Embracing changes together to improve physics learning

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Abstract. This workshop facilitates global exchange and discussion on current opportunities and challenges influencing physics learning, from early childhood to university level. Physics is important for culture development and is the foundation of many technological advancements. As technology progresses, a deeper understanding of physics becomes essential for innovation and development in fields such as engineering, medicine, telecommunications, and energy production. Moreover, with challenges like climate change, and the search for sustainable energy, a thorough understanding of physics is essential for addressing these issues and creating a sustainable future. Preparing students with the necessary physics knowledge and skills to be able to live and thrive in future societies demands cooperation between all the key shareholders to identify future perspectives and embrace changes together.

Introduction

Physics is an important part of human culture and has the potential to significantly contribute to the solutions of many of the issues that we confront today. Moreover, it is the foundation of many technological advancements: ss technology progresses, a deeper understanding of physics becomes essential for innovation and development in fields such as engineering, medicine, telecommunications, and energy production. Moreover, with challenges like climate change, and the search for sustainable energy, a thorough understanding of physics is essential for addressing these issues and creating a sustainable future.

However, it is well known that learning physics can pose various challenges for students, such as understanding, from one hand, the typical reductionist approach of physics, and from the other, the many complex concepts typical of physics, maintaining focus, performing well on assessments, solving problems, and putting in extra time and effort to study [1]. In addition, students may find it challenging to navigate through multiple representations in physics [2], and struggle to understand the abstract nature of physics concepts, while also needing to practice self-regulation and self-motivation in learning environments [3]. In addition, the absence of teacher experience and pedagogical content knowledge, coupled with scarce resources, time constraints, and teachers'/students' difficulty in applying innovative learning methodologies [4], poses obstacles for students in comprehending physics.

All this is reflected in several countries in the marked decrease, observed in the last decades, of students' interest in studying physics, and also in a decrease in enrollments in physics degree courses.

Solutions of those issues may involve reconsideration of the aims and methods of physics teaching, reflection on relevant aspects of current and innovative teaching and learning methodologies, acknowledgement of results from physics education research, pedagogy and cognitive psychology, improvement of cooperation between schools and university research, and more.

Framework and workshop theme

Since many decades members of GIREP have strived to improve the quality of physics teaching and learning across all educational levels, from early childhood to university level. In particular, GIREP Thematic Groups (GTG) are focused communities of GIREP members interested in contributing their expertise in particular facets of physics education, from working with children, through undergraduate work, to teacher training. This expertise is likely to be strong if they are research or development active in the area: doing work that yields insight or supports the development of practice. The GTGs are committed to exchanging thoughts, materials, and findings from various work contexts, and contributing to physics teaching and learning related to specific themes.

This workshop facilitates contributions from GIREP members from across the globe to share and review international practices that support physics learning from early childhood to university level. The first thirty minutes will provide an introduction and brief summaries from main contributors. One hour will be dedicated to discussing four key questions in separate groups: (1) What learning needs do students identify and perceive in physics education? (2) What pedagogical methodologies are best suited to improving physics learning? (3) What is the role of teachers in fostering effective student learning? (4) What is the role of national and international networks of teachers, physics education researchers and university-school collaborations in improving physics learning, and in promoting enrolments in physics degree courses?
Finally, the last thirty minutes will be dedicated to a plenary presentation of all contributions reported from individual groups and providing concluding perspectives.

References

[1] D. Wangchuk, D. Wangdi, S. Tshomo, & J. Zangmo,. Exploring Students' Perceived Difficulties of Learning Physics. *Educational Innovation and Practice* **6** (2023) https://doi.org/10.17102/eip.6.2023.03.

[2] Dong-Hai Nguyen, N. Sanjay Rebello, Students' Difficulties With Multiple Representations in Introductory Mechanics, *US-China Education Review* **8**(5) (2011) 559-569.

[3] S. Velayutham, & J.M. Aldridge, Influence of Psychosocial Classroom Environment on Students' Motivation and Self-Regulation in Science Learning: A Structural Equation Modeling Approach. *Res Sci Educ.* **43** (2013) 507–527 doi 10.1007/s11165-011-9273-y

[4] C. Konopka, M. Adaime, & P. Mosele, Active Teaching and Learning Methodologies: Some Considerations. *Creative Education* **6** (2015) 1536-1545 doi: 10.4236/ce.2015.614154.