

Chapter 1

LEARNING IN A DIGITAL WORLD: AN INTRODUCTION

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Abstract: In recent years, several scholars have called for more inquiry on the role of interactive media in learning in the digital and hyperconnected world. While the interplay of technology and learning may be difficult to fully unfold, current evidence suggests that technological innovations have an important effect on learning, engagement, and achievement in all educational settings -- formal, non-formal and informal. This book compiles contemporary and multidisciplinary research in this area, with the goal of arousing other investigators to contribute to the growing empirical literature on interactive media for learning. The chapters in this book explore research questions on technologically mediated learning from a variety of theoretical and methodological frameworks, in several different types of educational contexts, and from different participant perspectives (students and teachers). In doing so, the book is expected to shed light and raise academic discussions on the interplay of interactive media and learning in formal, non-formal and informal educational settings - how learning gains emerge and are documented, and how the use of interactive media relates to important behavioural, motivational, and achievement outcomes.

Keywords: learning, education, interactive media, educational technology, technology-enhanced learning, emerging technologies, ICT, formal, non-formal, informal

1. INTRODUCTION

Learning, as the act, process, or experience of gaining knowledge, skills, and attitudes happening throughout the lifetime of a human is unavoidably influenced by the advancement of Information and Communication Technologies (ICTs). ICTs are more than tools. As posited by Luciano Fioridi in his “Onlife Manifesto” (Fioridi, 2015) our daily experiences in a hyperconnected and digital society shape the way we interact with others

and with our environment, and the way we perceive ourselves and reality. These changes in our behaviour and perception have a clear impact on our expectations about learning and the role of interactive media in supporting learning. In fact, ubiquitous, social and mobile computing, virtual, augmented and mixed reality, interactive surfaces and spaces, robotics, Internet of Things (IoT) tools and serious games promise unique teaching and learning opportunities in dealing with the educational challenges of the 21st century society.

The often-called 21st century educational challenges include, among others, how to support hyperconnected people to develop skills such as problem solving, creativity, critical thinking, collaboration and communication (Binkley et al., 2012) -- skills that people need for work, citizenship and self-actualization in the 21st century (Dede, 2010). Many of these skills have been around for decades if not centuries, but the way we acquire and apply them has dramatically changed due to our pervasive relationship with ICTs that are making our world more global and immediate. For instance, collaboration has always been valued as an important interpersonal skill in education, but current frameworks of collaboration are relying upon complex technology-mediated environments of distributed intelligence in which people from different walks-of-life and countries need to work together (Dede, 2010). These new contexts require individuals with new attitudes and skills to be able to deal with additional issues provoked by distant, multidisciplinary and multicultural relationships. In an experience reported in Díaz, Acuña, Aedo, and Ocker (2011), teams of students from Universidad Carlos III de Madrid joined the PSU Partially-Distributed Project (Ocker, Rosson, Kracaw, & Hiltz, 2009) to collaboratively engage in web-design with several teams located around the world. This kind of collaboration forced to develop international, multidisciplinary and multicultural communication skills, not typically practiced in collaborative learning tasks where you know all your mates and you can easily distribute effort, negotiate and manage conflicts. Another relevant skill is that of *learning to learn*, focused on the need to prepare citizens for life-long learning through active engagement with the information society, collaboration with others, problem-solving and creative thinking. ICTs can support the development of these skills by enabling affordable simulations of real-world problems, collaborative learning environments, or multi-user critical-thinking and social creativity tools.

There is a lot of expectation around emerging technologies to continue to advance teaching and learning. There are now many products and prototypes available, but at the same time, lack of research to inform teachers, learners, education managers and even parents on best technologies for specific

learning tasks, considering also ergonomic and economic perspectives (Bricken, 1991). When selected wisely, interactive technologies can support learning experiences in line with the learners' needs and expectations as well as the requirements of the educational context. This challenge can be faced when learning technologies are envisioned as sociotechnical ecosystems made up of people, contexts and digital tools. Thus, their development should be addressed from a multidisciplinary perspective combining knowledge of different disciplines including education, design, human-computer interaction, or computer science among others.

