

# Preface

## INTRODUCTION

Game-Based Learning (GBL) is an emerging educational medium that employs video games to increase students' skills, their level of awareness, and their motivation to learn.

GBL has evolved considerably during the last decades, in terms of theoretical models and applications, and is gaining increasing recognition among a wide range of sectors including formal education and corporate training. This significant change has been supported by new and more accessible gaming technologies, and the advent of educational theories that promote a constructive approach to learning, and acknowledge motivation and personal differences as determining factors for successful learning.

However, despite a growing body of knowledge on educational video games, there is still a need for more rigorous experiments in order to define frameworks that guarantee systematic learning and motivation. Without solid theoretical foundations, and universal guidelines on how to design and use video games in educational settings, it will be difficult to obtain all the benefits that these games can offer.

Several successful GBL solutions have been produced to date, and researchers have made substantial findings which have furthered the understanding of the intricate factors that affect learning and motivation in video games. Nonetheless, many challenges lie ahead:

- More developers need to be informed of best practices pertaining to the design of successful educational games.
- More educators need to be aware of the educational potential of video games. They need to understand how this medium can be used successfully to consistently motivate and instruct learners.
- Stakeholders involved in funding and identifying relevant educational solutions (e.g., company owners, policy-makers, or managers) should be informed accordingly, so that they understand the economical and managerial implications of GBL. This should enable them to make informed decisions, thereby supporting instructors and learners with relevant structures and resources.
- Educational video games should be envisaged through a multidisciplinary approach, and be designed accordingly by multidisciplinary teams including experts in game design, instructional design, and psychology.
- Researchers should avoid the mistakes of the past and create educational applications that truly tap into the motivational and emotional potential of video games; educational games should also account for curricular learning objectives. These two conditions are crucial for the adoption of GBL by both instructors and students.

- More practical recommendations on how to use GBL systems are needed. Whereas many publications on GBL report on experiments and theoretical models, very few manage to provide simple and practical guidelines that designers and instructors can easily follow and apply.
- GBL systems should follow a user-centered approach to learning, and acknowledge personal differences at both cognitive and affective levels. It is only by providing personalized emotional and cognitive experiences to users (e.g., characters, scenarios, or learning interventions) that reproducible and sustainable results will be achieved.

To address some of these challenges and expand the existing body of knowledge on GBL, I decided to launch a publication project involving experts from different fields, all with an interest in designing highly engaging and educational game-based educational systems. The primary objective of this project was to compile current research in GBL, to provide a comprehensive yet practical explanation of GBL, and to analyze the multiple factors, including design, development, integration, and evaluation, that contribute to both learning and motivation in video games.

This project has been an interesting journey and a truly collaborative experience involving the work and contribution of many enthusiastic and dedicated individuals. More than a year after submitting my proposal for this book to IGI-Global, and having collected, reviewed, and compiled the invaluable information submitted by authors and reviewers, it is with great enthusiasm that I am writing the preface of this publication. I believe this book will be instrumental in expanding our understanding of the multiple factors that influence the effective design and use of GBL. I also hope that it will assist teachers, students, policy-makers, and developers, and inspire them to tap into the many possibilities offered by GBL.

This handbook includes chapters from more than 100 experts in instructional design, game design, psychology and educational psychology, who depict their experience of designing and deploying GBL solutions, and reflect on their achievements and shortcomings. These experiences are then employed to inform the reader by providing relevant advice and guidelines accordingly.

All chapters have been evaluated using a thorough review process. In order to recruit authors, a call for chapters was issued, requiring potential contributors to submit a proposal that described the coverage, uniqueness and relevance of their chapter. All proposals were then evaluated based on their relevance, and every effort was made to include a representative range of topics. Selected authors were asked to submit their chapters, which were then assessed through a double-blind review process by three reviewers. Following the double-blind reviews, accepted authors were provided with recommendations from the reviewers and the editor, and asked to submit an amended script. This amended version was then evaluated, and a final notification of acceptance was issued. As a result of this review process, this handbook includes 52 high quality chapters that provide a comprehensive explanation of the issues, solutions, and challenges related to GBL.

