



Chapter 8

Preparing Teachers for the 21st Century: A Mixed-Methods Evaluation of TPD Programs Under the Lens of Emerging Technologies in STE(A)M Education


Stavros Pitsikalis

 <https://orcid.org/0000-0002-3051-2555>
University of the Aegean, Greece

Apostolos Kostas

 <https://orcid.org/0000-0002-1567-2649>
University of the Aegean, Greece

Iiona-Elefteryja Lasica

 <https://orcid.org/0000-0001-6842-9901>
University of the Aegean, Greece

Chryssi Vitsilaki

University of the Aegean, Greece

ABSTRACT

This chapter provides an overview of (1) the current situation concerning teacher professional development (TPD) programs through studies referring to existing challenges; (2) the TPD programs under discussion that have been implemented during the last three years (2018-2021) in the context of European projects, including their structure and descriptions of the educational content; (3) teachers' views and feedback concerning the TPD program they attended, based on a specific evaluation framework, with focus on issues relevant to emerging technologies. The researchers provide directions towards an effective framework for horizontal TPD programs targeting large numbers of teachers, aiming to allow them to gain the appropriate knowledge and skills in order to integrate emerging technologies as concepts in interdisciplinary STE(A)M-based instructional scenarios, especially in the levels of Secondary general (Gymnasium and Lyceum in Greece) and (post)secondary vocational education (EPAL and IEK in Greece).

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INTRODUCTION

This chapter aims to provide practicing educators, teacher trainers and researchers in the field of educational science with directions for designing TPD programs for integrating emerging technologies, such as Augmented Reality (AR), in interdisciplinary STE(A)M based instructional scenarios, especially in the level of Secondary general (Gymnasium and Lyceum in Greece) and (Post)Secondary Vocational Education (EPAL - Vocational Lyceum) and IEK (Institution of Vocational Training in Greece). The suggested directions arise as a result of the evaluation process of specific components of TPD programs, where the authors have been involved in the evaluation process.

The chapter begins with an overview of the current situation concerning the trends for transformation and evolution of teaching practices through innovative pedagogical approaches and emerging technologies (Adnan & Tondeur, 2018; Darling-Hammond, 2017; Ramírez-Montoya, Andrade-Vargas, Rivera-Rogel, D & Portuguese-Castro, 2021; Tarling & Ng'ambi, 2016). Changing teaching practices is proving difficult to achieve, while it seems that many teachers (at least at European level) remain unprepared to effectively employ technology-enhanced teaching practices. This is a fact that has been highlighted in many studies (Cochran-Smith & Maria Villegas, 2015; Dotong, De Castro, Dolot & Prenda, 2016; Kaufman, 2014) and has recently emerged, during the global situation of the pandemic COVID-19 (Whalen, 2020; Winter, Costello, O'Brien & Hickey, 2021), where critical issues have raised concerning the need for ready-to-instruct teachers in the 21st century. Teachers attend numerous training programs on a variety of topics, including STE(A)M education, ICT in education, interdisciplinarity in education, 21st century skills etc. As a result, they gain fragmented knowledge having difficulties in connecting it and bringing it to practice (Santos, Franco, Leon, Ovigli & Donizete Colombo Jr, 2017). The main question that still needs to be answered is whether nowadays teachers are appropriately prepared to support their students to strengthen their 21st century skills and become human resources responding to the demands of the modern labor market. Teachers face challenges in deploying smart learning environments, since the development pace of information and communication technologies (ICT) and devices that could be applied in education, far exceeds the development pace of educational studies concerning the effectiveness of each technological innovation integration within the educational process (Lasica, Meletiou-Mavrotheris & Katzis, 2020a). Emerging technologies as well as any innovative tool introduced into the educational process, should be treated as a concept, taking into consideration numerous factors, rather than a sole technological tool offering new teaching and learning opportunities (Vitsilaki & Pitsikalis, 2017). It is critical not only for teachers, but also for those involved in the educational process (researchers, designers and developers of educational content, decision makers in education, school administrative staff etc.) to have opportunities for adequate training.

Taking the above mentioned into consideration, existing TPD programs have been evaluated, in which authors of the current chapter were involved during the design, development, implementation and/or evaluation phases, including: (a) “train the trainer” programs, targeted to teacher trainers in the context of the National Project “Training of teachers/trainers in Apprenticeship topics” (Pitsikalis, Lasica & Roussos, 2020) in Greece, (b) a TPD in the context of a European project (i.e. Enlivened Laboratories within STEM Education – EL-STEM), targeted to Secondary Education teachers from Greece, Cyprus and Estonia (Mavrotheris, Lasica, Pitsikalis & Meletiou-Mavrotheris, 2018). It is important to declare that the current research is part of the wider studies, implemented in the context of the relevant projects, including internal and external evaluations, as well as qualitative and quantitative data. The current chapter focuses on the book’s main topics towards practical approaches to integrating ICTs in

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