Today, the variety of available technologies to support learning and teaching is so broad that deciding what to use, how to integrate them in the classroom, and what outcomes to expect is a complex issue. A technologically supported learning environment is not effective by itself; it must be adopted by educators, learners and other stakeholders considering their goals, attitudes and expectations. This book aims at guiding this decision by providing discussions on the learning affordances and the challenges that interactive technologies pose through several experiences in developing and integrating them in varied educational settings. In the chapters of this book, scholars from different disciplines analyze complementary issues concerning the integration of interactive technologies in various educational settings, whilst they address theoretical, pedagogical, design and technical considerations. There are plenty of books, papers and reports on the use of interactive technologies for education, but what makes this book different is that the contributors focus on multidisciplinary research in this area, aiming to shed light at how interactive media can be used to promote the so-called 21st century skills (Binkley et al., 2012) in formal, non-formal and informal educational settings.

The study of learning in the digital world is by no means a trivial task. Unfolding the interplay of technology and learning is difficult to achieve due to the many factors involved (Lowyck, 2014). This is the reason why educational technology is a constantly evolving discipline concerned with advancements in technology in accordance to the evolving learners' needs and expectations regarding technology. The contributors in this book adhere to beliefs that interactive media can be used to address these needs and expectations and to develop engaging learning experiences in all educational settings, tearing down time, space, social and economic barriers.

2. BOOK GOALS AND STRUCTURE

The goal of this book is to extend the interest in interactive media for learning and to provide a theoretical and empirical basis for the use of

various technologies in supporting the development of the 21st century skills such as collaboration, problem solving, critical thinking, and creativity (Binkley et al., 2012). To achieve this goal, the book brings together a group of international scholars who approach research questions on technologically mediated learning from a variety of theoretical and methodological perspectives, in several different types of educational contexts, and from different participant perspectives (students and teachers). The 15 chapters included herein present various experiences from developing and integrating interactive technologies in varied educational settings with a view to offering readers a better and more comprehensive understanding of their “benefits and affordances, trade-offs and limitations.

All the chapters of the book aim at exploring the use of interactive media in promoting learning. In some cases, cutting-edge technologies that provide new learning opportunities, such as embodied learning, are analyzed whilst other chapters deepen on the use of perhaps less sophisticated technologies yet able to support crucial learning outcomes like collaboration and critical thinking. Other chapters focus on novel approaches to develop, integrate and use interactive media in various learning contexts. Overall, the chapters discuss pedagogical issues and affordances of specific interactive technologies for learning. The authors analyze the benefits of these technologies but also limitations and challenges in their integration, they provide empirical support for their utility in dealing with specific learning issues and teaching methods and they introduce useful guidelines and heuristics for designing technology-enhanced teaching and learning.

3. BOOK CONTENTS

3.1 Part I: Theoretical and empirical findings on the integration of interactive technologies

The first part of the book comprises eight chapters offering theoretically grounded perspectives on the integration of interactive media in various educational settings. The chapters aim to promote understanding of why and how to use interactive technology whilst raising questions for the readers with respect to the values, trade-offs, contributions and limitations of using technology in the educational setting.

Chapter 1, “Prompting deep learning with interactive technologies: Theoretical perspectives in designing interactive learning resources and environments” by Tiffany A. Koszalka, Mary K. Wilhelm-Chapin, Christopher D. Hromalik, Yuri Pavlov, and Lili Zhang, puts the focus on a key problem: the need to promote deep learning, from memorising contents

and test-passing to acquiring and applying key attitudes, knowledge and skills. The authors provide a solid discussion on how different interactive technologies might support learners in and in deep thinking and learning as they interact with content. The goal is to understand how technology can be used to support independent learners in solving real world problems through the lens of generative learning theory (Wittrock 1974), cognitive flexibility theory (Spiro et al, 1988) and reflection theory (Zimmerman, 2002). Starting with a sound review of the state of the art, the authors summarise the affordances of current technologies (e.g., simulations, educational games, virtual worlds, augmented reality). Their aim is to provide several design guidelines for learning resources and environments that enhance deep learning via interaction and engagement with content. The chapter ends by describing two examples on how to turn static and dynamic resources into valuable assets for deep learning.

