of many Danube Seminars on Physics Education held in Hungary. Why the title, "Danube Seminars"? George Marx wanted the countries of Eastern Europe, then frozen in the Soviet bloc, to come together to invent for themselves new ways of thinking about teaching physics in the school. And he wanted to ignite that fire with flames taken from the best and most recent work and thinking in other countries. I was there as one of the matchsticks in his matchbox."*

Jon Ogborn (left) and George Marx during a GIREP meeting in Balatonfüred (Hungary)

George organised a number of international seminars between the mid-1970s to the late 1980s to explore teaching in schools complex topics like wave mechanics, statistical mechanics, momentum, the structure of matter, nuclear physics, entropy, chaos and energy alternatives.

Educating outside Europe

George Marx enthusiastically embraced divers cultures from all around the world. He equally admired the old Chinese cultures as well as the Hindu religion and Buddhism. Jon Ogborn again [2] George's missions in Asia and Africa:

"In the 1980s and 1990s George made many visits to China, Japan and Africa. He also went to India in 1984. A long visit to China in 1983 was followed by a series of further visits, as he was invited back again and again. This in itself is testimony to the value Chinese people put upon his ideas and experience. A similar long series of visits to Japan started in 1986. In all these visits, George expounded his vision of a science education based on the deepest and most general elements of the scientific world picture, and designed to develop the creativity and talent of all students.

Starting in 1987, with the support of the International Centre for Theoretical Physics headed by his friend Abdus Salam (Nobel laureate), George Marx began a long series of workshops on the use of microcomputers in science and mathematics education. Between 1987 and 1993 he took his ideas, and his personal charm and warmth to Egypt, Ethiopia, Kenya, Ghana, Zimbabwe and Uganda. George was never there merely to teach. Above all, he tried to leave behind a sense of possibility, of personal creativity in every participant."

George Marx teaching in China

George Marx with African children

Epilogue

There isn't room in this short paper to list all achievements and results for which physics education has to thank George Marx. He received many awards for his scientific work, and also for his outstanding achievements in physics education. A year before his death, in 2001, he was awarded the Bragg-medal of the Institute of Physics. Earlier, in 1997, the IUPAP ICPE awarded him the ICPE medal for outstanding services to the teaching of physics, with an international dimension. Interestingly, this award was founded by George earlier, when he held the vice-chair of ICPE. The medal is the work of a famous Hungarian sculptor – Miklós Borsos, – who was also a friend of George. This homage to George is best finished by quoting a short excerpt of the laudatory text of his ICPE award [3]:

> *Throughout his long career Professor Marx has devoted himself to advancing the cause of science and of physics education. Both in his research work in physics, and in his work as a teacher, an author and an editor he has made seminal contributions to the literature. He has catalysed the organisation of numerous international conferences and projects in physics education. Always, and in all ways, George Marx has been a trusted advisor and a highly valued friend of physics teachers the world around, and through his continuing and tireless efforts on their behalf has earned their deepest respect, affection and gratitude.*

References

[1] Csaba Sükösd: "George Marx, the Educator" in: Fizikai Szemle Special Issue (2022) (in English). http://fizikaiszemle.hu/szemle/tartalom/102.

[2] Jon Ogborn: IUPAP-ICPE International Newsletter on Physics Education, April 2003. http://iupap-icpe.org/publications/newsletters/n45.pdf

[3] https://web.phys.ksu.edu/icpe/medals/Citations/marx.htm

GIREP THEMATIC GROUPS (GTGs)

GIREP Thematic Groups (GTG) are focused communities of GIREP members interested in sharing their expertise in particular facets of physics education, from working with children, through undergraduate work, to teacher training. The aim of the GTG is to stay in touch as critical friends, exchanging thoughts, materials and findings from the varied contexts in which we work and contribute to GIREP activities on the topic of GTG. The GTG leaders take responsibility for involving and organising the participation of GTG colleagues in conferences: offering an activity (workshop or poster-symposium, symposium) in each Conference or Seminar of GIREP https://www.girep.org/thematic-groups/

GTGs

GTG Title:	*GTG leaders*
Cultural Understanding of Physics: instruments and methods (CUP)	**Marco Giliberti**, University of Milan, Italy.
Thermodynamics and Energy	**David Sands**, Independent Educational Physicist. **Yaron Lehavi**, The David Yellin Academic College of Education , Israel.
Games with the Purpose of Physics Education (GaPE)	**Marilù Chiofalo**, University of Pisa, Italy. **Sabrina Maniscalco**, University of Helsinki, Finland.
Innovative Pedagogical Methods for University Physics	**Gerald Feldman**, George Washington University, USA. **Guillaume Schiltz**, ETH Zürich, Switzerland.
Laboratory Based Teaching in Physics (LabTiP)	Ian Bearden, Niels Bohr Institute, University of Copenhagen, Denmark. Paul Logman, Leiden Institute of Physics, Leiden, The Netherlands.
Mathematics in Physics Education	Gesche Pospiech, Technische Universität Dresden, Germany.
Multiple External Representation in Physics Education Research (MER@PER)	Christoph Hoyer, Stefan Küchemann and Jochen Kuhn, Ludwig-Maximilians-Universität München, Germany.
Physics and Society	Aristotelis Gkiolmas, University of Athens, Greece.
Physics Education Research at University (PERU)	Jenaro Guisasola, University of the Basque Country, Spain.
Physics Preparation of Teachers in Grades K-6	Stamatis Vokos, California Polytechnic State University-San Luis Obispo, USA. Federico Corni, Libera Università di Bolzano, Italy.
Strategies for Active Learning (SAL)	Claudio Fazio, University of Palermo, Italy
Teaching and Learning Quantum Physics	Sergej Faletič, University of Ljubljana, Slovenia Marisa Michelini, University of Udine, Italy Gesche Pospiech, Technische Universität Dresden, Germany

