Metadata of the chapter that will be visualized in SpringerLink

Book Title	Empowering Learners for Life in the Digital Age	
Series Title		
Chapter Title	Students' Conducts During a Digital Game-Based Museum School Visit	
Copyright Year	2019	
Copyright HolderName	IFIP International Federation for Information Processing	
Corresponding Author	Family Name	**Sanchez**
	Particle	
	Given Name	**Eric**
	Prefix	
	Suffix	
	Role	
	Division	CERF
	Organization	University of Fribourg
	Address	Fribourg, Switzerland
	Email	eric.sanchez@unifr.ch
Author	Family Name	**Paukovics**
	Particle	
	Given Name	**Elsa**
	Prefix	
	Suffix	
	Role	
	Division	CERF
	Organization	University of Fribourg
	Address	Fribourg, Switzerland
	Email	elsa.paukovics@unifr.ch
Author	Family Name	**Müller**
	Particle	
	Given Name	**Sylvia**
	Prefix	
	Suffix	
	Role	
	Division	
	Organization	HEP Valais
	Address	Saint-Maurice, Switzerland
	Email	sylvia.mueller@hepvs.ch
Author	Family Name	**Kramar**
	Particle	
	Given Name	**Nicolas**
	Prefix	
	Suffix	

	Role	
	Division	
	Organization	Musée de la Nature
	Address	Sion, Switzerland
	Email	Nicolas.Kramar@admin.vs.ch
Author	Family Name	**Widmer**
	Particle	
	Given Name	**Antoine**
	Prefix	
	Suffix	
	Role	
	Division	
	Organization	HES-SO Valais-Wallis
	Address	Sion, Switzerland
	Email	antoine.widmer@hevs.ch

Abstract

This paper deals with a preliminary empirical study carried out during a museum school visit. The study aims to understand the influence of a game on students' conduct in the museum. We address the use of digital games for personalising experiences in museums and for fostering visitors' interactions with the museum exhibition. The paper describes the design-based methodology and the collaborative design and testing of a digital game dedicated to help young museum visitors address the consequences of their relationships with nature and to understand the concept of anthropocene. Students were videotaped and the data collected enabled the identification of different conducts and situations depending on the gameplay performed by students.

Keywords (separated by '-')

Gamification - Game-based learning - Museum school visit - Anthropocene - Nature Museum

Students' Conducts During a Digital Game-Based Museum School Visit

Eric Sanchez[1(✉)], Elsa Paukovics[1], Sylvia Müller[2], Nicolas Kramar[3], and Antoine Widmer[4]

[1] CERF, University of Fribourg, Fribourg, Switzerland
{eric.sanchez, elsa.paukovics}@unifr.ch
[2] HEP Valais, Saint-Maurice, Switzerland
sylvia.mueller@hepvs.ch
[3] Musée de la Nature, Sion, Switzerland
Nicolas.Kramar@admin.vs.ch
[4] HES-SO Valais-Wallis, Sion, Switzerland
antoine.widmer@hevs.ch

Abstract. This paper deals with a preliminary empirical study carried out during a museum school visit. The study aims to understand the influence of a game on students' conduct in the museum. We address the use of digital games for personalising experiences in museums and for fostering visitors' interactions with the museum exhibition. The paper describes the design-based methodology and the collaborative design and testing of a digital game dedicated to help young museum visitors address the consequences of their relationships with nature and to understand the concept of anthropocene. Students were videotaped and the data collected enabled the identification of different conducts and situations depending on the gameplay performed by students.

AQ1

AQ2

Keywords: Gamification · Game-based learning · Museum school visit · Anthropocene · Nature Museum

1 Introduction

To educate visitors about the concept of anthropocene, a new relationship with nature and a global human impact of human behaviour, the Nature Museum of Valais (Switzerland) is seeking innovative approaches to offering young visitors engaging experiences and meaningful encounters with the museum's collections and exhibitions. Within this context, the PLAY Project addresses a specific question: how can we link conceptual knowledge with embodied and gameful experiences in the museum space?

