Teaching through games
Get learning back into the game

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ASSOCIATION NATIONALE
RECHERCHE TECHNOLOGIE

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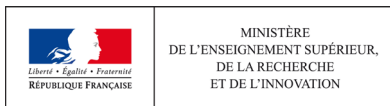COLLECTIVE**

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DE L'ENSEIGNEMENT SUPÉRIEUR,
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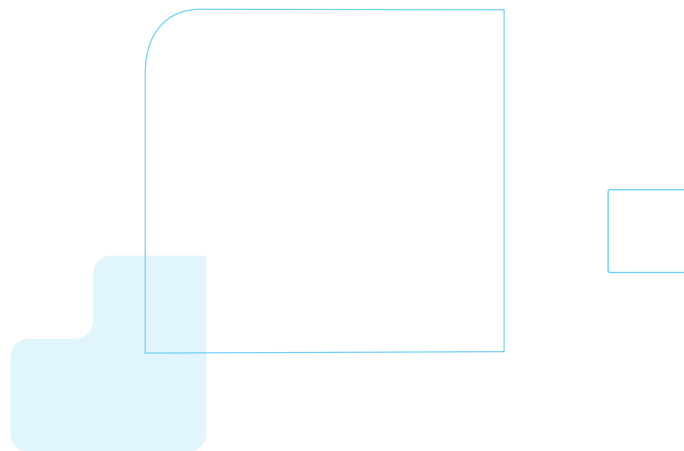
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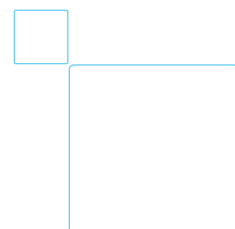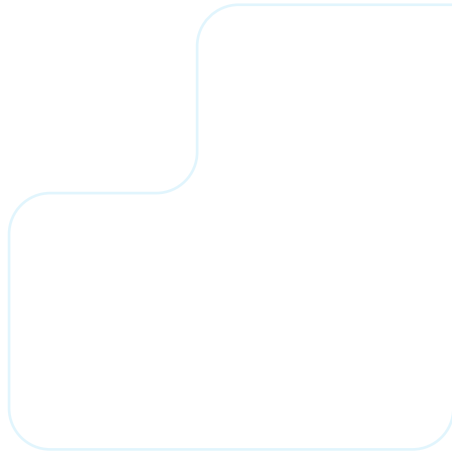
INTRODUCTORY NOTE

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This report describes the work undertaken by the ANRT working group on "teaching through games". The group is chaired by Hélène Michel, professor at the Grenoble School of Management, and gathers 57 business leaders, researchers and institutional figures from 33 ANRT member organizations[1].

The group met seven times from October 2018 to July 2019. Its work was based on six focus areas defined by Hélène Michel. For each of these areas, members of the group described their experiences and expressed their vision, expertise, interrogations and recommendations. Starting with these unique, real-life situations, the objective was to draw up a state of the art, identify expectations, and determine concrete measures for advancing teaching practices by developing and integrating games. This report presents this series of different cases. It describes experiences that are in themselves capable of generating lessons. Beyond that, this methodological approach makes it possible to take the specific features of each account and identify bridges between them, pinpoint similar characteristics (e.g. challenges, means of engagement, difficulties encountered by the actors, etc.) and extract elements of analysis to establish an overall picture shared by all members of the working group.

In addition, extracts from interviews with different actors in the field[2] and articles published in the press and on the internet have been used to enrich the analysis.

ANRT and the working group chairwoman would like to thank all of the people who directly or indirectly contributed their expertise, time and support to put together this project.
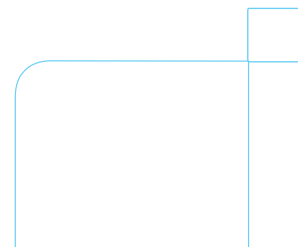
SOMMAIRE

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EXECUTIVE SUMMARY

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Following their long exclusion from the educational system and business sphere, educational games have recently made an entrance into these institutions. While difficult to grasp using a statistical approach, a wide range of games is available in terms of media (Lego®, board games, card games, video games, etc.) and content (simulation, strategic, expressive and cooperative games, etc.). What, though, does the use of games contribute to the learning process? What are the challenges involved? To attempt to answer these questions, ANRT set up a working group on teaching through games. The group features business leaders and researchers specializing in digital sciences, pedagogy, and innovation management. This FutuRIS Cahier sets out to compare their viewpoints and analyse their experiences, their ways of doing things, and their impacts.

FUN, INTERACTIVE TOOLS SPURRING MOTIVATION AND PLEASURE

To stimulate motivation among learners, teachers increasingly make use of games. And for good reason. Provided they are part of a full set of pedagogical tools, are allotted sufficient time, and follow clear rules, recreational devices "capture players' attention, take hold of their bodies and win their support, while giving them pleasure"[3]. Challenges and compensations can be valuable incentives. They drive emotions and allow players to move out of their "comfort zone". Yet that is not enough to be effective. It all depends on collective work. The interactions between learners and teachers are what anchor newly acquired knowledge. Teaching through play is thus a reflexive, collective practice orchestrated by a gamemaster.

TRANSMISSION OF TRANSVERSAL SKILLS

In general, games are used in schools and business environments in the form of project-based learning. This approach fosters the transmission of knowledge and cognitive faculties that are often neglected by a traditional teaching approach, for example team work, creativity, free individual expression, autonomy and adaptability. To guarantee the success of their action, gamemasters must, on the one hand, translate complex notions by simplifying them without distorting them. The main aim is to make knowledge more attractive by bringing it closer to the learners' personal culture. On the other hand, gamemasters need to devise and coordinate a teaching sequence that respects the three phases required for assimilating knowledge, i.e. set-up, practice and debriefing.

THE SHIFT FROM ONE WORLD TO ANOTHER

The use of educational games in schools and universities is up to teachers. Their conduct is motivated by their enthusiasm, attachment and interest in active teaching methods. For the most part, these teachers have a game culture resulting from a personal interest in playing games during their own leisure time. This practice equips them with expert skills, justifying the use of games with learners,

3- Jean-Marc Leveratto (2000), *La mesure de l'art. Sociologie de la qualité artistique,* La Dispute, p. 10-11.

11

colleagues and parents. Nevertheless, their initiative comes up against resistance. To counteract this, gameplayers must demonstrate their technical skills, reassure and convince that games are effective. Thus, sociotechnical support is necessary to facilitate their adoption by users. However, if deep-seated change is to take place, institutional support is indispensable, partly to ensure that the personal competencies of teachers are professionally recognized and partly to raise awareness of the value of pedagogical innovations and their transfer to the commercial sphere.

TRANSFORMATION OF EDUCATIONAL PRACTICES

Establishing education through games requires schools and companies to transform their training framework. Four modifications can be observed:

- **Creation of totally new experiences:** the teaching programme no longer features just the official syllabus. Teachers use it to bring learners a totally new experience that is adapted to their needs.

- **Modernisation of premises and teaching material:** updating premises and purchasing new material can in some cases represent a significant investment. This financial issue can be a hindrance for teachers. It means seeking subsidies and requires support from institutions.

- **Establishment of a partner network:** producing educational games is not the work of one individual. It requires mobilising a network of partners.

- **Creation of new services:** developing games in the education system goes hand in hand with a proliferation of new services and the creation of areas of sociability.

LARGE-SCALE DEVELOPMENT OF INNOVATIVE INITIATIVES

Developing educational games on a larger scale means setting up instruments to measure the return on investment and expectations, establishing a financial model, and defining the commercialization contexts and dissemination channels. Tools proposed by public authorities and public-private partnerships offer technical, human and financial means to bring educational innovations to maturity and commercialize them.

PROFESSIONALIZATION OF GAMING CAREERS AND EMERGENCE OF THIRD PLACES

Education through games calls for gamemasters with multiple skills who are capable of teaching, facilitating, organizing and managing. Jobs involving gaming are clearly undergoing a professionalization process. It is difficult to define the content of these emerging "occupations"[4]. They combine personal engagement, knowledge about games, financial skills, and competencies to manage groups and organize projects. To stabilize these professions, universities are organizing themselves to set up courses resulting in a diploma, thus contributing to the recognition of new competencies in this field. Lastly, the emergence of third places dedicated to designing games responds to the expectations of actors with different backgrounds and experiences. These individuals are keen to meet with professionals who share their ambition and passion.

4- According to the interactionist approach to professions described by the sociologist Everett C. Hughes (1984), *The Sociological Eye: selected papers*, Routledge. Hughes claims that "occupations" attempt to become professionalized as soon as possible.

RECOMMENDATIONS

Eleven recommendations have been formulated by the members of the ANRT working group. Aimed at schools, universities, companies and public authorities, they are devised to respond to the current developments taking place:

In schools and universities

1 Establish a list of the knowledge and transversal skills to acquire as part of education on emerging professions in the gaming sector.

2 Create a module on training to educate through games in the permanent syllabus of the teaching profession, from primary schools to university.

3 Recognize, when evaluating teachers, that the creation of an educational game is an intellectual contribution.

4 Offer courses on the value of educational games to teachers and knowledge transfer firms (e.g. SATTs: technology transfer acceleration companies).

In companies

5 Develop partnerships with higher education establishments to facilitate the promotion of games produced by public laboratories.

6 Increase the recruitment of Cifre doctoral students on topics related to educational games (e.g. on the issue of developing "proof of efficacy").

7 Encourage entrepreneurs to seek accompaniment throughout the development of their start-ups.

8 Improve the financing conditions of start-ups specializing in educational games (creation of crowdfunding, business angels, venture capital funds and capital development funds).