## BOOK STRUCTURE

The chapters in this book have been divided in five key areas:

- *Introduction to Game-Based Learning.* This section provides introductory material on Game-Based Learning. Readers with little or no prior knowledge of the field will find valuable information to help their understanding of how video games can be appreciated and explained in the

light of educational and motivational theories. It also includes two literature reviews on the use of computer games in education that will help the reader to appreciate the evolution of GBL and the challenges that lie ahead. This section also comprises an analysis of the barriers to using video games in the classroom, an overview of the necessary conditions for the successful integration and deployment of video games in instructional settings, and an explanation of the role that teachers can play to support the effective use of video games.

- *Cognitive Approach to Game-Based Learning: Design Patterns and Instructional Design.* This section describes GBL solutions that concentrate on the cognitive aspects of learning, with particular emphasis on instructional design, educational theories, and design patterns. The authors address the difficult and complex tasks of identifying, measuring and combining the factors that contribute to both learning and motivation in video games.
- *Psychological Approach to Game-Based Learning: Emotions, Motivation and Engagement.* This section focuses on a psychological approach to GBL, and explains how emotions and motivation can be harnessed to improve learning in video games.
- *User-Centered Approach to Game-Based Learning: Accounting for Users' Differences, Specificities and Disabilities.* This section accounts for users' differences, specificities and disabilities in the design of GBL systems. The authors describe theoretical frameworks and guidelines that address issues and challenges such as improving motivation, providing tailored interventions with Intelligent Tutoring Systems (ITSs), accounting for gender differences, applying games to neuro-rehabilitation, or engaging children with attention deficit or intellectual disabilities.
- *Curricular Approach to Game-Based Learning: Integrating Video Games in Instructional Settings.* This section describes how video games can be deployed and utilized in different instructional settings. The chapters include experiments on the use of video games to teach law, engineering, physics, leadership and health. The authors explain how these video games can improve current teaching practices. They describe the rationale and theoretical models behind the creation and deployment of their systems, and provide helpful insights and recommendations based on their experiences.

## Section 1: Introduction to Game-Based Learning

In Chapter 1, Svingby and Nilsson present a literature review of projects where Game-Based Learning (GBL) was employed to support science teaching. They classify 50 publications of the last decade that include empirical data on the use of video games to teach science. This in-depth literature review classifies and assesses each of the publications, based on several criteria, such as type of game, research design, research methodology and topic taught. In Chapter 2, Hailey, Connolly, Stansfield, and Boyle provide an introduction to and a literature review of GBL. They define GBL and associated terms, and analyze how video games have been employed to teach computer science, software engineering and information systems. The authors also discuss the advantages and limitations of video games as learning platforms. In Chapter 3, Kearney reviews and summarizes a study conducted across Europe on the use of video games for learning purposes. During this project, a comprehensive amount of data was collected in order to present a state of play of GBL from many different perspectives (e.g., teachers, experts and policy-makers). An analysis of the data collected has helped the researcher to identify and explain the barriers to using video games in the classroom, the necessary conditions for the successful integration and deployment of video games, and the role that teachers can play to facilitate and support the use of

video games in educational settings. Based on her analysis, Kearney provides useful recommendations to teachers and other practitioners. In Chapter 4, St-Pierre explains how video games can be appreciated and analyzed in the light of educational and motivational theories. After a brief introduction that situates the evolution of educational video games within the wider context of multimedia and educational theories, he provides an interesting overview of the instructional theories, often implemented implicitly in video games, that can be used to guide the design, implementation, and deployment of video games. Behavioral, cognitivist, and constructivist approaches to learning are considered. Particular attention is paid to user-centered design, and he explains how individual differences (e.g., personality, learning styles or multiple intelligences) can be accounted for in designing educational video games. St-Pierre also gives designers and instructors a set of specifications for the successful development of video games.