TPACK in Physics Teacher Education	M. Fatih Taşar, Gazi Üniversitesi, Turkey
Physics Teacher Professional learning (GTG-PTPL)	Eilish MCLOUGHLIN, Dublin City University, Ireland Dagmara SOKOLOWSKA, Jagiellonian University, Poland.

FOCUS
ON NEW GTGs

- **Physics Teacher Professional learning (GTG-PTPL) – Eilish McLoughlin & Dagmara Sokowska**

Education systems must adapt to the rapidly changing landscape of the global economy and society to prepare learners to live and thrive in a complex and connected society. Thus now, more than ever, providing support for physics teachers (from early childhood to university level) in addressing new challenges and barriers to student participation and engagement in physics education at school and university level is critical. The quality of pre-service teacher education supplemented by a continuing professional learning programme, is widely considered the most crucial factor for improving the quality of student learning. The effectiveness of teachers' instructional strategies depends on their understanding of how students learn not only a specific physics topic, but also more generally, and their awareness of how student learning is affected by other factors, such as the specific educational contexts and students' difficulties/ideas related to a topic. Teachers need to deploy a range of strategies to support individual and differentiated learning in their pedagogical practices. Crucially, teachers' engagement in professional learning is shown to have a positive influence on their learners' academic achievement in physics - and this is increased when teacher professional learning is extended over a period and involves the engagement of external experts and opportunities to take part in professional communities of practice.

The GIREP Thematic Group Physics Teacher Professional learning (GTG-PTPL) invites participation by anyone interested in addressing the following questions:

1) What are the key challenges and opportunities to recruiting and retaining physics teachers?
(2) What pedagogical methodologies are most effective in enhancing physics teaching and learning?
(3) What are the key challenges and opportunities for developing teachers' competencies for online teaching?
(4) What is the role of national and international networks of teachers, physics education researchers and university-school collaborations in improving physics teaching?

GTG-PTPL will support activities that foster communication and exchange among GIREP members with an interest in this area, including the organization of an Invited symposium or workshop at GIREP Conferences and actions associated with the corresponding proceedings.

For further information, please email to:
Eilish MCLOUGHLIN (Dublin City University, Ireland) eilish.mcloughlin@dcu.ie
Dagmara SOKOLOWSKA (Jagiellonian University, Poland) dagmara.sokolowska@uj.edu.pl

- **Energy and Thermodynamics, by David Sands**

This GIREP Thematic Group (GTG) was developed following the 2023 GIREP conference in Slovakia. It is a development of the GTG on Energy which was led at that time by Professor Paula Heron. Paula, who is well known to the GIREP community, had led the Energy GTG for many years and organised a number of events at various conferences, but after a discussion over a potential GTG on thermodynamics, she felt the time was right to hand the

Energy GTG over to new leadership and combine it with thermodynamics. Hence, a new GTG was formed that combined thermodynamics with energy. This GTG is jointly led by me (David Sands) on thermodynamics and Yaron Lehavi, from Israel, on energy. We held the first symposium of the joint GTG at the WCPE in Krakow in 2024.

Yaron's interest is primarily in teaching about energy changes. We still don't know what energy is, but we can convert it from one form to another and use it to our advantage to do work, heat our homes, cook, and to provide light, to name but a few uses. This coincides with my own interest, which lies in promoting the First Law, commonly known as the law of conservation of energy. My researches in thermodynamics were prompted by the realisation that the concept of entropy is flawed, a conclusion I came to owing to the numerous inconsistencies evident when one considers the physics of entropy. Not least of these is a conflict with the First Law, but very few thermodynamicists have recognised this for what it is, preferring instead to wonder at the mystery of this enigmatic concept. The conflict with the First Law is most easily appreciated in relation to the free expansion of an ideal, classical gas into a vacuum. The end result of such an operation is a gas at the same temperature, but occupying a larger volume. The final state has a larger entropy, and as the temperatures of the initial and final states are the same, the quantity, $T\Delta S$, which has the units of energy can be meaningfully defined. Yet, there are no real energy changes occurring either in the body or in the environment. There is no work done, no heat flow and no change in internal energy, so whatever $T\Delta S$ represents it is not connected to the First Law.