In public authorities

9 Extend video game tax credits to all educational games.

10 Adopt the same single VAT rate for educational games as the 5.5% tax on books.

11 Create a national award for educational games.
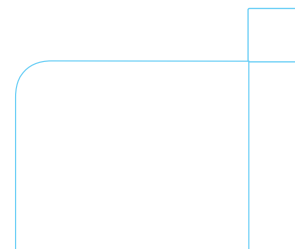
INTRODUCTION

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Recreational activities like Lego®, board games, role games, escape rooms, video and virtual reality games are booming. Instead of remaining restricted to the realm of leisure, they can now be found in schools, universities and companies due to their educational value. France has seen the emergence of a social demand for learning through games, coming not just from families, but from public and private institutions. This demand is boosting the development of recreational devices in teaching and vocational training. Many of these devices result from the personal initiative of teachers keen to find new ways to increase the effectiveness of their teaching, or blogger parents[5] and YouTubers[6], convinced of the benefits of active teaching methods, who create their own so-called "serious" games. But the multiplication of this type of game is also the result of increasingly common collaboration between teachers, trainers, researchers, games professionals and business leaders from all sectors. The objective of their collaboration is to devise fun educational tools that are suitable for both schools and companies, aimed at improving teaching methods and the means of transmitting knowledge; training for the jobs of the future; and helping to recruit new talents, access new markets and develop innovative management methods. This phenomenon therefore responds just as much to an educational, humanist concern of personal development as to an economic and political concern of scientific and technical innovation. It is supported by the French government, notably through the establishment of competitiveness clusters[7] and the launch of calls for "serious games" projects as part of the investments for the future programme (PIA)[8]. This support is justified by the possibilities opened up by the games market to not just reform the educational system, but to design and disseminate technological innovations and stimulate entrepreneurship, to ultimately create value.

Nevertheless, investment in teaching through games is only at its early stages in France, unlike in Nordic countries. In Denmark, for example, games are an integral part of children's education at school. There are even some schools where "all subjects are taught using role play. State programmes set out the obligatory knowledge to transmit. But within that framework, schools are free to use games as a way to learn and in particular to remember more. Once they are adults, employees, mothers or fathers, this exchange-based learning stimulates learners to communicate and work in synergy"[9]. This observation raises a number of questions, such as: What do these new recreational activities bring to the learning process? How has play managed to take a foothold in areas traditionally centred on work and productivity, rather than

5- To get a better idea, take the case of Sandrine and Christophe, creators of the internet blog "Apprendre par le jeu" (learn through play). This blended couple, parents to four children, "has been practising family education for six years. During that time, they have experimented with several types of teaching. They started with home schooling, then tested out correspondence courses, and finally autonomous learning. They conclude that the most effective way by far is learning through games". Their experience motivated Sandrine and Christophe to share with other families concerned about their children's education. They opted to do so using a blog, which gives them a "space to express their personal opinion from day to day that is directly consultable by other internet users, who can react with comments". Their blog combines a type of diary (with photos) with articles written by the young couple. These articles aim to convince readers of the benefits of educational games. They are on subjects like the role of play in children's cognitive development and the latest neuroscience advances. They also give tips on adapting existing games and creating your own Cf. https://apprendre-par-le-jeu.com/
6- Such as Estéban Giner, who proposes "fun video stories" (chroniques vidéoludiques) on his YouTube channel.
7- Created in 2007 in Lyon, Imaginove is a competitiveness cluster for people from digital content and use industries. Their actions are based on three creative areas (games and gamification, culture and knowledge, living better) and three technological spheres (content, metadata, experience). In January 2019, Imaginove merged with the cluster Minalogic, which specializes in digital technologies in the Rhône-Alpes region. Cf. http://www.imaginove.fr
Another example is the Cap Digital competitiveness cluster, which dates from 2006 and specializes in digital transformation. Cf. https://www.capdigital.com/
8- In 2009, the state launched a programme to stimulate the economy based on Web 2.0 and serious games.
9- Agnès Villette (2018), "L'école où les manuels valsent", in WE Demain, No. 21, March, pp. 89-93.

pleasure, relaxation and creativity? What is the impact of gamification[10] on players' attitude and commitment in a learning situation? Does it lead to a change in organizations and professions? How are educational games designed, tested and commercialized? What theoretical knowledge and skills do they transmit? What are the conditions for using them? How can their effectiveness be measured? What are the constraints and limits? What role does the gamemaster play?

All of these questions were tackled by the ANRT working group on teaching through games chaired by Hélène Michel, professor at Grenoble School of Management. The group's meetings were an occasion for business leaders and researchers specializing in digital sciences, education and innovation management to get together regularly and compare their experiences. This Cahier FutuRIS relates the diversity of recreational educational devices set up by members of the working group. For each type of device, we set out the meaning given to it by its creators, the action it fits into, the expectations it fulfils, and any contextual issues. Taking this approach requires identifying scientific and technological obstacles, the human, cultural and institutional resistances faced by the working group, and the strategies implemented to overcome them. More important still, this written account of their experiences is an opportunity to understand and analyse how "getting people to play" helps transform educational attitudes and corporate practices.

To give a full and detailed account, we have organized this report into six themed chapters[11]:

1 lthe representation of educational games as "spectacular objects"[12], in other words, capable of giving pleasure to learners in play situations, and of using the emotions produced to convey knowledge[13];

2 the conditions and means of transmitting knowledge through recreational devices ;

3 the capacity to take on games designed or adapted by educators and transfer them from one world to another ;

4 the consideration of changes in educational practices ;

5 potential solutions to stabilize and develop individual initiatives ;

6 the recognition of a reorganization of educators' competencies, the professionalization of new occupations, and the role of third places in local dynamics. To conclude, a series of recommendations are put forward aimed at companies, researchers, educators and public authorities.

10- In this report, gamification relates to the use of recreational devices for educational purposes or to accomplish a work task.
11- Each chapter was the object of a working group session. The themes are associated with six performance criteria for the training devices. The first five criteria, presented in appendix 3, refer to the work of Donald Kirkpatrick and Jack Philips. The sixth criterion (innovation capacity) was suggested by Hélène Michel. Cf. Donald L. Kirkpatrick (1994), Evaluating Training Programs: The Four Levels, Berrett-Koehler; Jack J. Philips (1996), "How Much Is the Training Worth?", Training and Development, Vol. 50 / n°4, pp. 20-24; Hélène Michel (2016), "Characterizing Serious Games Implementation's Strategies: Is Higher Education the New Playground of Serious Games?", Conference: 2016 49th Hawaii International Conference on System Sciences (HICSS).
12- An expression coined by Jean-Marc Leveratto (2006), Introduction à l'anthropologie du spectacle, La Dispute, p. 12
13- As described by Clifford Geertz, in "Jeu d'enfer. Notes sur le combat de coq balinais", Bali. Interprétation d'une culture, Gallimard, 1983, p. 210.

Are games a serious activity?

"As social science researchers put it, recreational activities are a key dimension of human existence and their organization is a characteristic trait of all social life"[14]. The Dutch historian and anthropologist Johan Huizinga, in his seminal work, defines games as a "free activity standing quite consciously outside 'ordinary' life as being 'not serious', but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner. It promotes the formation of social groupings"[15]. For Huizinga, homo sapiens is not just homo faber, the product of his capacity to make his own tools. He is also, and inseparably, homo ludens, a being who has become what he is by exercising his capacity to play. As a result, unlike seriousness, which "seeks to exclude play", "play can very well include seriousness"[16]. In other words, play can help individuals to take on knowledge and scientific tools, master the use of certain techniques, and adopt behaviour that is useful to their existence. This idea in fact emerged during the 15th century with the development of humanism. "In Italy, the expression 'serio ludere' was at the time used to designate the use of humour in literature to convey serious ideas"[17]. This is the educational principle behind today's "serious games": the recreational character of the situation and the pleasure it gives those who take part in the game contributes not just to "increasing their motivation to engage in tasks judged as complex or off-putting"[18], but brings an opportunity to acquire knowledge and skills.

14- Jean-Marc Leveratto (2006), Introduction à l'anthropologie du spectacle, La Dispute, p. 12.
15- Johan Huizinga (1938/2016), Homo Ludens, A study of the Play-element in Culture, Angelico Press, pp. 13.
16- Johan Huizinga (1938/2016), Homo Ludens, A study of the Play-element in Culture, Angelico Press, pp. 45.
17- Damien Djaouti (2011), "Serious game design: considérations théoriques et techniques sur la création de jeux vidéo à vocation utilitaire",
Doctoral thesis in computing, Toulouse III Paul Sabatier University, p. 18.
18- Hélène Michel, Peter Mc Namara (2014), "Serious games: faites vos jeux!", Systèmes d'information & management 2014/3 (Volume 19), p. 3-8.
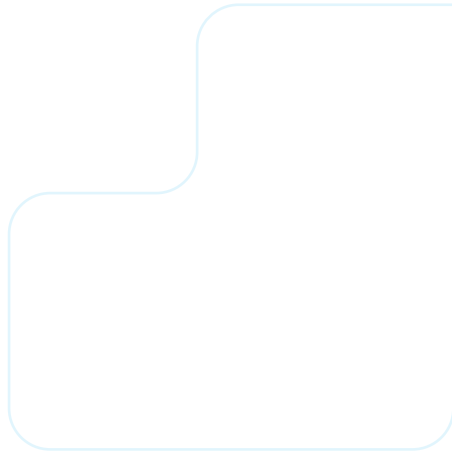
1 GAMES AS A SOURCE OF MOTIVATION AND PLEASURE

INCREASE MOTIVATION

The primary objective of all educators is to get learners interested so that they are fully engaged in a learning situation. How, though, can they deal with less enthusiastic students and disengagement among employees, who find it increasingly difficult to obey imposed rules whose meaning and usefulness are not always clear to them? To resolve this issue, teachers and business leaders are increasingly turning to games. And for good reason. "One of the main advantages of using games in schools and companies is their general positive impact on user motivation"[19]. This is backed up by Frédéric Kuntzman, CEO and co-founder of the company My-serious-game[20]:

"Games can be considered as a gadget, and at the same time as an effective tool for training players. They generate enthusiasm to take part and get totally involved in the situation. In other words, the game teaches the learner. And the learner becomes proactive in her learning. What's more, with some technologies you can respect an individual's particular pace."
Frédéric Kuntzman, My-Serious-Game,
working group meeting, 22 November 2018

Used as an educational tool, play works to "awaken learners' curiosity by putting them in stimulating and demanding learning situations. It gives them both the means and the methods to go out and find the information they need to achieve their project, build their knowledge and shape it in a production that they are proud of. This ambition can trigger a desire to learn and a pleasure in doing so, which gives the effort meaning"[21].