## **Section 2: Cognitive Approach to Game-Based Learning: Design Patterns and Instructional Design**

Identifying and measuring factors that contribute to learning and motivation in video games is a difficult task, perhaps due to the complexity involved in accounting for both cognition and motivation. However, in Chapter 5, Staaldin, based on a literature review of both video games design and instructional design theories, has singled-out 25 game elements that support deep learning, a state where learners develop a critical understanding of the topic taught. In a study where students used a game called TOP-SIM, the author has managed to assess the educational impact of 16 of these elements, and he shares his analysis and results. In Chapter 6, Djaouti, Alvarez, and Jessel introduce a classification of video games that they call the G/P/S. This classification can be used to choose and analyze video games, based on their educational and entertaining features. This model might be particularly useful for instructors with little or no prior knowledge of video games. The authors explain the theoretical basis for their model by providing a comprehensive review of existing classifications, identifying their limitations, and explaining in great detail how these limitations have been addressed in their model. The authors also offer a practical example of their methodology, by classifying a sample of different types of serious games with the G/P/S model. In Chapter 7, Ecker, Müller, and Zylka address the difficulty of successfully combining educational and entertaining features of video games thanks to design patterns. Their work is based on both game design patterns and pedagogical patterns. The authors explain the background for Game-Based Learning Design Patterns (GBLDPs); they provide examples for such patterns, and discuss the challenges in identifying, recording, and employing adequate patterns for GBL. In Chapter 8, Evans explores best practices for the design of effective GBL environments at university-level and for adult learners. Her approach is based on the premise that games are intrinsic learning experiences. She describes seven best practices of entertainment games design that can be adapted to educational content, namely, metaphor, visualization, content as mechanic, self-assessment, achievement, repetition, and multi-linear play. She then explores how these best practices can be employed using Digital Calculus Coach, an online video game that teaches calculus concepts and problem-solving to third-level students. In Chapter 9, Schott and Selwyn argue that there is a discrepancy between the literacy employed by digital natives when playing video games and the classification established by digital immigrants. They explain that, contrary to many preconceived opinions among parents and teachers, games also contribute to knowledge, and that more adults should start to learn about video games, and acknowledge their learning benefits. The authors believe that game literacy goes far beyond entertainment; however they also think that game regulations are often guided by beliefs, perception and attitudes. Their chapter offers

interesting insights and ideas to change this state-of-mind. In Chapter 10, Schwartz and Bayliss offer to bridge the gap between instructional design and game design, by reviewing instructional and game design concepts, and by comparing and contrasting their key aspects. Using three case studies, Schwartz and Bayliss draw parallels between instructional design and game design, and explain how these two fields can be combined successfully. In Chapter 11, Szilas and Acosta, who believe that video games are dynamic systems of signs, introduce a theoretical framework to explain how learning occurs in video games, using a semiotic approach. They then use their model to classify GBL strategies employed in three commercial games.

### **Section 3: Psychological Approach to Game-Based Learning: Emotions, Motivation and Engagement**

In Chapter 12, Hainey, Connolly, and Boyle present a study where Alternative Reality Games (ARGs), a popular form of interactive narrative, were employed to motivate secondary school students to learn a modern foreign language. Their chapter explains the rationale for the use of ARGs. It provides a literature review of the utilization of ARGs for educational purposes, with a focus on language learning, and presents both qualitative and quantitative analyses of the motivation of the students who took part in the study. In Chapter 13, Dormann, Whitson, and Biddle take a look at how computer games can support affective learning. Their approach, partially based on the activity theory, emphasizes the role of games as effective mediators of learning in the affective domain. They identify and describe design patterns that support affective learning. Many European countries are experiencing a decline in the number of students embracing a career in science, and GBL is often perceived as an appropriate solution because it provides an open-ended and entertaining environment, where students can experiment and learn-by-doing. In Chapter 14, Toprac describes his experience of employing a problem-based digital video game called The Alien Rescue Game (TARG) to teach and promote an interest in science to middle school students. Throughout Chapter 14, Toprac defines and explains the theoretical foundations and key motivational factors in video games. He then describes his experiments conducted with TARG. He explains and analyses how this video game has managed to increase students' learning interests and motivation. Toprac also provides newsworthy recommendations for designers and instructors, and identifies future relevant research directions. In Chapter 15, Annetta, Lamb, Bowling, and Cheng explore the psychometrics of an engagement observation protocol, based on cognition and learning theories. They explain that learning is strongly linked to involvement and engagement, and they describe how a Student Engaged Learning Technology rich Interactive Classroom protocol (SELTIC) was developed to increase and measure K-12 students' motivation when using a Serious Educational Game (SEG). In Chapter 16, Deen and Shouten propose to address learning and motivation in video games through identified regulations, which can be described as "negotiations with personal valued rules". They explain how identified regulations can motivate players to learn during the game, and even when the game is over. They illustrate their theory through the validation of a beta-version of a second language learning game called CheckOut!, a game designed with identified regulations in mind. In Chapter 17, Whitton considers the factors affecting the motivation of adults in the context of Higher Education (HE). She argues that adults' motivations for playing video games differ from those of children and teenagers. She reviews the theoretical explanations for adult motivation, and presents relevant guidelines to harness the educational benefits of motivation for adults. In Chapter 18, Voulgari and Komis investigate the use of Massively Multiplayer Online Games (MMOGs) for collaborative learning. They argue that these



