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# Higher Education Learning Methodologies and Technologies Online

4th International Conference, HELMeTO 2022  
Palermo, Italy, September 21–23, 2022  
Revised Selected Papers

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Editors


# Higher Education Learning Methodologies and Technologies Online

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# Preface

This volume of Communications in Computer and Information Science (CCIS) contains the post-proceedings of HELMeTO 2022, the fourth International Conference on Higher Education Learning Methodologies and Technologies Online, which took place during September 21–23, 2022 in Palermo, Italy.

The conference was organized by the Department of Mathematics and Computer Science at the University of Palermo and by the Institute of Educational Technology of the National Research Council of Italy. The 2022 edition of HELMeTO also marked the return of the event in presence, as the previous two editions had been held entirely online due to the Covid-19 emergency.

The growing interest in the topics of learning methodologies and technologies in higher education, and in particular in the interdisciplinary approach that characterizes this research field, suggested a change from a workshop format to a conference event, thus promoting a more international perspective. The success of this approach was highlighted by the 126 submissions received (almost double those received for the previous event) from more than 400 authors in 24 countries.

These numbers not only confirm the growth trend of an event that was born just four years ago (39 submissions in 2019, 59 in 2020, and 65 in 2021), but above all they consecrate HELMeTO as a key event for researchers and practitioners working in Higher Distance Education Institutions or studying Online Learning Methodologies to present and share their research in a multidisciplinary and international context.

The conference included two general tracks on Online pedagogy and learning methodologies and on Learning technologies, data analytics and educational big data mining as well as their applications. Thanks to the growing attention that the conference has attracted over the years, this edition collected twelve special tracks, focusing on specific topics, previously proposed by their organizers and peer-reviewed by the Program Committee.

- Special Track 1 - Improving education via XR and AI
- Special Track 2 - Educational Approaches and Innovative Applications to Counteract Social Media Threats
- Special Track 3 - Hybrid Learning and Accessibility in higher education
- Special Track 4 - E-learning for providing “augmented” mathematics education at University level
- Special Track 5 - STEAM Education old and new challenges in distance teaching/learning approaches in Higher Education
- Special Track 6 - Online Faculty Development: Next Steps for Practice and Future Research
- Special Track 7 - Artificial Intelligence and Multimodal Technologies in Education (AI&MTEd ‘22)
- Special Track 8 - Experience-based training activities for online higher education
- Special Track 9 - Intelligent Analytics for Process-aware Higher Education

- Special Track 10 - The digital innovation of university teaching observed through the prism of emotions
- Special Track 11 - Empowering soft skills and digital competencies in higher education
- Special Track 12 - Manufacturing Education for a Sustainable fourth industrial revolution

An international Program/Scientific Committee with members from 17 countries (Austria, China, Cyprus, Ecuador, France, Germany, Greece, Italy, Morocco, Palestine, Portugal, Slovakia, Spain, Sweden, Turkey, UK, USA) was in charge of peer-reviewing the 126 papers submitted to HELMeTO 2022; 105 papers were selected for presentation at the conference. A final set of the best 59 papers (47% of the original submissions) were selected and extended for publication in this book after a separate double-blind peer-review process performed by at least three members of the Program/Scientific Committee.

We thank all the authors for their contributions and presentations, for their efforts, and for their presence at the event. Similarly, we would like to thank all the committee members, organizers, and contributors, for their involvement and help in the process of preparing and hosting both the conference and this book. Our thanks go also to the University of Palermo and the Institute of Educational Technology of the National Research Council of Italy and to SIREM (Società Italiana di Ricerca sull'Educazione Mediale).

February 2023

Giovanni Fulantelli  
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# Learning Methodologies and Technologies Online. HELMeTO 2022 Editorial: Introduction to the Scientific Contributions (Editorial)

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**Keywords:** Distance learning · Virtual learning environment · Online learning · eLearning

The HELMeTO 2022 Conference combined methodology, innovation, and technology. These three pillars represent the key to making significant progress in the educational world, specifically for this conference, in the university sector. But these are three pillars that must work in an integrated way. Coordination is essential and, above all, sensitivity to understand that in online and hybrid learning there are not such hard divisions. While it is true that the focus can be on methodology, innovation or technology, it is also true that they feed each other and that only through a joint work they could have a significant impact on both, the educational process, and the user performance. The proceedings book that we introduce following reflects significant contributions through almost 60 chapters. Making the division according to the tracks of the conference (2 general tracks and 12 special tracks) would have been something long and not especially effective. That is why we have clustered them by the main foci of each chapter. Taking into account that the three foci that we have commented before are interwoven, there is always a primary one and that is the one we have used to adhere the chapters to one section or another. We show, therefore, three sections focused on 1) general aspects; 2) methodology and education; and 3) technology and digital environment. Each chapter should be considered as a contribution about one of the main foci but which, without a doubt, considers the others.

