Embracing changes together to improve physics teaching

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Abstract. This workshop facilitates global exchange and discussion on current opportunities and challenges influencing physics teaching and teacher education, from early childhood to university level. The rapidly changing landscape of the global economy and society in the XXI century demands new approaches to be adopted to recruit, upskill, and educate physics teachers so they can design and facilitate blended learning experiences. Preparing physics teachers with the necessary knowledge and skills to address emerging global issues requires cooperation between all the key shareholders to identify future perspectives and embrace changes together.

Introduction

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 [1]. The effectiveness of teachers' instructional strategies depends on their understanding of how students learn (a topic) and their awareness of how student learning is affected by other factors, such as the specific educational contexts and students' difficulties/ideas related to that topic. Teachers need to deploy a range of strategies to support individual and differentiated learning in their pedagogical practices. However, opportunities for teacher professional learning vary widely across educational levels and across different countries.

Research has shown that an effective pre-service teacher training model should provide future teachers with tools and methodologies that can allow them to "reconstruct" disciplinary contents and the general pedagogical tools and methodologies, adapting them to the needs of the students and to the learning difficulties known from research [2]. Crucially, teachers' engagement in professional learning is shown to have a positive influence on their learners' academic achievement in science - and this is increased when teacher professional learning is extended over a period of time and involves the engagement of external experts and opportunities to take part in professional communities of practice [3,4].

Framework and workshop theme

GIREP members have strived for many decades to improve the quality of physics teaching and learning across all educational levels, from early childhood to university level. In particular, GIREP organised two online seminars in 2020 and 2021 hosted by the University of Malta, focussed on "Physics Teacher Education – "What matters". Working Group 5 discussions at these

seminars reviewed appropriate formats and structures for pre-service teacher education and concluded that making pre-service physics teachers, at both primary and secondary levels, aware of the significance of active learning can enhance students' understanding of physics and of its methods. All also agreed that the best way to make future teachers aware of the effectiveness of active learning methodologies would be to introduce them to this methodology during the years of their university studies [5]. Working Group 6 discussions concluded that reviewing strategies and measuring the effectiveness of strategies used for physics teacher education is essential to ensuring the influence and sustainability of teacher professional learning [6].

This workshop facilitates contributions from GIREP members from across the globe to share and review international practices on pre-service and in service physics teacher education, 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 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? Finally, the last thirty minutes will be dedicated to a plenary presentation of all contributions reported from individual groups and providing concluding perspectives.

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