environments implicitly include a wide range of motivational and instructional features that ought to be harnessed to augment and improve current educational practices. Voulgari and Komis identify and analyze relevant characteristics that may positively impact on learning in MMOGs, and they review learning and psychology theories that could explain how learning and engagement occur in these environments. Following this analysis, they present a framework based on their observations, and provide the reader with recommendations for the effective design, deployment, and use of MMOGs for learning purposes. In Chapter 19, Aranda and Sánchez-Navarro describe video games as social activities, in which complexities and intricacies can be understood within sociocultural and educational contexts. They report on three studies that investigated the use of digital gaming in non-formal and informal education: (1) an empirical study on the use and perception of Spanish teenagers in relation to digital technologies as tools for leisure and socialization, (2) an analysis of the introduction of video games in the context of leisure activities, and (3) a workshop for families to discuss the cultural and social significance of the use of video games in the household. In Chapter 20, Haring, Chakinska, and Ritterfield explain serious gaming from a psychological perspective. They focus on the effect of video games on players, and describe the conditions and the significant factors for players' enjoyment, which may in turn influence the extent to which they learn. They also present and describe the Big-Five, a hierarchical model of game enjoyment based on empirical evidence. Accessibility in video games is an area that demands further attention and investigation from researchers, as there are very few experiments and studies focused on accommodating people with disabilities in video games. Although new standards and regulation have addressed some of these issues, it is very difficult to represent abstract concepts or complex information with inherent spatial attributes (e.g., mathematics) to blind people, who rely predominantly on their tactile and auditory senses to gather information. In Chapter 21, Neff and Pitt describe and analyze how spatial auditory information can be employed for expressing mathematical problems to blind students in the context of video games. They explain their framework, and illustrate it through the description of a study that examined the representation of trigonometric shapes using surround sound. In Chapter 22, Shin, Norris, and Soloway examine the use of mobile gaming environments for learning, and their effect on students' motivation and attitude toward Mathematics. The authors believe that mobile GBL provides a flexible, interactive and individualized medium for learning, and they explain the need for more empirical evidence on the benefits of mobile GBL. They provide a comprehensive overview of the previous research on mobile GBL, and present the results of a study that they carried-out over a four month period with second grade students. Based on their findings, Shin, Norris and Soloway provide recommendations and future directions to researchers for the development of effective mobile GBL environments. In Chapter 23, Hudlicka emphasizes the importance of using emotions in educational video games. She explains how emotions play a central role in learning, and how they can influence behaviors and the acquisition of new cognitive and motor skills. She focuses particularly on emotions-modeling, which she believes can improve user-modeling and the "believability" of Non-Player Characters (NPCs), and help video games to adapt to players' changing affective states. Hudlicka discusses the creation of an affective game engine, a tool she suggests could improve the design of affect-centered games. Hudlicka also provides interesting recommendations to researchers, practitioners and policy-makers for the advancement of serious affective gaming. Emerging game interface designs increasingly incorporate human gestural learning. Electronic gestural games, when effectively designed, offer high levels of user engagement. In Chapter 24, Danylak presents theatrical practice, an art form that manufactures expressive gestures in set paradigms, as a model for gestural game systems design. A rigorous definition of gesture is first developed from yoga practice as an exercise for performance preparation, emphasizing the gesture as a

still form executed within a narrative context. The theatrical model is then refigured into an interactive gestural film game design, ‘To be or not be,’ based on a section of text from Shakespeare’s play, *Hamlet*.