This paper aims to describe how this issue has been collaboratively addressed by researchers and the staff museum. Different game-based approaches have already been proposed for the use of digital technology as a means for personalising experiences in museums. For the PLAY project, we applied *ludicisation* to convert the museum visit into a gameful experience dedicated to help secondary school students to re-think their relationships with nature.

Published by Springer Nature Switzerland AG 2019
D. Passey et al. (Eds.): OCCE 2018, IFIP AICT 524, pp. 1–10, 2019.
https://doi.org/10.1007/978-3-030-23513-0_15

In the following sections, we describe the first iteration of the project. We also discuss the preliminary results of an empirical work carried out in the museum with 3 classes of secondary school students. These results deal with students' behaviours and students' interactions with the museum collection and also with the digital technology, peers and the museum staff. In the first section, we present the context, the concept of *ludicisation* for museums and the research objectives. A second section is dedicated to describe the methodology of the study and *Pearl Arbor*, a game dedicated to help young museum visitors to address the consequences of their relationships with nature and to understand the concept of anthropocene. In the last section, we discuss the results and the lessons learned from this study.

2 Museum Exhibition Ludicised

2.1 Understanding Human Relationships with Nature During a School Visit

The Nature Museum of Valais (Switzerland) is a natural history museum which gives a broad space to the topic of the relationship between man and its environment. In particular, since 2013, anthropocene has been the backbone of many of its activities offered to the public. As a result, since 2014, a room is dedicated to present the concept of anthropocene. The room concludes the museum path of the permanent exhibition, which is mainly based on anthropological knowledge presenting evolution during the time period covering the relationship between humankind and its environment.

The concept of anthropocene expresses the idea that humankind has become a geological force with direct and strong effects on geochemical cycles and on biodiversity [1, 2]. More precisely, the name anthropocene refers to the international chronostratigraphic chart also named geological timescale. Currently, there is a controversy to make anthropocene a new official geological period and there is strong debate on this in the scientific community.

Despite its controversial nature, anthropocene has been considered in the Nature Museum of Valais to have great potential for many reasons in both communication and science education. In terms of communication, the concept is more and more used in the media and, as a result, more and more known by a large audience. In terms of science education, it first offers the opportunity to present an overview on all ecological problems and to focus not only on climate change, that is certainly serious, but is definitely not the only problem.

From a school curriculum point of view, anthropocene enables perspectives on the borders of school disciplines. As it deals with topics like history, geography, anthropology and philosophy, anthropocene is not limited to the natural sciences. Anthropocene is a new idea, but is not a single and well-defined concept and many discourses are proposed. The project developed by the Museum can be affiliated on what is called "the bad Anthropocene" which does not mean that the vision is purely pessimistic but basically means that the concept has a strong cultural dimension. From this point of view, basic anthropological and philosophical topics are questioned, because the anthropological ascertainments are not limited to population overgrowing or bad use of

technology. It also has cultural dimensions; for instance, the myths and stories that societies have about their relation with nature or the classical modern ontology making a strong difference between nature and culture. Those cultural dimensions are contingent to space and time and must also be addressed.

Anthropocene is not mentioned in the Romand Swiss Secondary School Curriculum. However, in this official document, this concept precisely relates to the first sentence of the introductory text for social sciences and humanities: "Discovering cultures and ways of thinking through space and time; identifying and analysing the system of relationship that join each person and each social group to the world and the other". By combining diverse knowledge from disciplines as different as the physical, natural sciences, engineering, social sciences and humanities, anthropocene is a great opportunity for combining knowledge from many school disciplines and addresses both multi-disciplinarity and complexity. However, for secondary school students, addressing anthropocene is a big challenge and specific educational strategies might help. Thus, we decided to use digital learning technologies to implement a *ludicised* learning scenario for school visits.