## Contributions on General Aspects of Online Higher Education

The shift towards online learning for higher education has brought forth a number of general issues such as lack of interaction, technical difficulties, and reduced opportunities for hands-on learning. However, the COVID-19 pandemic has accentuated the need for universities to adapt to this mode of education delivery [1]. In response, online

pedagogy and learning methodologies have evolved to address these challenges, such as incorporating more interactive and engaging activities and leveraging learning technologies like virtual reality and simulations [2]. Furthermore, the use of data analytics and educational big data mining has become increasingly important in improving the online learning experience. These technologies allow for the collection and analysis of vast amounts of data about student learning and behavior, enabling universities to make informed decisions about curriculum design, student support, and the use of educational technology [3]. The application of these tools has the potential to enhance the overall effectiveness of online learning and provide a more personalized educational experience for students [4]. These general issues on online learning for higher education are covered by the chapters included in this section of the book.

## **Contributions on the Methodology and Pedagogical Issues in Online Higher Education**

The use of technology and digital tools has dramatically changed the way education is delivered, making it necessary to evaluate the relationship between methodology and education in this context [5]. In online higher education, the combination of these two elements is crucial in ensuring that students receive an engaging and effective learning experience. The development of appropriate and effective methodologies is critical in online education as it directly impacts the quality of teaching and learning outcomes. Furthermore, the use of technology has created new opportunities for innovative methodologies to be employed in online higher education. The goal of these methodologies should be to facilitate active student engagement and interaction, and to enhance the development of critical thinking and problem-solving skills. The chapters that we present in the Methodology and Education section cover some of the key aspects of the methodological and pedagogical issues in online higher education. One of the aspects of online learning that has gained significant momentum, since the end of the Covid emergency, concerns hybrid approach to learning, combining online and face-to-face instructions. This approach not only increases accessibility for students, but also enhances the learning experience by incorporating the benefits of both modalities. Experience-based training activities, such as virtual simulations and hands-on projects, can also enhance the online learning experience and provide students with practical skills that can be applied in real-world situations. Furthermore, empowering soft skills and digital competencies in higher education is essential in preparing students for the digital age. By integrating these skills into the curriculum, students can develop the necessary competencies to thrive in a rapidly changing, technology-driven world. STEAM education (Science, Technology, Engineering, Arts, and Mathematics) is another key concept for our discourse, due to the fact that well-designed online education methodologies can enable particularly effective STEAM education processes [6]. Online learning has revolutionized the way education is delivered and has made education more accessible to a wider audience. However, it has also brought new challenges, such as the threat of social media distractions and cyberbullying, which can negatively impact the learning experience. A number of chapters in this book illustrate innovative applications to counteract social media threats. Finally, as

online education continues to evolve, faculty development programs play a crucial role in supporting the transition to online learning and ensuring that educators are equipped with the necessary skills and knowledge to deliver effective online instruction.

## Contributions on the Technological and Digital Issues in Online Higher Education

Technology and the digital environment are a key tool for progress in online learning, online teaching, and online academic management [7]. Let us not forget that, although the usual speech is focused on learning, both teaching and management are key to producing a useful and interlaced ecosystem between all the actors involved in an educational process. We achieve through a well-integrated technology, a reflection of a digital society. And with a digital sensitivity such as the one we enjoy right now in much of the world, we can make use, distribution and production of resources, methodologies, assessments, analysis, predictions, and endless services to actively and positively influence the educational process. Let us not forget that technology is nothing more than a tool, and that what really makes the difference is what we do with it. That is why this section is meaningless without the other two sections, both on methodology and education, and on general and transversal aspects. A good strategy, well implemented, supports any tool. A good technology without a strategy is yet an empty device. The chapters that we present in this section of technology and digital environment talk about significant advances and effective technology-based approaches, such as artificial intelligence, augmented reality, data analysis, digital innovation, and a long etcetera. We should read between the lines to understand that all of them constitute fundamental actors in an online or hybrid environment. Further, and inevitably, they must be applied in a sensitive way, and with educational standards of the highest quality.

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