#### **Section 4: User-Centered Approach to Game-Based Learning: Accounting for Users’ Differences, Specificities and Disabilities**

In Chapter 25, Marty and Carron propose to increase motivation in GBL environments by improving both the flexibility of the system and users’ immersion. They explain the need for adaptive mechanisms to model users. They suggest the use of tailored interventions and scenarios, and describe how immersion can be augmented based on game design considerations. Marty and Carron then illustrate their approach through the description of a GBL environment called *Learning Adventure*, a management system representing a 3D environment where users are taught basic Unix shell commands, and are provided with an adaptive scenario. In Chapter 26, Ng studies students’ different attitudes to GBL and video games based on their gender, as she believes this issue has been overlooked over the past years. She describes a study in which student teachers were taught programming concepts using an educational video game. Ng analyzes their behaviors and achievements in terms of score, strategies, and time spent playing, and she observed interesting and significant differences between genders, notably that male students spent shorter time playing the video game but scored higher, and that female students were inclined to adopt a trial-and-error strategy. She then provides recommendations based on her experience and the results of her study. In Chapter 27, De Byl and Brand present guidelines on the appropriate selection of video game genres in educational settings, based on learners’ individual differences, such as learning styles and personality traits. Their comprehensive guidelines help teachers to match appropriate game genres with learning outcomes and students’ characteristics, and to maximize educational outcomes and motivation on the part of the students. In Chapter 28, Amon and Campbell focus on serious games for health, and explain how video games can be used to address common attention problems such as Attention-Deficit/Hyperactivity Disorder (AD/HD). The authors focus especially on biofeedback technology, and describe a study where biofeedback video games were used to teach children breathing and relaxation techniques, which helped them to reduce common symptoms of AD/HD. In Chapter 29, Linek analyses educational video games through a psychological perspective. She explains how design recommendations can be derived from the field of media psychology, a discipline that explores how psychology can impact on various media, including radio, television or video games. The author provides an overview of the different fields of media psychology that can be exploited for the creation of effective educational video games. Based on her approach, she identifies key design factors and derives guidelines for the design of educational video games in relation to game items, game mechanics, game characters and game narratives. In Chapter 30, Carr and Blanchfield explore how educational video games can be used to engage children with behavioral disorders (e.g., defiant behaviors or attention deficit). They explain how children, who usually find it difficult to maintain their attention in traditional educational settings, found educational video games more engaging. The authors describe the design and assessment of two prototypes of educational games. They share their experience of creating the game, and guide the reader through the difficult exercise of balancing the educational and entertaining features of the game in order to produce an experience that is both highly engaging and didactic. In Chapter 31, Maciuszek and Martens explain how Intelligent Tutoring Systems (ITSs), educational systems designed to tailor learning interventions to learners’ activities and knowledge, can be employed to seamlessly combine game play and learning. They review game-based ITS architectures, and propose a unified structure

partially based on Role-Playing Games (RPGs). In Chapter 32, Perry, Andureu, Cavallaro, Veneman, Carmien, and Keller explain how video games can be effective for neurorehabilitation because they provide motivation and goal-directed exercises and tasks. The authors argue that, for video games to be effectively used for rehabilitation, it is necessary to construct a unified and comprehensive framework that follows user-centered design principles, and that takes into account the needs and viewpoints of all stakeholders. They analyze methods employed in the rehabilitation process, and describe how video games and robotics can be used for rehabilitation. They then identify and outline the requirements for rehabilitation systems, and illustrate them through a prototype they have designed. In Chapter 33, Howel and Veale introduce strategies to facilitate and improve the development and integration of educational video games, and present a process employed in the creation of a video game designed to improve language skills. They describe issues linked to the integration of video games and ITSs, and propose recommendations accordingly. These are partially based on a case study that they carried-out with a serious linguistic casual game called BubbleWords. In Chapter 34 Saridaki and Moulras describe how video games can be successfully employed to motivate students with intellectual disabilities and their educators. They explain the issues and considerations related to teaching students with intellectual disabilities, and emphasize how motivation can play an important role in their learning process, and in changing their attitude towards learning. Based on a thorough literature review and several case studies, the authors show why and how video games can be a powerful educational and motivational medium in Special Educational Needs (SEN) classrooms.