Chapter 2, “Creating Dialectics to learn: Infrastructures, practices, and challenges” takes a similar approach to analyze how interactive media can promote 21st century skills like critical thinking and problem-solving (Binkley et al., 2012). In their chapter, John M. Carroll, Na Sun and Jordan Beck discuss the role of dialectical constructivist learning as an endogenous constructivism approach (O’Donnell, 2012) in preparing critical thinkers by pushing them to “articulate multiple perspectives and then comparatively debate, deconstruct, and analyze their strengths and weaknesses to synthesize new perspectives”. The authors frame “debate” as a core pedagogical activity central to modern dialectical constructivism and explore how different technological tools and platforms support this method. Different experiences are presented in the chapter: technology appropriation (using Piazza) and technology development (the Critical Thinker) to support controlled learning activities within a specific course and analyzing in-the-wild debates in Kialo -- an online peer production community. The chapter summarises the findings of these experiences in terms of issues, approaches, and lessons learnt that can help readers to understand why and how to use interactive technologies to integrate dialectics as a learning activity.

Who hasn’t played “Tens go fish” to learn how to add? Wasn’t it more engaging than just adding numbers in the blackboard? Digital games, often called serious games, have been around in the educational arena for the last three decades. They have been traditionally used in many classrooms to take profit from the intrinsic motivation associated with ludic activities and intersperse cognitive challenges that support learning. At the same time, gameful design and gamification have been utilized to bring game elements and fun into other types of learning activities around technology (Ioannou, 2018). It is not only that games and gamification are fun, but they are a way to learn and practice rules, social interactions and interpersonal skills.

However, just like with any other technology, digital games are just a tool and they do not guarantee effective learning. In Chapter 3 “Supporting learning in educational games: promises and challenges”, Valerie Shutte, Seyedahmad Rahimi and Xi Lu analyze types of learning supports in digital games including supports for reflection, modeling, advice, collaboration, feedback, and multimodality among others. In the second part of the chapter, the authors introduce their own educational game -- Physics Playground -- which supports students in acquiring physics competences. The chapter provides an in-depth description of the iterative process followed to design a game that meets the different needs identified in usability and experimental studies. The details of the design cycle as well as the valuable instructional resources presented in this work can help readers to understand the design process of a serious game as an incremental process focused on people (teachers, learners and other stakeholders) and their goals.

Virtual Reality (VR) is without doubt one of the technologies that has created high expectations in education. It has been used in the last 20 years mainly in lab experiments and simulations, but now that immersive VR devices are becoming commercially available and they are starting to enter our living rooms, new opportunities about their application in formal, non-formal and informal learning emerge. Chapter 4, under the title “The necessary nine: Design principles for embodied VR and active STEM education”, Mina C. Johnson goes deeper into two important affordances of virtual reality: the sense of presence into the virtual world that might generate engagement and attention and the agency of manipulating objects in a 3D space that might improve active learning by relying upon the main tenets of embodied learning (Wilson, 2002). The authors introduce some terms, affordances and associated pedagogies as well as a set of design guidelines in the form of heuristics that might guide readers in deciding how to create quality content for immersive VR educational experiences. The chapter describes two examples of design of VR educational experiences, where natural interaction is used to improve learning by enabling students to use their bodies to interact with the environment.

And what if the learning devices are embedded into what we wear? Can I use my watch, glasses or clothes to teach or learn? In Chapter 5, “A broad view of wearables as learning technologies: Current and emerging applications,” Lee and Saphiro discuss several uses of wearable devices to support teaching and learning activities. In the first part of the chapter, the authors analyse a number of experiences reported in the literature organised into four groups: experiences that support personal expression basically through smart textiles; experiences that integrate digital information into social interactions using devices like smart badges; experiences that support role-play in participatory simulations, and, finally, experiences that provide

just-in-time notification and feedback using smart watches and augmented reality glasses. The chapter ends by introducing two projects from the authors in which wearables are used in a more visionary way: (i) to get feedback from bodily experiences of humans, mainly to visualize activity tracks and enable discussion around healthy habits, and (ii) to get feedback from pets, to gain more insight into how pets experience the world. This review chapter provides an interesting glance at some of the possibilities that highly portable technology might bring to formal, non-formal and informal education and might inspire teachers and educators to envision innovative learning activities.