DEVELOP THE PLEASURE OF LEARNING

Play is inseparable from the notion of pleasure, the interest of which is often underestimated, and sometimes even contested in an educational context. The contemporary demand for it shows how far mentalities have changed. It exchanges traditional teaching practices for activities centred on experimentation, autonomy and the right to make mistakes. As confirmed by Jérémy Cornolo, Director of R&D at Décathlon, these activities respond to a desire from learners who no longer aspire to gaining exclusively encyclopaedic knowledge:

"Games are a way of creating an artificial situation where employees have nothing at stake. They can make mistakes and start again as often as they want. This makes it possible to discover new ways of being and doing, of feeling pleasure and starting again. At Décathlon, the line between work and play is a narrow one"
Jérémy Cornolo, Décathlon, interview, 22 May 2019

19- Julian Alvarez, Damien Djaouti, Olivier Rampnoux (2016), Apprendre avec les serious games? Canopé, p. 44.
20- The scientific literature supports this observation. For example, Alexis Souchet, Cifre doctoral student on a work-study programme with Manzalab and Paris 8 University quotes Santa Dreimane (2019), "Gamification for Education : Review of Current Publications", in Linda Daniela, Didactics of Smart Pedagogy, Springer, pp. 453–464; Ibrahim Yıldırım, Sedat Şen, (2019), "The effects of gamification on students' academic achievement: a meta-analysis study", Interactive Learning Environments, 49(10), pp. 1–18.
21- IGEN (2017), "Repenser la forme scolaire à l'heure du numérique. Vers de nouvelles manières d'apprendre et d'enseigner", Report n°2017-056, May, p. 44.

Seen this way, it is important to consider the impacts that games have on peoples' bodies. Repeated manipulation acts on individuals' sensitivity by procuring both affective and cognitive satisfaction. "The combination of problems to solve, challenges to overcome, mysteries to clarify and rewards stimulates dopamine, the pleasure hormone. Neuroscience has in fact shown that the more dopamine the brain receives, the greater efforts it makes to obtain more. That's why most distance learning today involves games"[22]. My-Serious-Game is perfect proof of this. The company developed an application for the Fnac-Darty group using game mechanics, in other words competition, challenges, levels and rewards. The aim was to "capture players' attention, take hold of their bodies and win their support, while giving them pleasure"[23].

"The fun application that we developed for the Fnac Darty group combines business and educational aspects. The ambition is to develop the skills of sales staff (their knowledge of products and sales techniques), boost sales in all of the stores, and shake up traditional codes. It's a "turnkey" mobile application that's easy to use on telephones and accessible to everyone. Throughout the year, split into four seasons, 90% of sales staff play for five to ten minutes a day. The players like it because it's so easy to use. The game is rooted in reality because it's connected to the store's different jobs and products. It considers the personal traits of sales staff[24] (their appetite for competition and communication, sense of service) and their individual sales performance (the game is indexed to KPIs[25]). The specific pleasure that this fun device brings users is its capacity to set challenges with different levels off difficulty, exceed them, and challenge other users. It's a collaborative, competitive digital application. Players form teams and play for their point of sale, with others and against others at the same time."

Frédéric Kuntzman, My-serious-Game,
group working meeting, 22 November 2018

Through this example, it is easy to see that challenges, competition and rewards constitute "so many dopamine kicks". They convey emotions (joy, fear, surprise, aversion, etc.) and allow players to move out of their "comfort zone". At the same time, it is important not to push them too hard and to take into account their game preferences to avoid the risk that learners might feel overwhelmed and give up.

LEARN TOGETHER

"Along with art and sport, games are one of the activities that give individuals the pleasure of exchanging with others"[26]. The collective aspect is crucial. As pointed out by Frédéric Kuntzman, CEO of My-Serious-Game, "The main objective isn't the fact of winning a match, but the pleasure of playing together". The group produces a trigger to "go for it" and "put your all into it", at the same time as an opportunity to get to know yourself better, make social connections, and develop a team spirit in a convivial atmosphere. The participatory observation of a session of Lego® Serious Play®, proposed to the ANRT working group and led by Hélène Michel, brings a chance to analyse the social space created by games:

Hélène Michel took small transparent bags filled with Lego® out of her bag. She distributed them to the members of the working group. Each member now had around fifty bricks and minifigures in different colours. Hélène invited us to lay them down in front of ourselves. She explained to us that the mission of these Lego® pieces was to help us speak the same language. The aim was to agree on the definition of a "deliverable". What would we like to produce after a year working on education through games?

The session began. The participants talked among themselves, with some spontaneously exclaiming: "It's been quite a while!" Clearly, the last time many of us had handled Lego® was years

22- Christine Halary (2019), "Bienvenue dans la pédagogie active", in Management Magazine, n°273, April, p. 73.
Hélène Michel points out that the striatum, which releases dopamine during play, is more specifically active when rewards are given non-automatically, or even unpredictably, with a high risk of failure. This occurs for example when a player opposes or collaborates with one or more players rather than a machine or program. Cf. Sébastien Bohler (2019), Le bug humain, Robert Laffont, p. 130.
23- Jean-Marc Leveratto (2000), La mesure de l'art. Sociologie de la qualité artistique, La Dispute, p. 10-11.
24- The game My-Serious-Game is available in 300 Fnac-Darty shops employing 1,500 staff.
25- KPI is the acronym for Key Performance Indicator.
26- Jean-Marc Leveratto (2006), Introduction à l'anthropologie du spectacle, La Dispute, p. 12.

ago. Hélène reassured us: "What's clever about Lego® bricks is that they fit together easily. It's a child's game for all ages". Then she addressed by videoconference the group members who did not have any Lego®. She suggested that they replace these small objects by drawing pictures. She went on to ask everyone to "remember a situation where you worked together with different partners from a variety of backgrounds. That collaboration resulted in the production of a successful deliverable." After a short period of reflection, she suggested that we use the Lego®

in front of us to build the characteristic that we considered determined the quality of the deliverable. She gave us three minutes.

We got down to work. Initially, I felt rather clueless. Going by the expressions on the faces of the other participants, they were feeling the same thing. Some were smiling, while others were pulling a face. No one knew what to do.

But we had no choice, we had to overcome the challenge! I observed that the instruction was sufficiently open for each of us to tackle his or her construction creatively. So, I took hold of those small objects. I fiddled with the snap-together bricks, flags and figurines and let my mind loose. Everyone was getting down to work in silence and seemed to be captivated by the colourful Lego®. Without paying much attention, three minutes later my 3D construction had taken shape. I looked around me and was amazed by the creativity of my partners: really elaborate, structured little worlds, some like ships, others like houses, had come to life on the tables[27].

Our time was up. We had a few minutes to present our construction. We had to argue our choice and explain our creation by referring to our personal experience. This purpose of this presentation was not to judge, select or reward, but to bring together ideas, exchange, and draw a lesson from our experience. When asked, "What are the characteristics of a good deliverable?" the answers came flying out. The group members were caught up in it. I was impressed by how seriously they were taking the task. One after the other, the players gave a meaning to their construction. Hélène adopted a listening stance. She was receptive, available, attentive. She took care not to interrupt. She repeated, reformulated and wrote down the key words on the conference whiteboard:

"passion and freedom / square / creative format and content / impacting / shorter but with content / put into practice / division of roles / skills upgrading / well-defined but not confining / creating meaning / pride for the team / foundation and common vision / something won at the end / close ties between partners / alignment and definition of priorities / trust / something in common / listening / controlled risk-taking / a unique object / long lifespan" .

27- Note that the motto of Lego® Serious Play® is, "Trust your hands!" As pointed out by Hélène Michel, "It's when you start producing that your thoughts get organized".

The modernity of this session resulted from creating a fun sociable space within which everyone was invited to affirm their individuality. The atmosphere was relaxed, without any rivalry or judgement. This conviviality made Hélène's task easier. The Lego® Serious Play® method reduced shyness and resistance from players. The session was based on their engagement and their capacity to connect a practical construction with an interpretation of their own approach and personal experience. In addition, the oral presentation of the Lego® construction was a way of rooting the constructions in the context of the working group. This situation obliged participants to talk about themselves, to memorize what had been said, and to position themselves in relation to others. They were part of a common initiative. Unlike a regular meeting, which requires visual attention and intellectual concentration from participants, this recreational session meant that group members had to "mobilize themselves". It established a relationship of complicity between the members and Hélène, which strengthened their connections. (Extract from the log book kept by Violette Nemessany, ANRT, working group meeting, 22 January 2019)

This observation confirms that games, because of their recreational character, can be used not just to construct sociable moments centred on the values of creation and sharing between players; they also contribute to training together through a collective exchange by which participants expound their opinions, compare their points of view, and develop their thinking capacity. This common area of practice, reflection and discussion appears to be a means to make progress in a learner "career". The importance of working in a group in cognitive development has not escaped some child psychology researchers. For example, Lev Vygotsky, who theorized the notion of the "zone of proximal development". He suggested that "a child's cognitive development should be perceived as a function of human groups". But Lev Vygotsky went further still.