## **Section 5: Curricular Approach to Game-Based Learning: Integrating Video Games in Instructional Settings**

In Chapter 35, Bösche and Kattner report on the transformation of a classical seminar course on the psychological impact of violent video games, into a virtual classroom experience. They explain the shortcomings of traditional methodologies, and how virtual environments can be employed to assess the impact of violence in video games. In Chapter 36, Anderson and Courtney describe an educational intervention, based on video games, to introduce and develop design thinking skills to two groups of Australian indigenous high-school students. The authors explain that mainstream education does not always build positive self-perception and self-esteem of Australian indigenous students, and they argue that video games, because they are “food for the soul” and provide a sense of control, are particularly appropriate for this purpose. In Chapter 37, Rossiou argues that Learning Management Systems (LMSs) are predominantly focused on the administration and management of learning resources, but that they place less emphasis on communication, interactivity and cooperation. She investigates how a web-based educational video game, combined with an LMS, can be used to increase interactivity and engagement in the learning process. Rossiou describes a framework to successfully implement such a system. She depicts the integration of a multiplayer game, in the context of a synchronous virtual classroom, and shows how several technologies were combined to produce a GBL system. In Chapter 38, Williamson and Sandford provide an analysis of the use of computer games in authentic classroom settings. They envisage GBL as the result of specific game-based pedagogies that are being developed and employed by increasing numbers of classroom teachers in UK schools. The chapter focuses on the ways in which classroom teachers discuss and describe GBL in relation to their curricular intentions, and their less formal cultural assumptions about the relevance of gaming in learners’ new media ecologies outside of school. In Chapter 39, Tan, Johnston-Wilder, and Neill describe the deployment and analysis of a GBL



solution at an upper secondary school in the UK, where they conducted a case study on students' perception of the benefits of using a Commercial Off-The-Shelf (COTS) video game to learn about biology. The authors investigate how GBL, combined with a dialogic teaching approach, can support deep learning among students. In Chapter 40, Flynn investigates the use of Commercial Off-The-Shelf (COTS) games in educational settings and assesses the practical challenges inherent to their deployment. He describes the issues associated with choosing a COTS game for teaching, and offers practical recommendations that should help instructors and researchers to identify and select appropriate COTS games, based on factors such as customization (e.g., level editors or Software Development Kit), ease of installation and deployment, and ease of empirical data collection. In Chapter 41, Chib reports on a study that examined the use of an educational interactive game to educate Peruvian youths about sexual and reproductive health. The research design consisted of pre- and post-intervention surveys. The study utilized social cognitive theory to determine the influence of prior knowledge, self-efficacy and game-playing on respondents' attitudes. Chib found that prior attitudes, knowledge, resistance to peer-pressure, and game-playing were significant predictors of attitudes toward sexual health. He also found that health attitudes were influenced by playing video games. In Chapter 42, Srinivasan, Butler-Purry, and Pederesen present their experience of developing an educational game to teach digital systems design to electrical engineering students. They explain how this approach helped to address the limitations of traditional teaching methods, and to consequently increase learning and motivation on the part of the students. This interesting chapter provides an in-depth overview of their journey from obtaining funding, to implementing and assessing the video game. It describes the challenges faced by instructors who plan to use GBL solutions, and it provides highly relevant and valuable guidelines to researchers and educators engaged in similar endeavors. In Chapter 43, Anagnostou and Pappa provide an extensive review of research related to the design and use of GBL solutions for physics education. They explain how learning can occur in video games, based on educational theories and game design (e.g., game mechanics and game genres). Relevant educational theories and game genres are reviewed, and their implications for physics education are analyzed. Based on this review, Anagnostou and Pappa define and describe their framework, which offers a valuable approach for designing effective and engaging video games. The authors also discuss the barriers that impede the widespread adoption of video games for educational purposes, and propose pertinent solutions and guidelines. In Chapter 44, Axe and Routledge share the success stories and lessons learned from the use of serious games, both in formal and informal education. Their goals are to create an increased awareness of GBL among educationalists, and to consequently improve collaboration, engagement and innovation. They explain how attitudes toward the use of video games for education needs to be changed, and emphasize the role of teachers and other educationalists as the key contributors to this change. In Chapter 45, Pappa, Dunwell, Protosaltis, Pannese, Hetzner, De Freitas, and Rebolledo-Mendez focus on GBL for sharing knowledge in the context of intergenerational learning. They explain the challenges of intergenerational learning, and describe how these were addressed by a model that they called e-VITA, which employs a methodology where knowledge creation is envisaged as a spiraling process of interactions between explicit and tacit knowledge. The application of this methodology in the context of the research project e-VITA is discussed, including the implications for pedagogy and game design. In Chapter 46, Akerfeldt and Selander argue that multimodality and didactic design should be considered for a deeper understanding of how information is presented in educational video games. They analyze two educational video games, Rixdax and El Patron, through a semiotic perspective, and they observe how learning goals and the display of on-screen information can be addressed. Their analysis is partially based on Prensky's six structuring factors and