The last three chapters of Part I present studies and reviews of interactive technologies used in education with a view to provide useful hints to designers and developers on current tendencies and uses. In Chapter 6, “Promoting online learning community with identity transparency,” Na Sun, Mary Beth Rosson and John M. Carroll examine social interaction as a key issue to guarantee retention in online learning. Online learning has gained momentum especially due to the increasing need for lifelong learning in the 21st century. Though initially online learners are mainly attracted by the fact of acquiring new knowledge or skills wherever and whenever they want, studies demonstrate that social interaction is a key issue to guarantee retention. In this chapter, the authors introduce three empirical studies, two qualitative and one quantitative, aiming to understand how social interaction is perceived and valued in online learning communities. Through semi-structured interviews with teachers and learners and quantitative investigation of two key constructs – the sense of community and the community collective efficacy – the authors present valuable findings that can be used by online teachers and developers of computer-supported collaborative learning systems. Some of the valued features identified, for example, identity transparency, live sessions, continuous social interaction and immediate feedback, suggest the need to think about online learning systems as structures to support not only content delivery and interaction but also, fluid and richer human-human interaction.

In Chapter 7, “Embodied learning in a digital world: A systematic review of empirical research in K-12 education” Yiannis Georgiou and Andri Ioannou discuss the notion of embodied cognition and summarize empirical findings from research on technology-enhanced embodied learning environments targeting student learning outcomes. The review revealed positive outcomes linked to technology-enhanced embodied learning – mainly cognitive outcomes in the domains of science, technology, engineering, and mathematics (STEM). The authors provide insightful direction for future research and practice in the field with respect to domain (e.g., beyond STEM), learning outcomes (e.g., consideration of affective,

and psychomotor domains), research methodology (e.g., more in-situ measurements and experimental designs), and design issues (e.g., integration research addressing tools for embodied learning, classroom orchestration, technological setup, learning design). The review sets the bases for further research in the field of technology-enhanced embodied learning.

In Chapter 8, authors Yu Wen and Chee-Kit Looi provide an overview of the literature the literature on Augmented Reality (AR) uses in education in their chapter “Review of augmented reality in education: Situated learning with digital and non-digital resources”. The authors propose a categorization of applications based on a matrix that proposes two dimensions: type of learning supported (surface vs. deep knowledge) and type of experience supported (context-independent vs. context-aware). With this matrix they categorize different contributions to try to identify fields in which AR is being used, the theoretical basis for the design of such experiences and pedagogical approaches followed. In this way the chapter provides a glance into the current state of AR uses in educational settings.

3.2 Part II: Theoretical and empirical findings on the integration of interactive technologies

The second part of the book collects several contributions more related with specific experiences and examples of using interactive technologies to support teaching and learning. In Chapter 9, “Virtual Reality Environments (VRLEs) for Training and Learning” by Kalliopi-Evangelia Stavroulia, Maria Christofi, Telmo Zarraonandía, Despina Michael-Grigoriou and Andreas Lanitis describe several potential uses of VR in education from the point of view of the learners as well as teachers. A very interesting contribution of this chapter is the use of VR at the Cyprus University of Technology to induce empathy as a learning goal (i.e., to deal with addictions, or improve social behaviour in multicultural environments) and to help teachers put themselves into their student’s shoes, which can be considered as an important skill in our globalized world (i.e., perceptiveness). The chapter ends by reviewing some of the end-user tools developed at Universidad Carlos III de Madrid that allow non-technical users to create their own educational VR worlds without requiring any programming skills.

Chapter 10, “MaroonVR - an interactive and immersive virtual reality physics laboratory” describes an interesting example of using an interactive learning tool in the STEM field. Johanna Pirker, Michael Holly, Isabel Lesjak, Johannes Kopf and Christian Gütl describe the architecture of the system and the iterative design process they follow to highlight several benefits and potential limitations that are summarised as design principles

which could also be translated to other domains. Such principles include heuristics like improving concentration through immersion, setting objectives for self-regulated learning, supporting different forms of immersion, allowing exploration and new forms of interaction, including social interaction.