According to him, "A young child is likely to learn better and make more progress in the company of another more experienced child, a parent or a teacher, rather than with a child at the same cognitive level". He stipulates that, "What the child is able to do in collaboration today he will be able to do independently tomorrow"[28]. A good illustration is provided by Ascension Vizinho-Coutry, principal technical marketing pre-University at MathWorks. As part of her activities, she works with teachers in schools. Her ambition is to get pupils to collectively engage in the learning process:

"In France, since 2011-2012, over 450 general and technology high schools have included supervised project work («Travaux projets encadrés» - TPE) for pupils in the last two years of school studying "engineering sciences" (SI) and "sciences and technologies of industry and sustainable development" (STI2D). These TPEs[29] include recreational principles in the form of fun platforms. They are characterized by project-based learning[30] bridging school with a social and technological environment. They're an occasion for pupils, split into several groups of three or four, to come up with new ideas and present them orally. These ideas are then debated and, once accepted, put into practice. The exchanges promote collaboration between students throughout the projects and in partnerships set up with sports associations or companies (Décathlon, Renault, Thalès, etc.). The learners experience pleasure in coming up against others, in particular during competitions like the national «Olympiades des sciences de l'ingénieur» contest or the international «Robocup» tournament. To sum up, TPEs are based on personal commitment and students' capacity to combine practical production with working in a team and interpreting an approach."
Ascension Vizinho-Coutry, MathWorks,
working group meeting, 22 November 2018

28- Lev Vygotski (1934/1987), Thought and Language, MIT Press, p. 211.
29- TPEs are organized annually, between September and May. They take place during a weekly time slot that ranges from four to six hours in SI and twelve hours in STI2D. They are centred on multi-disciplinary themes with a focus on questions of citizenship, related to the professional responsibility that engineers will need to exercise in their profession, for example renewable energies, protection of endangered species, well-being and health, etc.
30- Project-based learning is an active educational practice that generates learning by carrying through a concrete project.

"Put images into children's heads that they might not have noticed without Playmobil®". This was how the artist Richard Unglik described the exhibition he organized at the Saint-Jacques Gallery in Saint-Quentin[31]. The concept involved using Playmobil® to play out great classical works of music and art, like "The Mona Lisa", "Guernica" and "The Raft of the Medusa". In this way, Unglik offers families a tool, in the form of Playmobil®, to become familiar with and interpret art works, while conveying a notion of pleasure rather than obligation. Playmobil® figures, rather like in the Lego® Serious Play® method, are they key to the process. In this exhibition, the transmission of artistic culture involves these play objects that children are so familiar with. The Playmobil® figures have a function of entertainment, embellishment and education. They not only succeed in establishing and maintaining children's attention in the art works, they also foster dialogue with the accompanying parents. The exhibition visit thus creates a connection. For the parents, it constitutes a collective experience that contributes to maintaining and reactivating the sociability of the family. Sharing emotions and information around Playmobil® creations brings something for everyone: children, who take an interest in art thanks to Playmobil®, generate their parents' interest in the art world by their reactions and questions. This family visit opens up an area for sharing, resulting in a combined cognitive and affective experience.

RULES OF THE GAME

Games are not a cure-all. They cannot on their own resolve all of the problems encountered in learning situations. They should be integrated into a range of educational tools and used from time to time. In any case, the effectiveness of educational games depends on "a set of procedures and resources that make fun experience possible"[32]. More specifically, this requires:

- **A timeframe during** which play is "put into brackets"[33] and contributes to developing "flow"[34]. In other words, a state of high concentration, where time seems to stop for an individual "caught up"[35] in an activity that brings her a sense of accomplishment. The challenge for educators is to apply this psychological state to a group of learners, and so bring about a "collective flow"[36].

- **The educational knowhow** of the educator-gamemaster and her personal involvement to "maintain the educative situation"[37] .

- **Rules** that allow the fun experience to become "serious". They "structure the game, define what is allowed or forbidden and are subject to the collective acceptance of the players"[38]. In some ways, they are a "behaviour toolkit", aimed not only at organizing relations and interactions with learners, but on domesticating their bodies and adjusting their attitudes, in particular at human-machine interfaces. It is worth recognizing that "piloting a game with your body using motion capture or with a keyboard does not bring the same sensorimotor challenges"[39]. Put simply, play necessarily involves acting hand-to-hand with the recreational device. Players must on the one hand "be sensitive to the game by putting their body in a state to experience sensorial stimuli, extend the effects and verbalise them[40]. On the other hand, they need to put their body into the game by accepting its technical constraints and operating rules. According to Stéphane Goria, lecturer at the University of Lorraine, "Students want educational games with clear rules. These games need to be easy

31- The exhibition "The history of art, music and cinema illustrated by Playmobil figures" took place from 22 December 2018 to 24 February 2019.
32- Vincent Berry (2012), Jouer, vivre, apprendre dans un jeu vidéo, Presses universitaires de Rennes, p. 29.
33- Erving Goffman (1991), Les cadres de l'expérience, Minuit, p52.
34- Cf. Mihaly Csikzentmihalyi (1990), Flow, the psychology of optimal experience, Harper Collins, Harper & Row.
35- The French sociologists, Christian Bessy and Francis Chateauraynaud, introduce the concept of "prise" (caught up),
Cf. Christian Bessy, Francis Chateauraynaud (1995), Experts et faussaires, Métailié.
36- Milija Simlesa, a Cifre doctoral student who wrote her thesis while on a placement at the company SBT-Human(s) Matter, defines collective flow as "a state that comes about when a group acts as a whole. The members of a team are absorbed in a common activity, coordinate effectively and feel good together. Collective flow involves activities based on attention, motivation and social identity, triggered by specific preconditions like empathy with team members, collective ambition, and a shared group identity." Cf. Milija Simlesa (2018), "Collective Flow. Sociocognitive model of optimal collaboration", Doctoral thesis, supervised by Stéphanie Buisine and Jérôme Guegan, Paris Descartes University, defended publicly on 22 November 2018.
In addition, according to Hélène Michel, flow as a collective phenomenon appears to echo the adage of game designers when they describe what they consider as a "good" game: "You come for the game, you stay for the guild".
37- The question of educators' competencies is covered in Chapter 6 of this FuturRIS publication.
38- Maxime Duquesnoy, Gaël Gilson, Jérémy Lambert, Charlotte Preat (2019), "La pédagogie du jeu",
Dossier de veille et de curation sur la pédagogie du jeu, Atelier-Edu and PortailEduc asbl.
39- Julian Alvarez, Damien Djaouti, Olivier Rampnoux (2016), Apprendre avec les serious games? Canopé, p. 63.
40- Jean-Marc Leveratto (2006), Introduction à l'anthropologie du spectacle, La Dispute, p. 23.

to use". An example is provided by Julien Caporal, partner at the company Manzalab, which specializes in creating "experiencing", or immersive gaming experiences for the training needs of their clients:

"We developed an application for staff at a banking company. The first thing to do is to establish the rules of the game. This involves agreeing on the situation, the role to be given to the players and the target to reach. It takes place as follows: staff, equipped with a virtual reality headset, embody a burglar in action in an office. They have under two minutes to steal a dozen objects that threaten the company's data. The aim of the game is to raise employees' awareness of the importance of protecting data and help them acquire good reflexes."

Julien Caporal, Manzalab,
working group meeting, 2 July 2019

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Sébastien Genvo, Professor at the University of Lorraine[41], has developed "expressive games" an innovative type of "serious game" in the videogame sector. These games allow players to "put themselves in someone else's shoes to emotionally experience and reflect on their personal issues (social, psychological, etc.)". They can be employed as a moral and ethical training instrument because they allow users to better understand and question the meaning of their actions in the society they live in.

41- Presentation by Sébastien Genvo at the working group meeting of 22 November 2018.

THE EDUCATIVE VALUE OF EXPRESSIVE GAMES

SÉBASTIEN GENVO, UNIVERSITY OF LORRAINE

As part of his research centre work, since 2010 Sébastien Genvo has been studying the notion of "expressive games"[42]. Their characteristic is that they tackle a problem related to real life i.e. everyday, personal, psychological and social themes. The approach of expressive games is innovative in the "serious games" sector because they do not attempt to convince or transmit preestablished knowledge, their ambition is rather to tackle more "intimate" issues. Concretely, the learner is confronted with real-life representations of sensitive themes such as incest, suicide, slavery, illness and war. To tackle them, he draws from his personal knowledge to both interrogate and progressively construct new knowledge. Moreover, expressive games aim to raise users' awareness, provide them with guidelines, encourage them to imagine other possible actions, and equip them to adopt a responsible attitude in society[43] .

THE EDUCATIONAL VALUE OF EMOTIONS

Like "non-fiction" graphic novels[44] for example, "Maus" by Art Spiegelman, expressive games employ informal learning, i.e. the conscientization of sensitive and complex subjects. They attempt to raise strong emotions that are currently rarely explored in the videogame sphere, like sadness, melancholy and poetic sentiment. They thus engage the learner's emotions, while moving away from the notion of pleasure usually associated with games, generally understood to be humorous reactions, and joyful sensations generated by entertainment. Because games, like all artistic activities, cannot be reduced to amusement. The coming together of a recreational device and its user can produce in the body reactions of disgust and rejection in the face of a situation. It is by reflectively questioning themselves on this surge of intense emotion that players develop different knowledge to understand what is happening to them. In a sense, games offer players the possibility of playing with reality without necessarily attaching a value of entertainment or amusement to the game. On the one side, it "engages and delivers, on the other, it absorbs and captivates. In other words, it enchants"[45]. And that it how it engages players in an emotional, reflective way[46].