I realised that to identify the nature of the difficulty, I would have to go back to the original sources – or at least translations of the original papers – to see what ideas led to the development of the concept of entropy because whatever misconceptions exist within the subject are firmly and inseparably woven into the narrative of later texts. Therefore, I went back to Clausius' original papers. I identified the source of the inconsistency as arising from two main ideas: first, entropy is a property of a body and, secondly, Clausius sought to apply a theory developed for cyclic processes to non-cyclic processes.

Without going into the detail, this led Clausius to develop an inequality for entropy changes, $TdS \geq dQ$, which has formed the basis of modern irreversible thermodynamics. However, Clausius did not consider what physical property of a body with units of energy, TdS, is increasing. As illustrated above with reference to the free expansion, an increase of more than dQ conflicts with the First Law. The free expansion provides the simplest example, but it is possible to envisage other circumstances in which entropy changes conflict with energy conservtion. The symposium organised by the GTG at the recent WCPE took this as its theme. Entitled, *Energy, Energy Degradation and Entropy: Difficult Concepts And Conflicting Views In The Teaching Of Thermal Phenomena*, I posed in my presentation the fundamental question, *Energy or Entropy*? I set out the reason why Clausius regarded entropy as a property of a body with a view to arguing for the primacy of the First Law.

Essentially, the reason why entropy is regarded as a property of a body, by which I mean that an amount of matter, say a quantity of a gas, has a definite amount of entropy in a given thermodynamic state, is historical. It was commonly held at that time that heat was motion, or to be precise, kinetic energy, but this was a transitional view between the modern notion of heat as an exchange of energy and caloric theory, which regarded heat as an indestructible, invisible fluid-like substance. For Clausius, this meant that a body contained a definite amount of heat at a given temperature, and it followed logically to Clausius that the ratio dQ/T must itself be a property of a body, as it reflects changes in two quantities, heat and temperature, which are characteristic properties of a body.

The development of the concept of internal energy, as expressed in the First Law, means that heat is no longer regarded as a property of a body, but there was never any reconsideration of what this means for entropy. Logically, entropy should be connected to heat flow, but the inequality of irreversible thermodynamics breaks this connection. In consequence, it is argued that entropy can increase in irreversible adiabatic processes, which leads to the conflict with the First Law. Entropy is believed to increase because it is a state function, but I believe that this is nothing more than a mathematical property arising from the differential geometry of thermodynamic phase space, specifically p-V space in the case of gases. Entropy thus defined simply tells us how much heat would be required to

move from one state to another via a reversible path and finds its most important use in the analysis of heat engines.

This then set the scene for Fadi Sakran, from Yaron Lehavi's group, to talk about experts' conceptions of energy and showed how these conceptions can lead to refinements in the curriculum. There then followed two presentations of research into teaching the concept of energy, by Alessandra de Angelis, repesenting the work of Marisa Michelini, and Efrat Blau Barak, representing the work of Edit Yerushelmi's group.

Alessandra presented the results of a long study on teaching thermal phenomena from a thermodynamic perspective, both in primary schools and with older pupils at the age of 16. The essential idea is to use the methods of calorimetry and computer-based measurements of temperature to overcome the common notion of heat as a substance. This harks back to the theory of heat prior to the development of modern thermodynamics and suggests that this is a very common, almost natural conception. Nonetheless, if this conception persists, it can lead to all sorts of difficulties later when thermodynamic concepts are introduced and Alessandra's presentation showed that it is possible to convey a different concept of heat using these principles. Efrat presented the results of research on the professional development of teachers who used a simulation of a bouncing ball to understand how a macroscopic quantity of energy can be transformed into internal energy via processes of dissipation. It is intended that this symposium will feature in the poceedings of the WCPE.

Much of this article has focussed on entropy and the flaws built into the concept by Clausius because there is a real problem to be addressed, which is the need to reform the thermodynamics curriculum. There is plenty of research to show that students find the concept of entropy confusing and given the flaws and the ensuing inconsistencies, it is not surprising. One of the aims of this GTG is to promote effective ways of teaching difficult concepts and central to this is the notion that the First Law should take precedence over the Second Law and entropy. Indeed, it is a common conception that the Second Law states that entropy must always increase, but if entropy is not a physical property of a body, what is increasing? In fact, Clausius' original statement of the Second Law, that temperature cannot flow from a colder to a hotter body without some other effect occurring, is, like Kelvin's statement concerning the impossibility of converting an amount of heat completely to work, strictly applicable to cyclic processes. Clausius's later extension of the Second Law is based on his famous inequality, which, it has been argued above, divorces entropy from heat flow and leads to conflicts with the First Law. The First Law, on the other hand, describes the connection between changes in different forms of energy that actually occur and therefore represents one of the most important conservation laws in physics.

On behalf of the GTG, I would like to extend an open invitation to anyone considereing teaching thermodynamics from the perspective of energy changes to contact either myself or Yaron Lehavi via secretary@Girep.org.