In Chapter 11, “Designing learning activities using different Augmented Reality applications for different learning subjects for elementary students”, Sie Wai Chew and Nian-Shing Chen analyze how AR can be used to promote three instructional models: collaborative learning, inquiry-based learning and situated learning. The authors describe two experiences of designing and evaluating specific tools for learning about science and culture, respectively. These two experiences can help other educators to envision how to design AR learning tools for integration in their classroom.

Digital games are revisited in Chapter 12, “Teaching technology design: Practicing teachers designing serious educational games” from a different perspective. This is not a study on the utility of serious games but rather the description of an experience on how to engage teachers in the design of games. Leonard A. Annetta and Marina Shapiro use design thinking techniques to sparkle creativity and provide a certain process flow. In a study of practicing K-12 science and instructional technology teachers designing serious games, this chapter illustrates how teaching and learning design changes how teachers think.

Student motivation is a key issue in online learning. In Chapter 13 “Student and teacher’s perceptions toward the In-game Card as Educational Reward (ICER) Moodle plug-in,” Rita Kuo, Maiga Chang, Zhong-Xiu Lu and Cheng-Li Chen introduce a Moodle plug-in to use in-game cards as educational rewards. Teachers can assign card rewards to specific learning tasks and then students can compete with their peers using their cards in an online Trading Card Game (TCG). In an empirical evaluation the authors analyze the perceived importance of educational rewards and the perceived ease of use under four moderators (gender, role, experience in Moodle and experience in TCG). The authors present several expected and unexpected findings that might illustrate the benefits and design challenges of integrating this kind of educational reward.

Chapter 14, by Scott W. Brown and Kimberly A. Lawless reports on “The GlobalEd 2 Project: Interdisciplinary simulations promoting students’ socio-scientific simulation”. This is a PBL curriculum intervention that combines face-to-face and online learning, engaging students in interdisciplinary learning on science and written argumentation. The chapter details how GlobalEd 2 has successfully evolved over the past 15 years with documented learning outcomes on science and civics, written argumentations, interest in science, scientific literacy and global citizenship.

In terms of technology, the GlobalEd 2 communication and research platform is the backbone of the simulation which allows hundreds of students to connect and engage in negotiation, while other tools such as tables, the teacher's web portal are also needed technological means supporting the implementation. The chapter integrates findings from a series of GlobalEd 2 research studies as well as research on PBL, providing a guide for developers and educators planning to employ technology-based simulations in their classrooms.

Finally, the last chapter of the book "Designing a collaborative visualization-based learning system for problem solving to transform the classroom ecosystem" by Huiying Cai, Xiaoqing Gu presents the semantic diagram tool as a driver to transform the interactive sub-ecosystem between teacher and students as well as students in a group, during problem solving. The semantic diagram tool is used to change the roles of teachers and students and to support more active problem-solving. The tool pushed teachers to move from sheer knowledge disseminators to learning facilitators by giving more relevance to student activities.

4. BOOK AUDIENCE

The book compiles experiences with different interactive technologies with a view to provide a comprehensive perspective on the use, potential utility and value of interactive technologies in supporting teaching and learning. The primary book audience is researchers, teachers and students (e.g., graduates in teacher preparation programmes) and other stakeholders in the fields of education, educational technology, and ICTs in education.

The book is addressed to anyone interested in having a glance at how interactive technologies can be used to support key educational challenges. Chapters are written in a clear and understandable language making them accessible not only to educational researchers but also to educational practitioners. The book chapters do not focus exclusively on technology uses in educational settings but provide a broader view of the impact and affordances of technology to improve the learning process.

5. DISCUSSION AND FUTURE DIRECTIONS

We would like to sincerely thank the authors of the 15 chapters presented here. Because of their work, we now know more about the interplay of interactive media, pedagogy and learning as well as the affordances of various media for formal, non-formal and informal educational settings.

This book compiles contemporary and multidisciplinary research in this area, with the goal of arousing other investigators to contribute to the growing empirical literature on interactive media for learning.

