Ahmed Tlili · Maiga Chang
Editors

Data Analytics Approaches in Educational Games and Gamification Systems
Educational games, gamification learning systems and learning analytics are gaining an increasing attention from researchers and educators. The educational games and gamification system can get learners engaged and motivated in the learning process; at meanwhile, learning analytics grants a system the capability of understanding the learners’ needs, assessing learners’ skills and knowledge silently, providing teachers detailed information about their students and warning teachers and administrative personnel to pay attention on the at-risk students. This book covers applications of data analytics approaches and research on human behavior analysis in educational games and gamification systems. In particular, this book discusses the purposes, advantages and limitations of using data analytics approaches in game-based learning environments and applications.

This book talks about the data analytics methods, systems/tools and research for analyzing learners’ actions, profiles, records and behaviors stored or happened in educational games and gamified learning systems. As the research progress rapidly, this book can be an up-to-date textbook and reference book for not only post-secondary and academic, but also can be a handbook for educational technology relevant companies and industry.

This book arranges research based on three themes: learning analytics, academic analytics and learning assessment, and learner modeling and individual differences. Each theme covers three to four latest research results related to the data analytics in educational games and gamification systems. The aim is to provide readers with methodologies, evidences and experiments through these researches and help readers get clear picture of how data analytics approaches can help not only students and teachers but everyone in the world.

First, this book starts with Moon and Kang’s introduction chapter that helps readers get familiar with the subject areas and leads readers to know the importance of data analytics in educational games and gamification research area.

In the second part, four chapters talk about learning analytics in educational games and gamification systems. Moon and Liu in Chap. 2 explore the use of sequential data analytics in game-based learning and major issues while doing so via a systematic literature review. At the end of the chapter, they propose guidelines
for readers to use sequential data analytics properly. Ifenthaler and Gibson then in Chap. 3 bring the concept of challenge-based learning up. They study 8951 students’ transaction data and find the learning engagement is positively related to learning performance. Their finding in fact implies the importance of making a learning system like educational game or gamification system capable of catering for the individual learner’s needs. Shute, Rahimi and Smith, on the other hand, in Chap. 4 discuss the learning supports and their influences in educational game and present a usability study’s of designing and developing stealth assessment in an educational game named Physics Playground. At the end of the chapter, they provide insights of the future of using learning analytics in the games for stealth assessment. In the end of this part in Chap. 5, Montaño, Mondragón, Tobar-Muñoz and Orozco create a gamified platform called HERA. In HERA, students participate in gamified activities that are part of assessment and teachers can know their students via learning traces analysis.

The third part of the book is about the academic analytics and learning assessment in educational games and gamifications. This part also has four chapters. Denden and colleagues in Chap. 6 present an iMoodle that is an intelligent gamified Moodle. iMoodle has a built-in learning analytics plug-in that can provide teachers dashboard for teachers to control the learning process and an early warning system for predicting at-risk students. Their finding shows that iMoodle has a high accuracy rate which is almost 90%. Seaton, Chang and Graf also propose the use of dashboard in an educational game called OMEGA (Online Metacognitive Educational Game with Analytics) in Chap. 7. The dashboard can help players see how their performance and skills change over time and what are their weakness and strengths. With the dashboard, players can see their gameplay performance and habits and find the clues and strategies to improve their in-game performance. As the goal of educational games is to allow players to learn unconsciously while playing and playing educational games more and frequently players should learn more or have their skill better, the dashboard can avoid the players quitting from the gameplay due to stuck in the game and cannot get further progress. In Chap. 8, Chadli, Tranvouez and Bendella are also putting their focus on metacognitive skill, in particularly, problem-solving skill. They not only investigate the improvements of second-grade students’ word problem-solving skills with educational game’s help, but also propose a competency model to measure student’s knowledge levels. At the end of this part, Zheng, Cheng, Chew and Chen in Chap. 9 try to improve game-playing process with additional software and sensors. The game collects students’ interaction data and provides instantaneous feedbacks for the students.

The fourth part of this book aims to learner modeling and individual difference finding. This part includes three chapters. Manske, Werneburg and Hoppe first in Chap. 10 propose a framework for designing and evaluating game-based computational thinking environment named ctGameStudio. The proposed framework uses learning analytics to provide the learners’ dynamic guidance, scaffolds and feedback properly according to their actual state. Then, Luis Flores, Silverio, Feria and Cariaga in Chap. 11 present a learning analytics model that can measure students’ motivation within an educational game, Fraction Hero, based on their in-game data.
The model assesses three motivational factors include goal orientation, effort regulation and self-efficacy. They also find that students have higher in-game motivation than self-perceived motivation toward solving problems. At the end of this part, Chap. 12 organizes and clarifies gamification concepts according to seven properties: personal, functional, psychological, temporal, playful, implementable and evaluative, through a user-centered approach done by Klock, Gasparini and Pimenta.

Finally, the last conclusion chapter is written by Tlili, Chang, Huang and Chang. The chapter summarizes all the presented chapters and also discusses correspondent challenges and future insights while adopting data analytics in educational games and gamification systems.

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