Kress and Van Leeuwen's multimodal framework. These models are used to assess video games in terms of information value, information sequencing, and affordance for meta-reflection on the part of the user. Based on their analysis, the authors provide helpful recommendations for game designers. Despite evidence of the potential of video games for learning purposes, it seems that few law schools have embraced the use of GBL systems, as many of them essentially use traditional teaching methods. In Chapter 47, Lettieri, Fabiani, Tartaglia Polcini, De Chiara, and Scarano present an interesting system called Simulex, an online environment for the creation of Role Playing Games (RPGs) that simulate trials. The authors explain how serious games can match the objective of legal education, and how they can provide a more appropriate and effective approach. They review current technology-enhanced teaching solutions for law education, and explain how their project fits within this context. The chapter includes an interesting description of the different stages involved in the design, creation, testing and assessment of the system. Based on their experience, the authors also give pertinent recommendations for the design of effective legal serious games. In Chapter 48, Shabanah describes how and why video games can be employed to teach data structures and algorithms, two topics often perceived as complex and difficult to understand by students. She explains that many algorithm visualization systems are not satisfactory, partly because they are essentially based on graphics and sound, and not on relevant pedagogical or motivational considerations. She describes how algorithm games, which are based on sound educational theories, have inspired students to learn algorithm through active engagement and intrinsic motivation. She explains the rationale behind the use of algorithm games and their attributes in terms of game design and instructional design. She then depicts the design of several algorithm games prototypes. In Chapter 49, Dai, Daloukas, Rigou, and Sirmakessis discuss issues related to the design and implementation of effective mobile GBL environments, with an emphasis on games developed for Moodle and Open Source systems. The chapter includes an appreciation of the factors that prevent the integration of games in educational settings. The authors describe how they have incorporated video games into Moodle, and made them available on mobile devices using Java2ME. In Chapter 50, Corradini explores how 2D recreational puzzle games can improve basic spatial skills such as tilting, rotating and flipping. The author describes an experiment with students from high schools and universities, where 2D spatial Maths puzzles were employed to improve students' confidence and problem-solving skills. Corradini explains the practical and theoretical considerations underpinning the design of the games used in the study. Results show that the game, which offered many challenges in terms of forward-planning, decision-making and spatial skills, helped users to visualize the problem mentally, and to elaborate a successful strategy. In Chapter 51, Ruben, Immordino, Tromp, and Agnew describe the different approaches to, and critical challenges in, leadership development. They explain how simulations and video games offer a compelling approach because they can be designed to address many dimensions of leadership and integrate the benefits of other instructional approaches. The authors describe LEADER.edu, a scenario-based simulation that is designed to engage participants in strategic leadership learning experiences, using a combination of online access and interactive dialogues and feedback. The authors list, define and explain the theoretical foundations for this software, as well as its structure and content, in terms of pedagogy and interaction. They also provide general recommendations, based on their experience, for those who plan on developing simulation games on a similar topic. In Chapter 52, DaCosta, Nasah, Kinsell, and Seok identify the gaming propensity of 580 post-secondary school students through a survey. Results suggest that age, gender, and socioeconomic status are composite factors that contribute to gaming. The findings have a number of implications for educators, policy-makers, practitioners, researchers, instructional technolo-

gists, and game developers across both the education spectrum and the entertainment industry, for the use and development of video games.

## INTENDED AUDIENCE

This book is intended for all stakeholders closely or remotely involved in financing, designing, deploying and using Game-Based Learning solutions. It includes a wide variety of chapters with both theoretical and practical information. Researchers, lecturers, and students will find in-depth literature reviews, theoretical models, and the description and analysis of relevant experiments. Teachers and instructors interested in deploying GBL solutions will be able to learn from the experience of the authors, use guidelines, and appreciate the organizational, technical, and pedagogical requirements for such environments. Developers will find innovative and effective concepts to improve both the educational and motivational aspects of their games. Policy makers will be able to appreciate the changes needed to facilitate the inclusion of GBL.

Each chapter is written with practicality in mind and dedicated to individuals working in different instructional settings such as primary schools, secondary schools, third-level education, or the industry. Different applications are considered, including maths, physics, law, biology, leadership, or language-learning. Particular attention is paid to users' specificities and differences (e.g., gender, age, disabilities, learning difficulties, learning styles, or personalities).

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