GIREP GENERAL ASSEMBLY 2024
Minutes of the General Assembly held on 5th June 2024 at 15:00 (CET)

The GIREP vzw General Assembly was held online using Zoom meetings on 5th June 2024 at 15:00 (CET) and the convocation was held in accordance with the statutes of the GIREP Organization. Altogether 20 GIREP members were present online including the seven members of the GIREP Board (GB).

Agenda for 2023 General Assembly:

1. Welcome Address
2. Approval of the minutes of the GIREP vzw General Assembly 2023
3. Approval of the GIREP vzw Annual Report 2023, including
    a. GIREP vzw activities 2023
    b. Financial report 2023 and provisional financial budget 2024
    c. Auditor's report 2023
4. Approval to discharge the GIREP vzw Board 2023
5. Approval of GIREP vzw Board 2024-2027
6. Approval of GIREP vzw Auditor 2024-2027
7. Approval of the GIREP Handbook of Internal Regulations
8. GIREP fee and policy for membership
9. Activities in 2024 and future activities:
    a. GIREP Books
    b. GTG activities
    c. GIREP website and social media
    d. Sara Barbieri Prize
    e. GIREP Cooperating Bodies
    f. GIREP Honorary Membership
    g. GIREP Conferences
    h. GIREP Summer school
10. Activities proposals by GIREP members
11. Varia

The General Assembly started with a welcome from GIREP President Eilish McLoughlin and she presented the minutes of the 2023 GIREP vzw General Assembly and members were invited to vote to approve the GA 2023 minutes.

- Outcome of Voting: 16 pro votes, 0 counter votes, 1 abstained.

GIREP President Eilish McLoughlin presented the annual report of 2023 GIREP Board activities. Twelve GIREP vzw Board on-line meetings were held during 2023 and presented a summary of the main issues discussed:

- Execution of GIREP Board members roles and responsibilities (2020-2023).
- Updating and agreement of GIREP vzw new Statutes.
- Development of GIREP website and social media channels.
- Preparation of post conference publications from 3rd WCPE.
- Preparation for online GIREP General Assembly on 16th June 2023.
- Organization and planning speakers and programme for
    - GIREP-EPEC 2023 Conference held in Košice, Slovakia, 3-7 July 2023.
    - 4th WCPE Conference to be held in Krakow, Poland, 26-20 August 2024.
- Development of GIREP Thematic Groups and Communities.
- GIREP vzw cooperation with eleven partner organizations based on signed agreements and with two other organizations without a signed agreement.
- Involvement of GIREP national representatives.
- GIREP agreements with Springer and IOP Journal of Conference Proceedings.
- Preparation of two newsletters (available at: ISSN 2307-0366).

GIREP Treasurer Claudio Fazio presented the GIREP vzw Financial Report for 2023. Wim Peeters presented the 2023 Auditor Report. The three annual reports were made available on the GIREP Website in advance of the General Assembly.

GIREP vzw 2023 Annual Report
GIREP vzw 2023 Financial Report
GIREP vzw 2023 Auditor Report

After clarifications and comments the GIREP vzw Annual Report 2023, including GIREP activities, GIREP Financial Report 2022 and provisional Budget for 2024 and this was approved in voting.

- Outcome of Voting: 20 pro votes, 0 counter votes, 0 abstained votes.

After which GIREP President Eilish McLoughlin requested that the GIREP Board should be discharged, and this was approved in voting.

- Outcome of Voting: 19 pro votes, 0 counter votes, 0 abstained.

GIREP President Eilish McLoughlin presented the members of GIREP vzw Board for the period 1 January 2024 to 31 December 2027 which consists of seven members with the following roles and responsibilities:

- GIREP President - Eilish McLoughlin - with responsibility for GB meetings, relationship with cooperating bodies and editorial policy.
- GIREP Vice-President - Claudio Fazio - with responsibility for universities and research, GIREP Thematic Groups.
- GIREP Vice-President - Dagmara Sokolowska - with responsibility for activities aimed at teachers and schools and country representatives.
- GIREP Treasurer - Paul Logman - with responsibility for financial management and membership.
- GIREP Secretary - David Sands - with responsibility for secretarial functions, newsletter and updating handbook.
- GIREP Policy Officer - Stamatis Vokos - with responsibility for analysis of educational policies, emerging issues, etc.
- GIREP Early Career Researchers - Edit Yerushalmi - with responsibility for early career researchers.

In addition, the GIREP board has appointed the following individuals with responsibilities:

- GIREP Legal Representative - Wim Peeters - with responsibility for representing GIREP in official circumstances related to the bank KBC and the Belgian government.
- GIREP Auditor - Wim Peeters - oversees the correct management of accounting and administrative procedures and reports to the General Assembly via the Annual Report.
- GIREP Webmaster - Onofrio Rosario Battaglia - with responsibility for updating the GIREP website.

After which GIREP President Eilish McLoughlin requested members vote to approve the GIREP Board 2024-2027 and this was approved in voting.

- Outcome of Voting: 19 pro votes, 0 counter votes, 0 abstained votes.