The chapters in this book explore research question on technologically mediated learning from a variety of theoretical frameworks, including generative learning theory, cognitive flexibility theory, reflection theory. Key pedagogical approaches are presented (e.g., constructivist dialectics, problem-based learning) in line with interactive media technologies. Current technologies (e.g., simulations, virtual and augmented reality, wearables) are utilized and discussed in different types of learning contexts, and from different participant perspectives (students and teachers). Their use appears to be instrumental for the learning process with evidence of learners' gains in knowledge, attitudes and skills. Design issues are of concern in all chapters; a few design hints, principles, guidelines and heuristics can be distilled from the included studies.

Nonetheless, there is still a dearth of systematic research in this area. For certain, the relevant questions still to be answered are many, and the methodologies appropriate for answering those questions are varied since we are living in a rapidly changing world where technologies are not only pervading all daily activities, but also changing the way we perceive the world and ourselves. Accordingly, we hope this book will spark more discussion and reflection on the issues raised by the authors and encourage other researchers to take on the task of rigorously studying the factors involved in the design and use of interactive media for learning. That said, below we offer questions for prospective researchers to consider:

- *How can we open education to integrate all the stakeholders (educators, learners, managers, families, communities) in a more active way?* This is a broad challenge that can be to some extent, supported by interactive technologies, particularly pervasive and social computing. Yet, as illustrated in many of the chapters of this book, we also need to encourage all stakeholders to participate in a meaningful, sustainable and affordable way. Research needs to advance in open educational models created and managed by different types of stakeholders. Teachers, educational managers, learners, families and members of the community can contribute their part to a participatory learning ecosystem. Such ecosystem can be envisioned as a digital knowledge ecosystem, that is, as a “distributed adaptive open socio-technical system for knowledge sharing and management exhibiting properties of self-organization, scalability and sustainability” (Briscoe, 2010).

- *How can we enable non-technical people to appropriate and personalize technology to create their own learning experiences?* This research question is directly related to the idea of scalability and

sustainability of digital ecosystems. There are no one-size-fits-all solutions in education, neither solutions that work always and forever. Learning is a complex, evolving and long-term process that depends on personal, sociocultural and economic factors. We cannot expect that some technology, pedagogical approach or tool will work the same in different educational contexts. Thus, we need to be able to adapt our tools and methods to the specific requirements of each educational context. For that to be possible, we can rely on motivated humans who know the problem, have the passion required to tackle it, but probably lack the technical background to implement a solution. End-user engagement and tools can help to democratize innovation by enabling non-professional software developers to ideate, create and modify their own learning experiences.

- *How can we use technology to turn every living space into an educational opportunity?* Interactive technologies such as augmented reality, pervasive computing (including wearable and mobile computing) and IoT tools can be exploited to turn every space and moment into a learning experience. Technology is ready and available, what remains is to understand which pedagogical models can be served and mediated by these technologies and how to design useful yet enjoyable learning experiences.

- *How can we promote creativity and authenticity in education through the mean of technology?* Social computing can serve groups of people who connect and interact to co-construct knowledge, driven by their common passion, interest and goals in a specific domain (Lave & Wenger, 1991). Such communities can foster the authentic knowledge and skills needed for the development of creative outcomes in response to real-world needs. Such communities can only be realized by integrating technologies that allow to overcome critical disparities in terms of location and time and inspire communication and collaboration.

The above list of questions is of course not exhaustive. Instead, it is an initial list of ideas based on the authors' reflections on the included chapters and their own scientific perspectives from research in this area. We are confident that the chapters presented here will contribute to our deeper understanding of interactive media for learning. Taken together, these chapters highlight the many ways in which interactive media can help to shape knowledge, attitudes, behaviour, and achievement in all learning settings. The book compiles experiences with different interactive technologies aiming to provide a comprehensive perspective on the use, potential utility and value of interactive technologies to support teaching and learning.

6. CONCLUSION

Learning is an extremely broad concept, and this makes it hard to answer the question of what the main factors influencing learning are, and thus to identify technologies and methods that optimize learning (Lowyck, 2014). At the same time, the variety of available technologies is so broad that deciding what to use, how to integrate, and what outcomes to expect is a complex issue. This book aims at guiding this decision by providing not only examples of the use of technologies but also well-grounded discussions on their learning affordances and the challenges they pose. Communication between scholars of different disciplines, including education, design, human-computer interaction, computer science can ensure that learning theories, models, and principles will guide the design of technological tools with best possible value for learning. Using systematic, theoretically grounded, and empirically sound research, we can build on the work presented in this special issue to move the field forward. To sum up, we perceive the following most important features and benefits of the book:

- It compiles the experiences of international scholars on the use of interactive media for learning.