2.2 Ludicisation of School Visits

Museums are considered ideal environments for experimenting with learning technologies [3], and, recently, a multitude of game-based programs have been designed for different media, platforms, and visitor types. Current approaches entail the use of mobile devices, guiding families' explorations of collections through treasure hunting and mystery solving [4, 5] or tasks that scaffold students' problem-solving across school and museum contexts [6–8]. In designing learning games that both engage and support inquiry across school and museum contexts, mobile social media, 'smartphone' technologies, and ubiquitous Internet access have been pivotal developments [9, 10]. However, technology is not an objective per se and experts agree on the need to increasingly focus on personalising experiences in museums [11].

Given this context, *ludicisation* [12] may offer an opportunity for designing game-like experiences for museum school visits. *Ludicisation* is now proposed as an alternative concept to gamification. Indeed, initial definitions of gamification are focused on the use of game elements and game mechanics for non-game contexts. Since no specific elements belong to games [13], recent definitions describe gamification in more psychological terms. Gamification is grounded on motivational affordances, the actionable properties between an object and an actor [14] and gamefulness or 'gameful experience', the experiential condition that is unique to games [13]. The concept of *ludicisation* is a new step forward to recognise the subjective and performative nature of play. The suffix –icisation emphasises that it is not possible to "make" the game, as suggested by the suffix "-fication" (facere) of gamification, but mainly, that it is possible to *change* the meaning of an ordinary situation with the implementation of affordances grounded in game-design principles, to foster gamefulness [12] and to personalise experiences.

2.3 Research Objectives

By using *ludicisation* techniques, we expect to foster students' engagement into meaningful encounters with the museum's collections and exhibitions. We expect that *ludicisation* will enrich students' experience in the museum. We also expect that the students will take advantage of this experience by developing knowledge related to the concept of anthropocene and their relationships with nature. This paper deals with a preliminary study based on the experimentation of the very first version of the game. It focuses on students' behaviour in the museum when they play the game and we address two main research questions:

1. Does *ludicisation* foster new types of encounters with the museum's collections and exhibitions? How do we foster students' interactions that help them to identify their relationships with nature and to rethink these relationships?
2. Which element, or which methods, should be taken into account for the l*udicisation* of a museum school visit?

For the first question, we examine students' behaviours and hypothesise that a specific gameplay should have specific consequences on students' behaviours and knowledge in terms of:

a. interactions with the museum's collections and exhibitions;
b. interactions with peers, teachers and museum staff;
c. self-identification of their relationships with nature.

For the second question, we want to elaborate on concrete experiences gained through the concrete implementation of *ludicisation*.

3 A Design-Based Research Project

3.1 A Collaborative, Iterative and Contributive Methodology

The study is grounded on a design-based research methodology (DBR) [15] and strong collaboration between researchers and practitioners [16]. Design-based research (DBR) consists of conducting an iterative process [17] dedicated to game design, taking advantage of the museums as educational resources [18]. This design process is combined with the analysis of the data collected during experimentations carried out collaboratively by researchers and practitioners (museum educators and software engineers) in naturalistic contexts (museums) [19]. Thus, DBR aims to address theoretical issues with targeted research based on interaction design with digital artifacts and empirical studies performed in naturalistic contexts [16].

The methodology used in this project can be described based on the five following characteristics of DBR [15]:

– *Contributive*: Practice is considered to be a condition but also a means for carrying out research [20]. A game (called *Pearl Arbor*) has been designed during a one-week workshop organised in the Museum. Four Master-level students participated in the workshop in 2015. In 2016, one of the Master-level students was hired for the

writing of the final version of the specifications of the game. In 2017, the first version of the game was developed by students from a Swiss computer science vocational school.