GIREP President Eilish McLoughlin requested members vote to approve the appointment of Wim Peeters as GIREP Auditor (2024-2027) and this was approved in voting.

- Outcome of Voting: 19 pro votes, 0 counter votes, 0 abstained votes.

The GIREP Handbook of Internal Regulations was presented by GIREP Secretary David Sands and Wim Peeters as GIREP Legal Representative. This document describes all daily and changeable activities and processes within the GIREP organization and is constantly available online at https://www.girep.org/girep_handbook-of-internalregulations/. The GIREP Handbook of Internal Regulations was approved by voting.

- Outcome of Voting: 19 pro votes, 0 counter votes, 1 abstained votes.

Paul Logman with responsibility for GIREP membership then presented an update on GIREP Membership. GIREP had 221 registered members on the 31st December 2022 and 218 members on 31st December 2023. There were 138 members registered on 1st June 2024. He reminded members that membership had been increased in 2024 to €40 and can be renewed online at https://www.girep.org/ He advised that a reduced conference fee was available to GIREP members registering for 2024 World Conference in Physics Education.

GIREP President Eilish McLoughlin presented on GIREP Activities in 2023 and in the future. She provided an update on GIREP Editorial Agreements with Springer which allows for continued publication of selected papers from GIREP Conferences as Part of the book series: Challenges in Physics Education. members were reminded that free access was available for GIREP members to GIREP books published by Springer, namely:

- Selected papers presented in 3rd WCPE in 2021 *Physics Education Today* (eds. C. Fazio and P. Logman)
- Selected papers presented in GIREP Webinar 2021, *Physics teacher Education, More About What Matters?* (eds. J. Borg Marks and P. Galea)
- Selected papers presented in GIREP Webinar 2020, *Physics Teacher Education – What matters?* (eds. J. Borg Marks, P. Galea, S. Gatt and D. Sands)
- Selected papers presented in GIREP-ICPE-EPEC-MPTL Conference 2019, *Teaching-learning contemporary physics, from research to practice*, (eds. C. Sükösd and B. Jarosievitz)
- Selected papers presented in GIREP-MPTL Conference 2018, *Research and Innovation in Physics Education: Two Sides of the Same Coin* (eds. J. Guisasola and K. Zuza)
- Selected papers presented in GIREP-ICPE-EPEC Conference 2017, *Concepts, Strategies and Models to Enhance Physics Teaching and Learning* (eds. E. McLoughlin, P. van Kampen)
- Selected papers from 2nd WCPE in Sao Paolo 2016, *Upgrading Physics Education to Meet the Needs of Society* (ed. M. Pietrocola Pinto de Oliveira)
- Selected papers presented in GIREP Seminar 2016, *The Role of Laboratory Work in Improving Physics Teaching and Learning* (eds. D. Sokołowska, M. Michelini)

GIREP President Eilish McLoughlin informed members of the agreement with the **Institute of Physics (IOP).** Online Proceedings of GIREP Conferences were available under open access for 2016-2024 conferences, namely:

- Online proceedings of the GIREP Conference 2022 - Effective Learning in Physics from Contemporary Physics to Remote Settings (eds. S. Faletic, S. Dolenc, J. Pavlin, K. Susman, A. Kranjc Horvat) https://iopscience.iop.org/issue/1742-6596/2750/1
- Online proceedings of the 3rd WCPE 2021 Innovating physics education: from research to practice' as its

theme (eds. C. Fazio and P. Logman) https://iopscience.iop.org/issue/1742-6596/2727/1

- Online proceedings of the 2021 GIREP Webinar Malta *Physics Teacher Education – what matters?* (eds. J. Borg Marks and P. Galea) https://iopscience.iop.org/issue/1742-6596/2490/1
- Online proceedings of the 2020 GIREP Webinar Malta *Physics Teacher Education – what matters?* (eds. J. Borg Marks, P. Galea, S. Gatt and D. Sands) https://iopscience.iop.org/issue/1742-6596/2297/1
- Online proceedings of the 2019 GIREP-ICPE-EPEC-MPTL Conference in Budapest, *Teaching-learning contemporary physics, from research to practice,* (eds. C. Sükösd and B. Jarosievitz) https://iopscience.iop.org/issue/1742-6596/1929/1
- Online proceedings of the 2018 GIREP-MPTL Conference in San Sebastian, *Research and Innovation in Physics Education: Two Sides of the Same Coin* (eds. J. Guisasola and K. Zuza) https://iopscience.iop.org/issue/1742-6596/1287/1
- Online Proceedings of the 2017 GIREP-ICPE-EPEC Conference *Bridging Research and Practice in Physics Teaching and Learning* (eds. E. McLoughlin, P. van Kampen) https://iopscience.iop.org/issue/1742-6596/1286/1
- Online Proceedings of the 2016 GIREP Seminar in Kraków, *Research-based proposals for improving teaching and learning – focus on laboratory work* (ed. D. Sokolowska) http://iopscience.iop.org/issue/1742-6596/1076/1