- Key technologies like augmented and virtual reality, serious games or ubiquitous computing are analyzed in specific educational contexts demonstrating their utility and value.

- It focuses on teaching and learning methods and practices linked to the integration of specific technological tools.

- It presents multidisciplinary projects aimed at a variety of learning outcomes e.g., science learning, critical thinking skills.

The book chapters provide a broader view that does not focus on technology characteristics but rather, on the impact and added value of technology integration in teaching and learning. The book is addressed to researchers, educators and other stakeholders in education interested in having a glance at how interactive technologies can be used to support key educational challenges. Overall, the book is expected to shed light and raise academic discussions on the interplay of interactive media and learning in formal, non-formal and informal educational settings - how learning gains emerge and are documented, and how the use of interactive media relates to important behavioural, motivational, and achievement outcomes.

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Prof. Dr. Paloma Díaz is Full Professor at the Department of Computer Science and Engineering of Universidad Carlos III de Madrid. With a Degree and PhD in Computer Science and Engineering from Universidad Politécnica de Madrid, she has been involved in interdisciplinary research in the Interactive Systems research group (DEI LAB) and the Institute of Culture and Technology from UC3M. Her main areas of interest are interaction design, web/usability engineering, mobile and ubiquitous computing, big data visualization, civic participation, ICT for learning and teaching and digital cultural heritage. Since 1996 she leads the DEI LAB (www.dei.inf.uc3m.es) that is focused on the design and development of interactive systems, data visualizations, collaborative systems and learning and simulation. The group does use-inspired basic research in areas such as emergency and crisis management, operation control, elearning and

training, and cultural heritage and it also goes into enabling research to devise the capabilities of emerging interactive devices. Dr. Díaz has led national and international research projects about the application of interactive technologies for design, learning and training, crisis management, civic participation or the operation of electrical smart grids. Some of her publications can be reached at [dblp](#) and [researchGate](#). She has also organized international conferences and symposiums like IEEE ICALT 2008, IEEE VLHCC 2010, and IS-EUD 2015, ISCRAM-MEd 2017 as well as tracks in conferences such as Social Networking and Collaboration at ISCRAM 2010-2013, Serious games and simulation at ISCRAM 2014-2015, Creativity in Collaborative Design at ACM Cognition and Creativity 2015 or the track Technologies for Open Learning and Education at ICALT 2017 and ICALT2018.

Dr. Andri Ioannou is an Assistant Professor in the Department of Multimedia and Graphic Arts of the Cyprus University of Technology, Director of the Cyprus Interaction Research Lab (<https://www.cyprusinteractionlab.com/>), and Team Leader of the “Educational Media for Education and Edutainment” Multidisciplinary research Group within the Research Centre for Interactive Media, Smart Systems and Emerging Technologies (RISE) of Cyprus. Andri has a Ph.D. in Educational Technology from the University of Connecticut (USA), an MA in Education from the same University, and a BSc in Computer Science from the University of Cyprus. Her research interests contribute to several key areas of Educational Technology, including (i) design and evaluation of innovative educational technologies and learning environments; (ii) development and evaluation of pedagogical frameworks and ICT tools for learning in both distant and collocated, formal and non-formal learning settings; (iii) study of tools and pedagogies targeting the development of skills within the 21st-century learning framework e.g., collaboration, problem solving, leaving-in-the-world skills; (iv) use of educational technology for social change. Dr Ioannou has established a respected research record through numerous publications in prestigious international journals and international conferences (e.g., Computers in Human behaviour, Interactive with Computers, Education Technology and Society, Educational Technology Research and Development, Educational Computing research etc.). Dr Andri Ioannou has obtained considerable funding in support of her research from funding agencies in Cyprus and the EU. She has participated in the capacity of coordinator or research collaborator in programmes of the H2020 framework, Erasmus+ and programs of the Cyprus National Research Foundation, focused on technology-enhanced learning in K-12, higher education and vocational training (e.g., KA2 Project INTELed 2017-1-

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