- *Collaborative*: For the design of the game, the Master-level students were assisted by 2 researchers (scholars in game-based learning and museums). During the one-week workshop, specific meetings, focus groups or interviews were organised with stakeholders: the director of the museum, museum visitors, museum educators and other museum staff. The design of the game was grounded on Agile [21] and user-centred [22] methodologies and thus used a collaborative process aimed at designing visitors' personalised experiences adapted to the museum's objectives.
- *Iterative*: the design of the game and the scenario were iterative. The preliminary version designed by the Master-level students was modified. Some changes were made to the writing of the specifications and new changes were decided during a workshop organised after a first experiment in the museum. The design of the game and the scenario resulted from several steps that combined design and analysis for flexible design revisions.
- *Experimentation in naturalistic contexts* [19] was enabled by the participation of museum staff for the whole process. DBR considered the complexity of the studied context without restricting it to a few variables only [23]. Three experimentations were carried out in the museum with the presence of the researchers, the software engineer and the museum staff.
- *Diffusion of the results*: The theoretical issues and the gameplay tended to be communicated through papers and presentations to the scientific community and practitioners. Informal learning contexts of museum needed to be documented to raise and improve existing practices [18]. All the participants in the project were involved in the writing of this paper.

In the following sub-section, we describe the game designed by the Master-level students and re-engineered during the writing of the specifications and the software development.

3.2 Pearl Arbor, a Metaphor of Relationships with Nature

Pearl Arbor is a mobile game accessible on digital tablets. Using augmented reality (AR), the game is playable by teams of students. The game encompasses two parts, representing a shift of relationship with nature. In the first part, players are asked to virtually capture animals using AR. They try to gain as many points as possible. The museum has a large collection of stuffed animals. For this first part of the game, each player can point the camera to a stuffed animal. The mobile application (app) recognises the animal and asks the player what she wants to do. At this stage, the player can choose if she wants to domesticate the animal using a finite stock of food or tools or if she wants to capture the animal through a combat with an animal from her collection already captured. The outcome of the combat is based on statistics, computing the chance of winning depending on the kinds of animal faced during the battle. For example, a bear has a better chance to win against an ermine than the opposite. If the battle is won, the animal is captured and placed in the player collection and can be used

in future combats. Each time an animal is domesticated or captured, a collective life gauge representing the amount of natural resources is lowered. This gauge starts at 100%. It is visible on all mobile apps. When the life gauge is close to 0, the first part of the game ends. Then, a short debriefing session is conducted by the museum educator. Players are made aware that the game ended due to the lack of natural resources that was collectively lowered by players when they captured animals.

The second part of the game leads players to better understand nature by answering a set of multiple choice questions (MCQs) to collectively set the nature resources back to normal. The set of MCQs is based on pieces of information available in the museum exhibition. One good answer increases the life gauge of a few points and one bad answer has no effect on the life gauge. When all players have answered the set of questions, they get information about the level of the final life gauge.

The two parts of the game are a metaphor of a shift of our relationships with nature and the consequences of this shift on the sustainability of natural resources. We expect that the game will help students to get an embodied experience of these relationships through gameplay. After the end of the game, the students are grouped in the main room of the Museum. This final step consists of a debriefing session conducted by a museum educator. The objective of the debriefing session is to deconstruct the metaphor and to make the knowledge explicit. The discussion is based on the experience that the students get through the game. It offers the opportunity to introduce core ideas in which the concept of anthropocene is grounded.

3.3 First Experimentation and Data Collected

During autumn 2017, three experimentations were carried out with 3 classes of secondary school students. The whole scenario encompasses different phases: (1) explanations about the museum, security rules and objectives of the game; (2) the first part of the game played by the students; (3) a debriefing session and explanation of the second part of the game; (4) the second part of the game played by the students; and (5) the final debriefing session. The whole scenario was orchestrated by the museum staff according to the decision previously taken by the team.