CHALLENGES TO OVERCOME

Sébastien Genvo admits that coming up with these serious games was not easy. The research lecturer faced two major challenges. The first resides in the game design. How do you produce images capable of emotionally engaging players, leading them "to translate sensitive impressions, aesthetic affects, ethical feelings and technical processes into words, and argue their judgements"[47]?

42- Cf. Sébastien Genvo, (2019), "Quand le jeu vidéo explore les drames de la vie" , The conversation, 3 October 2019.
43- In October 2019, Sébastien Genvo published an expressive game entitled "Lie in my heart", concerning issues like losing a loved one who has taken their own life, bipolar disorder, resilience, and supporting children through bereavement.
44- In other words, biographical graphic novels and historical accounts.
45- Johan Huizinga (1988), Homo Ludens, Essai sur la fonction sociale du jeu; Gallimard, TEL, p.28.
46- Jean-Marc Leveratto supports this idea when he says: "The bodily confrontation with recreational devices is an occasion to transmit emotions (sadness, joy, anger, surprise, fear, shame, etc.). The fact that I interiorize this emotion confirms that I am the member of an ethical community, and the pleasure that I take in playing ratifies this belonging", in Jean-Marc Leveratto (2006), Introduction à l'anthropologie du spectacle, La Dispute, p. 61.
47- Jean-Marc Leveratto, Mary Leontsini (2008), Internet et la sociabilité littéraire, Bibliothèque publique d'information, Centre Pompidou, p. 73.

The second challenge is related to the added value of expressive games. How can we measure it? Expressive games are effective when individuals are put into a creative situation. This type of recreational device gives players a chance to build, take in and adapt knowledge. It is not necessarily suitable for transmitting preconstructed, fixed knowledge. However, according to Sébastien Genvo, expressive games can be used as teaching tools within an education system provided that they, "give learners some freedom of adoption and allow them to develop a critical, analytical approach to the representations of the world that they are presented with". The role played by educational tutors is crucial here. They provide information that will help learners decode and analyse the messages conveyed by the videogames. With what aim? To allow them, through educating them in visual images, to stand back from the game by adopting a reflective stance. This distancing fosters players' creativity. The pedagogical supervisor needs to make sure that learners feel they are being listened to, recognized as unique individuals and as subjects faced with the proposed theme.

ESTABLISHMENT OF DIGITAL SOCIABILITY

The success of expressive games has led some players to create a sociability network to share their thoughts and knowledge via discussion forums or YouTube and Dailymotion channels. They thus relate their experiences of games, their way of playing, the emotions they experience, difficulties encountered, successes, and possible improvements to recreational devices[48]. They "integrate into their opinion the knowledge of another person whom they trust because they have experienced the same things"[49]. The fact of "being able to exchange, and as a result daring to express and defend a personal opinion in front of people who treat others as equals, makes that person grow, encourages him to express his opinion, and at the same time allows him to learn, through the argumentation of a point of view"[50].

Emergence and dissemination of serious games with an educational purpose

Since the early 20th century[51], the use of computers to initiate and train people has developed considerably in the United States. The first teaching machine dates back to 1924. The "Drum Tutor" devised by the psychologist Sydney Pressey featured about fifteen quizzes to prompt learning. In 1946, an innovative approach emerged with the introduction of simulation into training processes. Unlike previous methods, it did not simply involve a "mechanical" validation of knowledge, but introduced three new dimensions, i.e. immersion, imagination and interaction. The "Whirlwind" project, designed by the Massachusetts Institute of Technology (MIT), is a good example. This was the first calculator to simulate the behaviour of a military aircraft. "The aim was to instruct aviators by getting them to tackle the difficulties of piloting with minimum risks"[52] . This requires not only engaging them in the action, but learning based on the right to make mistakes, bodily training (learner's concentration, domestication of the calculator), and a relationship with the educator who supports and corrects the student.

The "Whirlwind" project marked a significant step in the progress of computer-based educational tools because it used play to engage aviators in the activity. However, it was not until 1970 that the expression "serious games" appeared for the first time in the eponymous work by Clark Abt[53] . "This researcher recognized games as a means to enrich school syllabuses, by blurring the line between 'academic learning' and 'informal learning'. He gave numerous examples of teaching through games on themes ranging from physics to human sciences and politics"[54] . The current definition of "serious game" dates from 1999 following the work of Benjamin Sawyer. "This consultant was working on a university management game for US students called 'Virtual U'.

48- Cf. The studies on gameplay by the researchers Hugo Montembeault, University of Montreal, and Simon Dor, University of Quebec.
49- Jean-Marc Leveratto (2002), "Le corps comme instrument de mesure ou la compétence ordinaire du spectateur", Porosité entre savoirs savants et savoirs ordinaires : les usages sociaux de la catégorie « compétences », Maison des sciences de l'homme et de la société, Université de Poitiers.
50- Jean-Marc Leveratto, Mary Leontsini (2008), Internet et la sociabilité littéraire, Bibliothèque publique d'information, Centre Pompidou, p. 75.
51- Stéphane Goria, lecturer at the University of Lorraine, says that, "By the end of the 18th century and early 19th century, some officers in the British Navy (with the game "John Clerk" simulating naval battles) and the Prussian army (with war chess, then Kriegspiel to simulate land battles) had become interested in games as simulation and learning tools. The dissemination of this type of game in armies around the world developed to the point where it was common practice by the end of the Second World War under the generic term, wargaming". Cf. Stéphane Goria (2012), "Wargames et stratégies de communication", Communication et organisation, 42, p. 133-146.
52- Hélène Michel, Dominique Kreziak, Jean-Mathias Heraud (2009), "Évaluation de la performance des Serious Games pour l'apprentissage : analyse du transfert de comportement des éleveurs virtuels de Vacheland", Systèmes d'Information et Management, Vol. 14 : Iss.4, Article 5, p. 73.
53- Clark Abt (1970), Serious Games, The Viking Press.
54- Julian Alvarez, Damien Djaouti (2012), Introduction au serious game, Questions théoriques, Lecture Play, p. 13 et p. 94.
55- Benjamin Sawyer (2002), Improving public policy through game based learning and stimulation, Foresight and governance project, Woodrow Wilson international center for scholars.
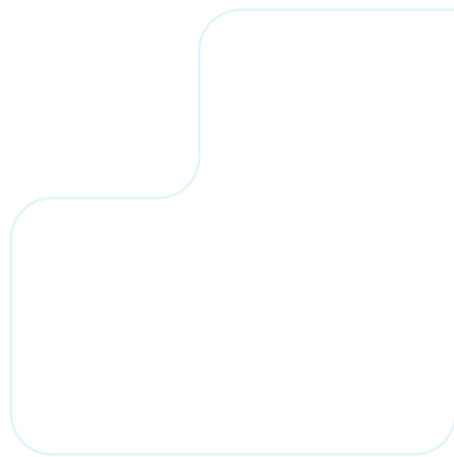
His experience led him to write a white paper[55] on using videogames for utilitarian purposes"[56].

Gradually, simulation games became more mainstream and more professional thanks to the development of digital carriers. They moved into Europe, including France, where "learning games" for vocational training started appearing the 2000s. "L'Oréal, for example, uses the game 'Hair-be12' to train its hairdressers to manage a salon by putting them in a situation of welcoming and retaining customers"[57]. Nowadays, according to Hélène Michel and Peter Mc Namara, "All top French listed companies use these devices. It's not just about training in technical skills, but about raising behaviour awareness, like how to conduct sales relations, recruitment interviews, crisis meetings, etc. Since the 2010s, these serious games have been more widely employed in higher education, in particular French universities, making them the representation of a new generation of e-learning devices"[58].

56- Julian Alvarez, Damien Djaouti (2012), Introduction au serious game, Questions théoriques, Lecture Play, p. 95.
57- Hélène Michel, Dominique Kreziak, Jean-Mathias Heraud (2009), "Évaluation de la performance des Serious Games pour l'apprentissage : analyse du transfert de comportement des éleveurs virtuels de Vacheland", Systèmes d'Information et Management, vol. 14 : Iss.4, Article 5, p. 75.
58- Hélène Michel, Peter Mc Namara (2014), "Serious games : faites vos jeux !", Systèmes d'information & management 2014/3, volume 19, p. 4.
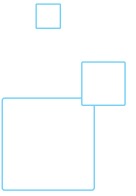
2 GAMES AS A WAY OF TRANSMITTING KNOWLEDGE AND SKILLS

DEVELOP TRANSVERSAL SKILLS

In general, the use of games in schools and the work place involves project-based teaching. This no longer consists in a series of intellectual or technical exercises, but an interconnection of "practice" and "theory". The objective is to achieve a concrete production, which involves making learners proactive in their learning. This approach fosters the transmission of knowledge and cognitive faculties that are often neglected by traditional teaching methods, for example team work, creativity, free self-expression, autonomy and the capacity to adapt. This is illustrated by Ascension Vizinho-Country, principal technical marketing pre-University at MathWorks, through the TPEs organized in general and technical high schools:

"Using the Mathlab and Simulink digital tools developed by MathWorks, students work in groups to make models that communicate with the real system. It could be a scooter, an electric vehicle, a miniature farmer robot, etc. The idea is to lead the students to analyse the differences with the representation and come up with solutions to improve the performances of the system, or create a new one. It's also a fun way to help them understand the utility of maths and physics. When carrying out their TPEs, students have no physical constraints: they can get up, move around the room, and talk. Unlike in regular lessons, silence is not obligatory. However, the teacher takes care to avoid any behaviour that might disturb others in their work. To put it simply, TPEs aim to develop a sense of innovation in students, while allowing

them to express and promote their personality. Each participant needs to find his or her place in line with their skills. This means recognizing themselves in different obligations. Some of them might take care of the modelling, others might deal with the wiring or market surveys. If they want to reach the objectives set by the project and make their collaboration effective, they need to learn to work together."
Ascension Vizinho-Coutry, MathWorks,
working group meeting, 22 November 2018