GIREP Vice-President Claudio Fazio presented an overview of the GIREP Thematic Groups (GTGs) and a summary of 2023 activities All members are invited to contribute to the focus of each the thirteen GIREP GTGs through a dedicated area on the GIREP website (https://www.girep.org/thematic-groups/), namely:

- Energy (Leader: Paula Heron)
- Strategies for Active Learning (SAL) (Leader: Claudio Fazio)
- TPACK in Physics Teacher Education (Leader: Fatih Taşar)
- Games with the Purpose of Physics Education (GaPE) (Leaders: Marilù Chiofalo, Sabrina Maniscalco)
- Mathematics in Physics Education (Leader: Gesche Pospiech)
- Innovative Pedagogy for University Physics (Leaders: Gerald Feldman, Guillaume Schiltz)
- Laboratory Based Teaching in Physics (LabTiP) (Leader: Ian Bearden and Paul Logman)
- Physics and Society (Leader: Aristoteli Gkiolmas)
- Physics Preparation of Teachers in Grades K-6 (Leaders: Federico Corni, Stamatis Vikos)
- Physics Education Research at University (PERU) (Leader: Jenaro Guisasola)
- Teaching and Learning Quantum Physics (Sergej Faletic, Marisa Michelini and Gesche Pospiech)
- Multiple External Representation in Physics Education Research (MER@PER) (Leader: Christoph Hoyer, Stefan Küchemann & Jochen Kuhn)
- Cultural Understanding of Physics: Instruments and Methods (CUP) (Leader: Marco Giliberti).

GIREP Vice-President Claudio Fazio presented an overview of the GIREP website (https://www.girep.org/) and Social Media channels (YouTube, Facebook and Twitter). He highlighted features for members on the GIREP website, e.g. forums for members and thematic groups.

GIREP President Eilish McLoughlin shared details of the Sara Roberta Barbieri award which has been developed in collaboration with the Barbieri family. This award can be conferred to teacher(s) from any school type or country. The

project has to be presented by a teacher, or by a group of teachers who have carried it out in strict collaboration and must have an innovative and possibly also research nature.

GIREP President Eilish McLoughlni shared details of GIREP Cooperating Bodies. On the basis of a signed agreement:

1. American Association of Physics Teachers (AAPT)
2. American Physical Society (APS)
3. Association de Profesores de Fisica de la Argentina (APFA)
4. Conferencias lnter-Americanas sobre Educaci6n en Fisica (CIAEF)
5. DS Kothari Centre for research and lnnovation in Science Education (DSKC)
6. European Physìcs Society - Physics Education Oivision (EPS - PEO)
7. lnter-American Conference on Physìcs Education (IACPE)
8. lnternational Association of Physics Students (IAPS)
9. lnternational Society of Educational Research (iSER)
10. Latin-American Physics Education Network (LAPEN)
11. Multimedia in Physics Teaching and Learning (MPTL)
12. Physics Education Society Japan (PESJ)

Without a signed agreement:

1. European Science Education Research Association (ESERA)
2. lnternational Conference on Physics Education (ICPE)

GIREP President Eilish McLoughlin announced that GIREP bestows the status of GIREP Honorary Member to Marisa Michelini and Wim Peeters in recognition of their significant and durable contributions at all levels to the GIREP physics education community.

GIREP Vice-President Dagmara Sokołowska presented an overview of the 4th WCPE World Conference in Physics Education to be held 26-30 August 2024 in Krakow, Poland.

GIREP Treasurer Paul Logman presented an overview of the GIREP 2025 Conference to be held in Leiden, the Netherlands, 30th June-4th July 2024.

GIREP Board Members Edit Yerushalmi and Stamatis Vokos presented a proposal to develop a GIREP summer school for early career researcher with the specific goals to:

- Attract new researchers to GIREP
- Provide a PER-specific venue for receiving high-quality feedback on research questions/methodology
- Fill a niche need that AAPT (including PERC) and ESERA do not serve
- Improve connections among researchers

The proposed structure was to schedule just before the annual GIREP Conference (Sat-Sun), ~ 7 working groups: 75-min sessions in each of which an advanced PhD student presents, in turns, work in progress, to other PhD students, postdocs, and senior researchers; and receive feedback. Include opportunities for networking and developing community. The feasibility of offering this opportunity as early as GIREP 2025 is being explored and help is needed in raising funds from national societies or other funding agencies.

GIREP President Eilish McLoughlin invited comments and proposals from GIREP members and asked members for suggestions for themes/locations for future GIREP Conferences/seminars.