Three categories of data were collected:

- Notes taken during the workshop dedicated to discussing the first experimentation of the game. Different stakeholders participated in the workshop: researchers (scholars in game-based learning and science education, and a PhD student) and practitioners (2 museum educators, the museum director and a computer scientist). The workshop took the form of a focus group, where the knowledge gained by the different participants through the participation in the experimentation were gathered and discussed. The discussion occurred at two levels that formed a praxeology [20]: practice (What was done? What should be done in the future in order to increase the visitor experience and learning?); and theory (How can we understand what was observed? What did we learn from the experiment conducted in the Museum?).
- Field notes taken about students' behaviours and specific events.
- Videotaping of the students with 3 digital cameras (2 fixed and 1 mobile).

The videos were analysed with HyperRESEARCH, a software which enables tagging of specific events. Specific attention was paid to students' conduct during the school visit. A preliminary analysis consisted of the identification of students' conduct during the visit for one selected class. Three variables were used to describe a students' conduct. The first variable was the spatial distribution of students for a given team. Are they grouped? Are they separated from each other and do they act individually? The second and third variables were the terms that described an action performed in the museum. Do they take a picture of an animal? Do they interact with peers? Do they interact with the museum exhibition? The terms are a verb ("to take", "to discuss with") and direct or indirect objects of the performed action ("a picture", "with peers"). Students' conducts enabled researchers to define different situations with different values regarding what we can learn from the museum visit.

4 Students' Conduct and Lessons Learned

4.1 Students' Behaviours and Interactions

The analysis of the video recorded for one class of students enabled researchers to identify 13 different situations for the first part of the game and 18 for the second part. The situations differred according to the spatial distribution of students and the performed action. This preliminary result might not be exhaustive. However, it shows the large diversity of situations permitted by the game in the museum.

Table 1. Different categories of interactions observed for the same class (one camera)

Part of the game	Interaction with…							
	Peers only		Museum		Tablet (picture)		Tablet (questions)	
	P1	P2	P1	P2	P1	P2	P1	P2
Individual	0	0	1	2	0	0	0	0
Individual + museum educator	0	0	0	0	1	0	0	0
Team	0	1	1	4	4	0	0	3
Team + museum educator	0	1	0	1	2	0	0	2

Table 1 summarises the observations performed with the videos recorded for one class and information is given in terms of students' interactions. Interactions are categorised depending on the spatial organisation of students (individual, group, with or without the museum educator) and depending on what they interact with (digital tablet or museum exhibition). The numbers from Table 1 indicate how many times a situation was enabled for a given type of interaction. These preliminary results are too limited to be conclusive. However, they tend to show that interactions are different for the 2 parts of the game. During part one, the majority of the situations observed and reported

concern students who mainly interact with the digital tablet. For the second part of the game, we observed a majority of situations where the students interact with the museum exhibition. These results are coherent with the hypothesis of our project. Different gameplays should enable different types of interactions and *ludicisation* makes possible the influencing of attitude and/or behaviour by implementing motivational affordances [13]. Indeed, the results are also coherent with the game metaphor: a shift from relationships based on the exploitation of natural resources for part 1 (the students take as many photographs as possible without really paying attention to the museum exhibition), to a novel way of interacting with nature based on the understanding of the museum exhibition for part 2 (the students try to get information for being able to answer questions and to get points).

Data analysis was continued and these results tended to be confirmed by a more systematic and larger analysis and data collected by all cameras. During phase 1, a group of students (Gr. 1) was mainly involved in taking pictures or other interactions with the tablet (n = 17) and direct interactions with the exhibition were limited (n = 2).

4.2 Lessons Learned from the Focus Group

The focus group that was held after the experiment was carried out in the museum enabled the collection of data from the different participants to the project that were useful to address game-based informal learning issues. These issues are:

- *The roles of museum educators during the school visit*. For game based learning, debriefing has already been recognised as a crucial step regarding metacognition [24]. This issue was already taken into account for the first iteration of the project with two debriefing sessions that took place after the 2 parts of the game. However, we learnt that the debriefing should be grounded in the data collected when the students play. Depending on their behaviour in the museum, depending on the success or errors that they make when they answer questions, a specific approach should be followed by the museum educator. Thus, we plan to offer the museum educator the opportunity to visualise data that might be useful. We also learnt that the role of the museum educator was not limited to the debriefing session. The way she introduced the game to the students was also crucial. We decided to call this introductory part "constructing the metaphor". It consisted of offering the students the opportunity to understand the game narrative and to give a different meaning to the school visit by identifying themselves as autonomous actors.
- *The roles of teachers during the school visit.* It has been underlined that the role of the teachers should be clarified. Indeed, it was observed that, depending on the class, the teachers were inactive and appeared not concerned by the school visit (the responsibility was transferred to the museum educator) or, in contrast, were active and participated in the tutoring of students and in the debriefing sessions. It was also mentioned that active teachers faced difficulties for participating due to their lack of knowledge about the game. *Ludicisation* needs to be orchestrated and, for the next steps, we will explore two possibilities: (1) the teacher will act as a game-master and will get specific responsibilities; and (2) the teacher will be a player with a specific

role within the game. In order to address this issue, we also plan to involve voluntary teachers in the research team.

– *The design of the game.* The game-based museum school visit was to an extent recognised to be a success in terms of students' behaviours and students' engagement. However, a lot has still to be done in terms of learning content. The limited number of questions that are not totally adapted to the students' school level did not enable the learning objectives to be fully addressed. In addition, it was mentioned that the feedback was not totally clear and, for the students, it was difficult to link the decisions that they took to the consequences in the game. The game design was complex. It did not only consist of integrating learning content with game mechanics. The design of a good metaphor of the learning content and the design of motivational affordances is important for fostering desired behaviour and learning.

5 Conclusion

Implementing *ludicisation* for a museum school visit does not only consist of creating a game. It is essential to address the complexity of the context by designing a scenario where the game is important but also only one element among many other elements that should be taken into account. In particular, the roles taken by the museum educators and the teachers are crucial. In addition, the learner should be taken into account and his lusory attitude [25] fostered with motivational affordances. *Ludicisation* can be seen as managing players' behaviours and designing epistemic interactions.

This issue can be addressed by design-based research. The collaborative design enables gathering of the needed expertise from different stakeholders. Experimentation in naturalistic contexts and collecting data make it possible to learn from concrete field experiments and to envisage a new iteration enabling improvement of the existing scenario. Thus, the design of the innovative scenario and the digital artefact become a means for carrying out education research.

References

1. Steffen, W., et al.: Planetary boundaries: guiding human development on a changing planet. Science **347**(6223), 736–746 (2015)
2. Waters, C.N., et al.: The anthropocene is functionally and stratigraphically distinct from the Holocene. Science **351**(6269), 137–148 (2016)
3. Pierroux, P., Bannon, L., Kaptelinin, V., Walker, K., Hall, T., Stuedahl, D.: MUSTEL: framing the design of technology-enhanced learning activities for museum visitors. In: Trant, J., Bearman, D. (eds.) Toronto: Archives & Museum Informatics (2007). http://www.archimuse.com/ichim07/papers/pierroux/pierroux.html
4. Cabrera, J., Mu, H., Frutos, H., Stoica, A., Avouris, N., Liveri, K.: Mystery in the museum: collaborative learning activities using handheld devices. In: Tscheligi, M., Bernhaupt, R., Mihalic, K. (eds.) Proceedings of the 7th International Conference on Human Computer Interaction with Mobile Devices & Services, Salzburg, Austria, pp. 315–318 (2005)