The remarks of Ascension Vizinho-Country illustrate the educational value of the recreational tools developed by MathWorks. They allow students following compulsory schooling to assimilate abstract notions (mathematical concepts) and acquire knowhow by personally engaging in what they do. What is at play here is the capacity of the students to form a "cooperation chain". They learn to organize their project with others and accept any differences, agreeing that everyone can have their own vision of how to do things. This approach is shared by INRA[59] researchers, who develop a range of educational games, like CD-Roms, board games, smartphone applications, etc.:

"The games developed by INRA researchers are aimed at agricultural professionals (farmers, breeders, technical advisors, etc.), educational bodies (agricultural colleges, higher education), and cooperatives whose work concerns land planning. Each game responds to a specific issue. For example, the board game "Rami fourrager" is designed to adapt breeding systems to a range of challenges; the card game "Foncijeu" initiates

59- The Institut national de la recherche agronomique (INRA) is a research organization that comes under both the ministry for research and the ministry for agriculture. INRA produces and disseminates knowledge on food, agriculture and the environment.

players to think about the question of land access, and the objective of the application "Canteen Game" is to make students more aware about nutrition. All of these games are devised to both transmit knowledge and foster exchanges with numerous actors. They aim to encourage players to verbalize their impressions by mobilizing technical concepts and notions. This innovative approach trains learners from different backgrounds, drawing from their interests and personal experiences."

Stéphanie Potok, INRA,
working group meeting, 5 March 2019

Frédéric Kuntzman, CEO of the company My-Serious-Game, agrees. According to this business leader, educational games contribute not just to intellectual and technical learning, but also ethical learning (critical thinking, ecological conviction, and sense of responsibility). To prove his point, he told us about a simulation game developed by My-Serious-Game:

"We have created a collaborative, customizable serious game aimed at companies, universities, associations, etc. The aim of the game is not to transmit knowledge to users, but rather to pass on a message that raises their awareness of sustainable development. In other words, this game is devised to change habits and make players more responsible. As they play, they learn, with the knock-on effect that they become aware of possible action. This gives meaning to the experience, whatever their initial level of knowledge on the subject."

Frédéric Kuntzman, My-Serious-Game,
working group meeting, 5 March 2019

Jean-Marc Labat, professor at the Sorbonne, adds that some games foster incidental learning. In other words, the game experience is enough to transmit knowledge. Nevertheless, numerous research lecturers, including François Lecellier, lecturer at the University of Poitiers, regret that "the transversal skills acquired through games are not recognized in the current national curricula. That's why many students opt not to mention this type of learning in their curriculum vitae. They esteem that it doesn't have any real value on the work market"[60].

MAKE KNOWLEDGE ATTRACTIVE

How do games enable the transfer of knowledge and skills? ANRT working group members are clear: by simplifying the notions to transmit, without distorting them. The main point is that it makes them more attractive by bringing them closer to learners' personal culture. To achieve this, five conditions are recommended:

- **use games occasionally, in a defined time slot.** As pointed out by Jean-Christophe Guérin, research and development laboratory manager at Décathlon, "Developing games as part of training shouldn't be an obligation. Games are a way of creating an artificial situation with nothing at stake for learners. This 'game time' has to be a break in the learner's professional life. The error to be avoided is to think that all training has to be gamified. Games are one teaching tool among many."[61]

- **pay attention to the graphic interface (images, music, sound effects).** In the words of Bertrand Laforge, professor at the Sorbonne, "This involves considering the demand for quality that comes from students, who are intensive consumers of videogames during their leisure time. Their consumption equips them with an expert skill, which legitimizes a reaction of approval or rejection depending on their experience when they come into contact with games."[62]

- **translate knowledge into original, unexpected scenarios.** This is the case of the videogame Assassin's Creed, published by Ubisoft. Players are invited to navigate through a given historical period[63]. The environment features a multitude of objects, characters, fauna and flora, architectural constructions, etc. These are painstakingly reconstituted by the Ubisoft teams, which include teams specializing in artificial intelligence. The players do not follow an obligatory path. They are free to explore, at their own pace, this "open world". The accent is on interaction with the graphic elements. Each decision taken alters the course of the action[64].

60- François Lecellier, University of Poitiers, working group meeting, 2 April 2019.
61- Jean-Christophe Guérin, Décathlon, interview, 22 May 2019.
62- Bertrand Laforge, Sorbonne Unversity, working group meeting, 2 April 2019.
63- Each new game in the Assassin's Creed series features a different historical period, like Egypt or Ancient Greece, the American Revolution, Victorian England, etc.
64- Exhibition "Behind the Game", Gaîété Lyrique, Paris, from 13 December 2018 to 5 February 2019.

- **allow players to change their stance, position and view.** In companies, for example, this type of experience equips "a director to see something she doesn't normally see or pick up on something that she hasn't noticed in the organization"[65]. In schools, SBT-Human(s) Matter has developed the game "P'tits Profs!", in which primary school pupils become the teachers. They have to manage a class, ask pupils questions, reward them, test them and take care of everyday issues. Thanks to this 'reverse teaching', they take a proactive role in their own learning"[66].

- **foster learning through trial and error.** This means "leaving learners the possibility of making mistakes so that they can be aware of the consequences, and to give them a chance to adapt their learning strategy depending on the situation"[67]. Jérémy Cornolo, R&D Director at Décathlon, affirms that, "Learning through trial and error builds players' confidence, which has been affected by the obligation to develop new skills to avoid being overtaken by the changing job market"[68].

Good practices for designing and using serious games

Alexis Souchet, Cifre doctoral student (Manzalab / Paris 8 University), refers to the work of Douglas B. Clark and his team[69]. He points out that the researchers identify twelve "good practices" for designing and using serious games:
- Play multiple times to learn better;
- Avoid additional non-game instruction;
- Use non-collaborative and non-competitive serious games;
- Use simple mechanisms, like points and badges;
- Vary player actions;

- Opt for games mechanisms intrinsically connected to learning tasks;
- Use scaffolding, e.g. guidance on the correct answers;
- Avoid over-realistic graphics;
- Avoid over-anthropomorphic representations of the players;
- Prefer a third-person perspective;
- Use narrative elements not directly connected to the learning content;
- Allow learners to modify the scenario if they choose."[70].

ORGANIZE THE UNFOLDING OF THE RECREATIONAL LEARNING SEQUENCE

Let us look at the case of the company SBT-Human(s) Matter, which takes inspiration from neuroscience to devise "learning experiences"[71] :

"SBT-Human(s) Matter have developed an "alternate reality" game for LVMH. The game is available on a mobile application, meaning that the professionals concerned can consult it rapidly, frequently and piecemeal. The idea was to avoid a constrained, serious-type game and instead create a game that is easy to get into. The story is split into eleven episodes at a suggested pace of one every fortnight. The scenario cleverly combines fiction and reality, integrating actions to be carried out, like have an environment code of conduct signed by your suppliers, with microlearning capsules explaining in a few words the practices to follow. The procedure is very powerful on a cognitive level. Players participate without precisely realizing when they are playing and when they are learning. Lastly, the SBT-Human(s) Matter team explains the mysteries of the story to the players. Making them aware of the mechanisms

65- Emmanuelle Savignac (2017), La gamification du travail. L'ordre du jeu, Collection innovation, entrepreneuriat et gestion, ISTE éditions, p. 147.
66- Franck Tarpin-Bernard, SBT-Human(s) Matter, working group meeting, 22 November 2018.
67- Julian Alvarez, Damien Djaouti, Olivier Rampnoux (2016), Apprendre avec les serious games ?, Canopé, p. 45.
68- Jérémy Cornolo, Décathlon, working group meeting, 22 November 2018.
69- Cf. Douglas B. Clark, Emily E. Tanner-Smith, Stephan Killingsworth (2016), "Digital games, design, and learning: A systematic review and meta-analysis", Review of Educational Research, 86(1), pp. 79–122.
70- For a serious game to work, Alexis Souchet adds that, according to studies by Pieters Wouters (et al.), it should avoid elaborate narratives so as not to cognitively overload learners, and avoid photorealistic graphics. Cf. Pieters Wouters, Christof van Nimwegen, Herre van Oostendorp, Erik Van der Spek (2013), "A meta-analysis of the cognitive and motivational effects of serious games", in Journal of Educational Psychology, 105(2), pp. 249–265.
71- Christine Halary (2019), "Bienvenue dans la pédagogie active", in Management Magazine, n°273, April, p. 72.

that they have implemented to reach the end of the scenario creates an additional loop to ingrain new behaviours."

Through this example, we can distinguish three interconnected phases in the unfolding of this learning sequence. They are indispensable for memorizing and assimilating knowledge:

- **setting the scene:** the educator provides the rules of the game "to obtain learners' engagement and guide them towards the learning objectives to attain"[72].

- **using the game:** Using the game: by playing, learners are put into a proactive role of seeking, acquiring and adopting knowledge. Throughout this phase, the educator plays a support role.

- **debriefing:** "This phase is strategic to help learners become aware of their experience and identify the knowledge and knowhow incorporated, or that need strengthening. Debreifings are also an occasion to exchange points of view and develop critical thinking"[73].

To conclude, the example of "IFSImulation" described by Florent Teyras[74], educational consultant at My-Serious-Game, illustrates particularly well how transversal skills are transmitted through games.