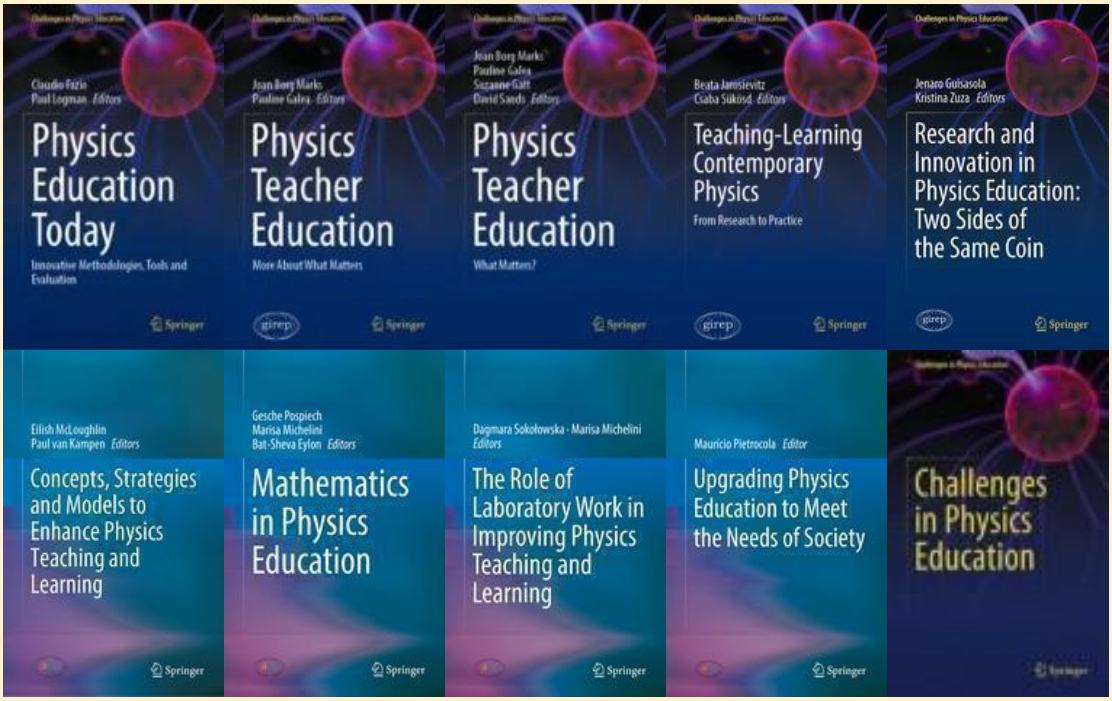
Comments/activities proposals by GIREP members included:

- Csaba Sukosd requests individuals to send on contributions to him to include in marking Professor George Marx centenary. George Marx (1927-2002). He was a member of GIREP from the early days to his death, he also was a member of GIREP Board during several years and was also president of GIREP from 1992- 1995.
- Wim Peeters asked if GIREP could host a workshop/meeting aimed at teachers doing evidence-based research (e.g. Practitioner Inquiry) along the lines of summer school for early career researchers. There are some plans in place for WCPE in 2024. Stamatis Vokos suggests GIREP organise a workshop where experienced teachers present to others followed by an interactive poster session session.
- Jerry Feldman welcomed the opportunity for representatives of Cooperating Bodies to meet during GIREP 2023 and planned a meeting during WCPE in 2024 and asked for further activities to be explored.
- Jerry Feldman shared details on a workshop for Physics Faculty which has been held in the past and would like to see this organised again in the future.

GIREP PUBLICATIONS WITH SPRINGER

A series of GIREP books have been published based on a written agreement between GIREP and Springer since 2016. The agreement with Springer supports the publication of Books of Selected Papers from GIREP conferences. The books published by Springer are accessible for each GIREP member via the members area of the GIREP website.

Book Series: Challenges in Physics Education



- Selected papers presented in GIREP 2023 Conference, *Physics learning promoting culture and addressing societal issues, In preparation.*
- Selected papers presented in GIREP 2022 Conference, *Effective learning in physics from contemporary physics to remote settings*, *In preparation.*

- Selected papers presented in 3rd World Conference in Physics Education 2021, *Physics Education Today: Innovative Methodologies, Tools and Evaluation* (eds. C. Fazio & P. Logman). Springer Nature Switzerland AG 2024.
- Selected papers presented in GIREP Webinar 2021, *Physics Teacher Education: More about what matters* (eds. J. Borg Marks and P. Galea). Springer Nature Switzerland AG 2023.
- Selected papers presented in GIREP-ICPE-EPEC-MPTL Conference 2020, *Physics Teacher Education: What Matters?* (eds. JB Marks, P. Galea, S. Gatt & D. Sands). Springer Nature Switzerland AG 2022.
- Selected papers presented in GIREP-ICPE-EPEC-MPTL Conference 2019, *Teaching-learning contemporary physics, from research to practice,* (eds. C. Sükösd and B. Jarosievitz). Springer Nature Switzerland AG 2021.
- Selected papers presented in GIREP-MPTL Conference 2018, *Research and Innovation in Physics Education: Two Sides of the Same Coin* (eds. J. Guisasola and K. Zuza). Springer Nature Switzerland AG 2020.
- Selected papers presented in GIREP-ICPE-EPEC Conference 2017, *Concepts, Strategies and Models to Enhance Physics Teaching and Learning* (eds. E. McLoughlin, P. van Kampen). Springer Nature Switzerland AG 2019.
- Selected papers from 2nd WCPE in Sao Paolo 2016, *Upgrading Physics Education to Meet the Needs of Society* (ed. M. Pietrocola Pinto de Oliveira). Springer Nature Switzerland AG 2019.
- Selected papers presented in GIREP Seminar 2016, *The Role of Laboratory Work in Improving Physics Teaching and Learning* (eds. D. Sokołowska, M. Michelini). Springer Nature Switzerland AG 2018.