5. Dini, R., Paternò, F., Santoro, C.: An environment to support multi-user interaction and cooperation for improving museum visits through games. In: Cheok, A.D. (ed.) Proceedings of the 9th International Conference on Human Computer Interaction with Mobile Devices and Services, Singapore, pp. 515–521 (2007)
6. Bakken, S.M., Pierroux, P.: Framing a topic: mobile video tasks in museum learning. Learn. Cult. Soc. Interact. **5**, 54–65 (2015)
7. Charitonos, K., Blake, C., Scanlon, E., Jones, A.: Museum learning via social and mobile technologies: (how) can online interactions enhance the visitor experience? Br. J. Educ. Technol. **43**(3), 802–819 (2012)
8. Pierroux, P., Krange, I., Sem, I.: Bridging contexts and interpretations: mobile blogging on art museum field trips. J. Media Commun. Res. **50**, 25–44 (2011)
9. Tallon, L., Walker, K. (eds.): Digital Technologies and the Museum Experience, Handheld Guides and Other Media. Altamira Press, Plymouth (2008)
10. Wishart, J., Triggs, P.: MuseumScouts: exploring how schools, museums and interactive technologies can work together to support learning. Comput. Educ. **54**, 669–678 (2010)
11. Freeman, A., Becker, S.A., Cummins, M., McKelroy, E., Giesinger, C., Yuhnke, B.: NMC Horizon Report, Museum edn. Horizon, Austin (2016)
12. Sanchez, E., Young, S., Jouneau-Sion, C.: Classcraft: from gamification to ludicization of classroom management. Educ. Inf. Technol. **20**(2), 497–513 (2016)
13. Huotari, K., Hamari, J.: A definition for gamification: anchoring gamification in the service marketing literature. Electron. Mark. **27**, 21–31 (2017)
14. Gibson, J.: The theory of affordances. In: Shaw, R., Bransford, J. (eds.) Perceiving, Acting, and Knowing: Toward an Ecological Psychology. Erlbaum Associates, Hillsdale (1977)
15. The Design-Based Research Collective: Design-based research: an emerging paradigm for educational inquiry. Educ. Res. **32**(1), 5–8 (2003)
16. Wang, F., Hannafin, M.J.: Design-based research and technology-enhanced learning environments. Educ. Technol. Res. Dev. **53**(4), 5–23 (2005)
17. Anderson, T., Shattuck, J.: Design-based research: a decade of progress in education research? Educ. Res. **41**(1), 16–25 (2012)
18. Reisman, M.: Using design-based research in informal environments. J. Mus. Educ. **33**(2), 175–185 (2008)
19. Cobb, P.: Supporting the improvement of learning and teaching in social and institutional context. In: Carver, S., Klahr, D. (eds.) Cognition and Instruction: 25 Years of Progress, pp. 455–478. Lawrence Erlbaum Associates, Mahwah (2001)
20. Sanchez, E., Monod-Ansaldi, R., Vincent, C., Safadi, S.: A praxeological perspective for the design and implementation of a digital role-play game. Educ. Inf. Technol. **22**(6), 2805–2824 (2017)
21. Highsmith, J.: Agile Software Development Ecosystems. Addison-Wesley Professional, Boston (2002)
22. Norman, D., Draper, S.: User Centered System Design: New Perspectives in Human-Computer Interaction. Lawrence Erlbaum Associates, Hillsdale (1986)
23. O'Donnell, A.M.: A commentary on design research. Educ. Psychol. **39**(4), 255–260 (2004)
24. Garris, R., Ahlers, R., Driskell, J.E.: Games, motivation, and learning: a research and practice model. Simul. Gaming **33**(4), 441–467 (2002)
25. Henriot, J.: Le jeu. Presses Universitaires de France, Paris (1969)

Author Query Form

Book ID : **481033_1_En**

Chapter No : **15**

Please ensure you fill out your response to the queries raised below and return this form along with your corrections.

Dear Author,
During the process of typesetting your chapter, the following queries have arisen. Please check your typeset proof carefully against the queries listed below and mark the necessary changes either directly on the proof/online grid or in the 'Author's response' area provided below

Query Refs.	Details Required	Author's Response
AQ1	This is to inform you that corresponding author has been identified as per the information available in the Copyright form.	
AQ2	As Per Springer style, both city and country names must be present in the affiliations. Accordingly, we have inserted the city and country names in affiliations. Please check and confirm if the inserted city and country names are correct. If not, please provide us with the correct city and country names.	