72- Julian Alvarez, Damien Djaouti, Olivier Rampnoux (2016), Apprendre avec les serious games ?, Canopé, p. 88.
73- Julian Alvarez, Damien Djaouti, Olivier Rampnoux (2016), Apprendre avec les serious games ?, Canopé, pp. 88-89.
74- Presentation by Florent Teyras at the working group meeting of 22 January 2019

THE LEARNING MECHANISMS OF IFSIMULATION
FLORENT TEYRAS, MY-SERIOUS-GAME

L'IFSImulation is a serious game using digital simulation devoted to medical prescriptions to learn through practice. It was developed in response to a request from the IFSI, an institute that trains nurses.

NECESSARY CONDITIONS FOR DEVELOPING A GAME

The first step was making sure we understood each other: What is the advantage of a game for training nurses? How can we transmit the skills required to reconcile contradictory obligations, like assistance, autonomy and risk-taking? To answer these questions, the team at My-Serious-Game carried out interviews with healthcare professionals working at the training institute. It then analysed the training strategies and learning logbooks known as "rubans pédagogiques"[75] used in this establishment. Working with this information, the IFSImulation project was developed. The main purpose of the tool is to give trainee nurses an occasion to practice in a realistic environment with the aim of "learning to give treatment without testing it out on the patients."

Playing IFSImulation requires several indispensable qualities:

- **expertise qualities** based on knowledge and experience of the healthcare profession (knowledge and knowhow).

- **human qualities** specific to the medical profession, for example considering the psychology of patients and respect for the human body (behavioural skills).

- **pedagogical qualities** facilitating the transmission of this knowledge.

Two constraints were imposed by the training institute. The game had to be realistic and give users an impression of immersion, and it had to be "accessible everywhere, all the time, for everyone". The objective was to contribute to the professionalization of these future nurses, with an accent on testing points, such as understanding a background file, administering medication, hygiene issues, relationships with doctors and families, etc.

TRANSLATION EFFORT TO TRANSFER SKILLS

IFSImulation brings nursing students an immersive experience in a realistic 3D world and in total autonomy. They are put right at the heart of a number of scenarios. Based on real-life facts, these situations cover the fields of competence expected throughout the three-year training course. The aim is to lead students to evolve in a context that they face in the future. The writing of the scenarios conditions the quality of the experience. This thus required translation work from the My-Serious-Game team. Guiding nurses

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75- The "ruban pédagogique" features a detailed account of each training sequence and constitutes a guide for internship managers and trainers.

in their first steps meant that representatives from the digital company had to communicate with the training institute and agree on how to transmit medical knowledge, gestures, technical rules and human skills indispensable to the job. This involved combining different language registers to rank the content, objectives and choices of a principle of action compatible with the game format (duration of the sequence, quality and realism of the images, sound and noise level, effort to add a human touch to support for the learners, testing, etc.).

HOW THE GAME WORKS

The way it works is simple. Each session is organized into three stages that connect visual information with physical impressions:

- **the learner consults the patient's file.** Just like in a real situation, he is accompanied and monitored by Hélène, a virtual auxiliary nurse. She gives him three key information items: the patient's name, room and treatment.

- **role play:** The learner's critical thinking is solicited. He must administer the treatment in the "rules of the art", using all of the means at his disposal.

- **Test situation:** The learner makes a decision to treat the patient. The objective is to establish proper clinical reasoning and critical thinking capable of questioning, if necessary, the medical prescriptions or treatment.

Each scenario presents a different case (Alzheimer's, obesity, etc.). The student is required to administer the right medicine to the right patient at the right time, with the right dose and in the right way. Navigating between treatment rooms, patient rooms and pharmacy cupboards, the learner must understand the situation and its context, discover the patient files and implement the right treatment. The particular pleasure that IFSImulation brings resides in the mass of information made available to the student nurses, coupled with their total freedom. The game allows them to carry out a series of actions and make mistakes, without being blocked in the simulation. This virtual professional

role play helps them adopt a reflective approach to their way of doing things and strengthens their judgement.

DEBRIEFING

To consolidate knowledge, for each simulation a debriefing is proposed with the trainer. A simulation report and a detailed list of all of the actions carried out are sent to the student and trainer at the end of the session. These documents interpret the learner's level of skills and propose an overall score. Based on the recommendations of the French Health Authority (HAS), they can be used to precisely identify the right actions and those that need perfecting, and put together personalized support.

EDUCATIONAL EFFECTIVENESS OF THE GAME

The benefit of integrating this simulation technology into nursing staff training is threefold. It contributes to:
- learning theoretical knowledge;
- learning technical gestures and picking up the right reflexes;
- learning about ethics by helping students control stressful situations.

IFSImulation was devised to allow learners to analyse situations in a calm way without putting patients in danger. Mistakes become a way of learning. As pointed out by Florent Teyras: "You tend to remember your mistakes more than your successes." From one scenario to the next, the situations become more complex, which facilitates progressive, solid skills-building. To some extent, this tool is the guarantee of the IFSI's professionalism. It can be used by its representatives to present training courses, recruit new students, familiarize them with their job and build up their skills without giving them the impression of being over-assisted. The simulation game thus establishes a living relationship by creating a service relationship between institutions and learners. The digital transformation of the nursing school has served to put their practices and operating methods "back into the game".
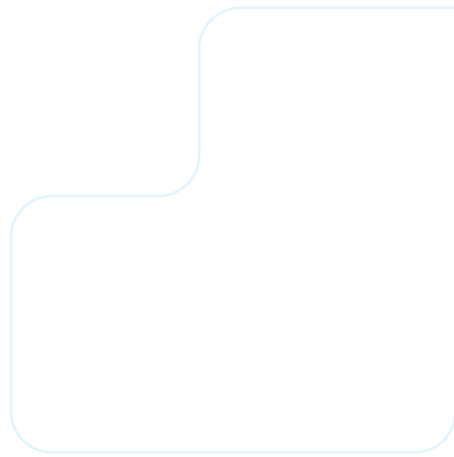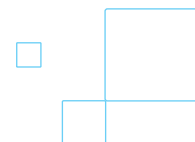
3 THE CAPACITY TO MOVE FROM ONE WORLD TO ANOTHER

MOVING FROM THE WORLD OF LEISURE TO THE WORLD OF EDUCATION

As we have seen, while a few years ago, teaching through games was practised by only a handful of insiders, it is now increasingly popular in schools and universities. Nevertheless, this development is difficult to grasp statistically because numerous practitioners create their games outside of any academic recognition. In any case, that is the opinion shared by Guillaume Isaac, educational engineer at the University of Pau and the Adour Region, and Bertrand Laforge, professor at Sorbonne University:

"I've developed a new teaching method based on gamification. It comprises a pack of cards aimed at making training more fun and stimulating. I put a great deal of personal effort into developing it. I created the whole thing in my spare time and without a budget."
Guillaume Isaac, University of Pau and the Adour Region, working group meeting, 2 July 2019

"I spent a whole summer listening to the Collège de France conferences on the radio on the theme of experimental cognitive psychology. They convinced me of the benefits of games to transmit knowledge. I then decided to create an alternative recreational device to modernize my teaching at the university."
Bertrand Laforge, Sorbonne University, working group meeting, 2 April 2019

These comments highlight the personal commitment of teachers to creating educational games. The use of them in schools depends on educators' initiative, enthusiasm, and their interest in active learning methods. The individualization of their practice can be explained by the possibilities opened up by the development of the games market for leisure purposes. As an example, François Lecellier, lecturer at the University of Poitiers, explains that his use of the videogame Minecraft during his spare time gave him a chance to gauge its educational value:

"As a Minecraft player, I understood that I had a game with multiple educational qualities in my hands. During my IUT lectures, I opted to use the standard version rather than "Minecraftedu" developed by Microsoft, which is surprisingly less appropriate in a learning situation. The new version is too expensive and has technical issues. To play it requires taking out a subscription and having Windows 10, not to mention servers that aren't accessible online."
François Lecellier, University of Poitiers, working group meeting, 2 April 2019

We can therefore affirm that educators acquire technical expertise from the quality of games, due to the recreational culture acquired during leisure time. This skill sets them apart and justifies the introduction of recreational devices in schools and universities.

MOVING FROM PERSONAL EXPERIMENTATION TO COLLECTIVE ADOPTION

Learners, colleagues and parents. But this originality is also what hinders its recognition and raises resistance. It can result in several types of negative reaction. For some, learning through play is a waste of time. Others feel unsettled, or even irritated, at not knowing what kind of object they are dealing with. It is up to the gamemasters to find the words to reassure them. They have to convince players of the usefulness of educational games. Which, according to François Lecellier, is no small matter:

"The first session is always difficult. Introducing the Minecraft videogame into the classroom triggers diverse reactions: while most students say they are satisfied (60%), some spontaneously express a feeling of incomprehension (about 30%). They're bothered by the fun side of the situation compared to a normal lesson. Others (about 10%) feel an aversion to the Minecraft game.
I observe these reactions of rejection in my colleagues too. I'm disappointed to note that most of them consider my lesson as 'entertainment'. They're sceptical and not convinced of the appropriateness of using Minecraft in the classroom. Most parents have a similar attitude in that they don't take learning through games seriously and are concerned to hear that their children are playing at university."
François Lecellier, University of Poitiers,
working group meeting, 2 April 2019

The challenge can only be overcome by educators "putting it into words and practice". They need to be able to adapt their explanation to the people in front of them, demonstrate their technical mastery of the recreational device, and transmit their knowhow to learners. Stéphane Goria, lecturer at the University of Lorraine, recommends for example: "avoiding written instructions. It's a better idea to use tutorial-type videos on YouTube or Dailymotion channels"[76]. François Lecellier adds:

"I've written a user guide to Minecraft in the form of a tutorial aimed at novice users. But it isn't enough. I've also given training sessions. The objective is to convince the most reticent about using Minecraft in teaching."
François Lecellier, University of Poitiers,
working group meeting, 2 April 2019

Put simply, educational games should not be employed without socio-technical support. This might be provided by the gamemaster, or even by the learners themselves through social networks (YouTube, blogs, Tweets). Lastly, it takes time for the "graft to take". To win people over, usually, but not always, educators adapt commercial games that have already been shown to work in the teaching field.