GIREP PUBLICATIONS WITH INSTITUTE OF PHYSICS

A written agreement has been signed between GIREP and IOP to enable proceedings of the GIREP Conference/Seminars from 2016-2023 to be published online under open access.

IOP Journal of Physics Conference Series (Open access):

- Online proceedings of the GIREP 2023 Conference, *Physics learning promoting culture and addressing societal issues, In preparation.*
- Online proceedings of the GIREP 2022 Conference, *Effective learning in physics from contemporary physics to remote settings*, *In preparation.*
- Online proceedings of the 3rd World Conference in Physics Education (2021) Innovating physics education: from research to practice (eds. C. Fazio and P. Logman)
- Online proceedings of the 2021 GIREP Webinar Malta Physics Teacher Education – More about what matters? (eds. J. Borg Marks and P. Galea).
- Online proceedings of the 2020 GIREP Webinar Malta, *Physics Teacher Education What Matters?* (eds. JB Marks, P. Galea, S. Gatt & D. Sands).
- Online proceedings of the 2019 GIREP-ICPE-EPEC-MPTL Conference in Budapest, *Teaching-learning contemporary physics, from research to practice,* (eds. C. Sükösd and B. Jarosievitz).
- Online proceedings of the 2018 GIREP-MPTL Conference in San Sebastian, *Research and Innovation in Physics Education: Two Sides of the Same Coin* (eds. J. Guisasola and K. Zuza).
- On-line Proceedings of the 2017 GIREP-ICPE-EPEC Conference *Bridging Research and Practice in Physics Teaching and Learning* (eds. E. McLoughlin, P. van Kampen).
- On-line Proceedings of the 2016 GIREP Seminar in Krakow, *Research-based proposals for improving teaching and learning – focus on laboratory work* (ed. D. Sokolowska).

Show the Physics

Freek Pols & Peter Dekkers, from Delft University of Technology, have published the book Show*the*Physics available from: https://interactivetextbooks.tudelft.nl/showthephysics/.

The book provides a collection of 99 demonstrations which originated from the three Dutch NVON volumes Show*de*Fysica. The book includes demonstrations with videos, a description of a proper pedagogical approach for each demonstration, python simulations and opportunities to analyse data in the browser (using Python). Several chapters discuss the general pedagogy of physics demonstrations and the different learning goals that can be attained.

All materials are CC BY NC, which means that the materials are **free** to use, **adapt** and **republish**, as long as the use is not commercial and appropriate references are made. Technical issues can be raised through github, allowing the editors to address them.

FUTURE CONFERENCES

- **2025 GIREP conference** June 30 to July 4, 2025, in Leiden, The Netherlands
- 2025 AAPT meeting in winter (St Louis, 18-21 January) and 2025 summer meeting (Washington July). Information for both can be found at https://www.aapt.org/conferences/
- The 2025 ESERA Conference in Copenhagen, Denmark (25-29 August); https://esera2025.org/

GIREP MEMBERSHIP RENEWAL & FEES

We would like to remind you that you can pay your GIREP membership fee (40 euro per year per January 1st, 2024) either by bank transfer or "as a friend" via PayPal. Both possibilities are described in detail on the GIREP membership fees webpage: https://www.girep.org/membership-fees/.
There is also a possibility to pay your GIREP membership fee using your credit card via PayPal (though this is slightly more costly than sending the fee to GIREP as "a friend" via PayPal). You can also visit the page http://www.girep.org/members-area/.
Here, you can see your membership fee payment history. In any case of payment, please send an email to the GIREP treasurer (claudio.fazio@unipa.it) and inform him, that you have made the payment and what years your membership payment should be applied to.

It should be noted that according the GIREP Statutes, Art.6, §5: "Members not paying their yearly fee before the 1st of July of the current year are no longer considered as members." So, please, be so kind and pay your membership fee in time.

BENEFITS FOR GIREP VZW MEMBERS

As a GIREP member you have **exclusive access** to the digital proceedings of the past GIREP conferences. In addition, you can get a **reduced registration fee** for GIREP conferences and for conferences of our partner organisations (see GIREP Newsletter 54). Since 2018, GIREP members get also **free access codes to GIREP books** published by Springer.

CALL FOR CONTRIBUTIONS TO THE GIREP NEWSLETTER

We would like to encourage all GIREP newsletter readers to participate in sharing news and ideas about physics teaching and learning and physics education research. Please, send contributions for the next GIREP Newsletter to GIREP Secretary, secretary@girep.org

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