MOVING FROM THE WORLD OF EDUCATION TO THE WORLD OF COMMERCE

For Hélène Michel, professor at Grenoble School of Management, institutional support is indispensable to ensure recognition for the initiative of game teacher-designers. She thinks that it is vital to encourage these educational innovations, just like scientific and technological innovations. This means recognizing games as an intellectual contribution that needs protection. This could start with getting games certified by accreditation organizations, which would give value to the experience of educators as part of their professional assessment. For example, having a "gameography" could be a positive criterion for moving up a grade in the teaching profession, similar to a list of publications. Along with the promotion of this intellectual approach, distribution channels should be set up authorizing commercialization. To illustrate her point, Hélène Michel mentions two exemplary cases in which educational games were promoted and transferred to the commercial sphere:

"The 'Scratch' game is a good example of how a game produced by a research laboratory ended up being commercialized. It was developed by MediaLab at MIT[77]. Its aim is to teach primary school children how to code through play. The game can be used with other electronic devices

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76- Stéphane Goria, University of Lorraine, working group meeting, 22 January 2019.
77- Massachusetts Institute of Technology.

*developed by MIT, such as «MaykeyMaykey».
The promotion and distribution channels for
these games are easy to access and inexpensive.
They are sold at the MIT store.
Another example is "Superwisor", which is a
serious game for directing doctoral studies.
It was devised by the Grenoble School of
Management for students using a curation system.
The content and internal validation system
come with the game, so that it can be adapted
to other contexts and used autonomously.
It has been sold to other organizations."*

Hélène Michel, Grenoble School of Management,
working group meeting, 5 March 2019

**The case presented by Stéphanie Potok, manager
of agricultural partnership and entrepreneurship
at the promotion department of INRA**[78]**, is a
good example for examining the strategies
put in place by the research organization to
promote educational games produced by its
researchers. She makes a point of underlining the
technological, institutional and human obstacles.**

78- The Institut national de la recherche agronomique (INRA) is a research organization that comes under both the ministry
for research and the ministry for agriculture. INRA produces and disseminates knowledge on food, agriculture and the environment.

PROMOTION AND TRANSFER OF GAMES DEVELOPED BY INRA RESEARCHERS

STÉPHANIE POTOK, INRA

INRA is the leading agricultural research centre in Europe, and the second in the world. It groups seventeen research centres and is organized into thirteen departments, including SAD (sciences for action and development) and SAE2 (social sciences, agriculture and food, space and environment). The latter have developed methods involving play (role play, board games, fun software, etc.) that are different from the kind of action traditionally employed at this research organization. INRA decided to promote these innovative devices which, until 2016, were not counted among its innovations. Since then, the promotion department has encouraged its game researcher-producers to make invention statements. In 2017, 166 invention and results statements were produced and recorded.

Most of the time, creating games involves research projects that are financed by public bodies, such as the ANR (national research association), the European Commission, Ademe (French environment and energy management agency), ministries, etc. According to Stéphanie Potok, "Games are rarely an end in themselves. They are an original way to address issues on the field translated into research questions and to give local actors the tools to carry through their missions (farmers, breeders, advisors, schools, etc.)". INRA games have a special feature: researchers can devise different versions to adapt the recreational device to audiences, local areas and types of usage. In some situations, games can also be used in the family.

PROMOTION STRATEGIES FOR EDUCATIONAL GAMES AT INRA

In general, game researcher-creators do not possess all of the means and skills required to transfer their pedagogical inventions and ensure their commercialization. For this reason, the INRA Transfer promotion service provides them with the expertise required to draw up contracts, and apply for licences, patents or trademarks. Three types of contract exist:

- direct sales using one-off contracts that connect the game creator with a buying organization. This situation is rare, partly due to the high cost of game boxes (from €300 to €500). To make this purchase financially viable, buyers need to use it multiple times. In addition, games available on CD-Rom come with licences that can be used on one or several computers.

- direct sales via the publishing house "Educagri" for teaching on agricultural matters. This is a simple way to make fun resources developed by INRA researchers available to teachers.

- services proposed by a private partner that contributed to creating the game, either through an existing private structure, or one in the process of being created following an INRA innovation. These concern games that require support. Due to the complexity of the games, this is often the case. Training may be provided.

However, some games obviously do not get as far as being transferred and remain on the shelf. Most often, this is the case for guidance and training tools. They are not promoted because

the researcher who created them has since left INRA (short-term contract, for example) or does not have the time to devote to it due to other research projects.

CREATION OF START-UPS[79] BASED ON SERIOUS GAMES FROM INRA

Few permanent researchers choose to throw themselves into entrepreneurship. However, some staff on short-term contracts (engineers, doctoral and post-doctoral students) create a start-up at the end of their contract to take further the recreational device that they developed at INRA. As a result, they need to:

- train trainers to strengthen the game distribution network;

- put together presentations on the theme of the game to understand user needs and come up with recommendations.

Several options are possible to protect these games developed by researcher-entrepreneurs: a knowhow agreement or trademark licensing agreement, depending on the usage.

OBSTACLES TO PROMOTING INRA GAMES

There are three types of obstacle:

- **the first one is technological.** It occurs at the point of upscaling. The passage from a prototype to mass production generates tensions: Who will help the researchers manufacture the game? How much will it cost? How do you define the most appropriate financial model (sell the game, rent it out)?

- **the second obstacle is institutional.** SATTs[80] and investment funds are not particularly interested in these "atypical" companies 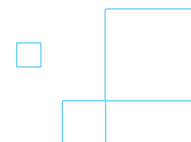because they have a low return on investment. For this reason, it is difficult to identify economic partners capable of accompanying these start-ups throughout their development.

- **the third is human.** Few researchers create a company based on a game. They are apprehensive about leaving their environment. The resistance is cultural. Although less common that before, two conceptions of research continue to come up against each other: one involves producing knowledge for the public good, and the other involves creating value by promoting products. It is difficult to combine these two ways of thinking and to convince the most reticent.

79- Note that since 1999, 108 start-ups have been created based on INRA innovations or competencies. 64 are still in business
80- Technology Transfer Accelerator Offices (sociétés d'accélération du transfert de technologies - SATTs) are simplified joint stock companies created by several public research bodies as part of the investment for the future programme (programme d'investissement pour l'avenir - PIA). Their vocation is to maximize the socio-economic impact of academic research and foster job creation in France by simplifying, accelerating and facilitating the transfer of public research technology and knowledge to companies of all sizes. Cf. https://www.satt.fr/
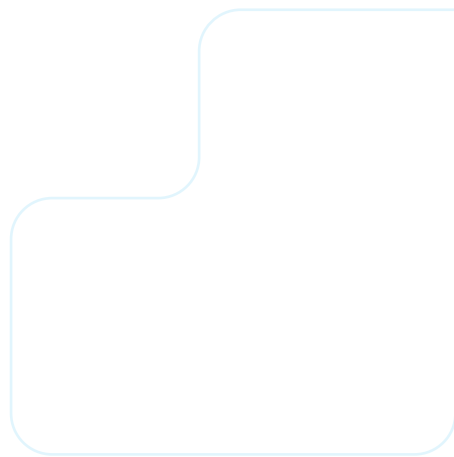
4 TRANSFORMATION OF TEACHING PRACTICES

The experiences of the ANRT working group members are valuable for understanding how recreational devices help bring teaching practices forward. They indicate four different characteristics of this development:

CREATION OF NOVEL EXPERIENCES

Teaching is no longer just based on official syllabuses, it is translated[81] by educators to bring learners an original experience. Bertrand Laforge, professor at the Sorbonne, explains:

« "With our game tool, we want to build up a way of teaching that:
- *uses students' centres of interest;*
- *puts gamified, immersive digital simulation at the centre of teaching;*
- *connects my research activities to my teaching;*
- *-experiments and innovates by mobilizing new technologies.*

Bertrand Laforge, Sorbonne University,
working group meeting, 2 April 2019

At the company My-Serious-Game, educational engineers define the content of the games. Thus, based on specifications put together with their clients, they can adapt their services to the professional context:

"We developed a serious game for an association. We started out by analysing the client's requirements. We interacted with the management and learned about the strategic plan that the association produces every five years. We then interconnected our analysis with the game's content.
The objective of this serious game is to train employees to improve service relations with users, while respecting them as people. This serious game is original because it gives players the impression that they're in a mirror game. They are put into a situation and, based on their personal experience, have to manage the problems they encounter when receiving members of the public. As a consequence, learners play the role of actors, spectators, and knowledge producers. Put another way, this game initiates a reflective, mutual learning process in which skills and knowhow progressively build up through the collaboration and shared actions involving the players and the game's mission commanders."
Florent Teyras, My-Serious-Game,
working group meeting, 2 April 2019

MODERNIZATION OF PREMISES AND LEARNING MEDIA

The way that premises are arranged changes with the use of recreational devices. For example, in contrast to traditional layouts, it is not uncommon to see tables and chairs arranged so that learners can see each other, exchange, circulate freely and play in groups or standing up. Ascension Vizinho-Country, principal technical marketing pre-University at MathWorks, enthusiastically describes the material conditions required to make gaming platforms effective in high schools:

81- According to the meaning given by Michel Callon. Translation in sociology as proposed by this sociologist is an analysis instrument particularly suited to studying innovative devices for teaching. Cf. Michel Callon (1986), « Éléments pour une sociologie de la traduction. La domestication des coquilles Saint-Jacques et des marins-pêcheurs dans la baie de Saint-Brieuc », L'Année sociologique, n°36, pp. 170-207.

"The classroom features technical and digital equipment. It looks like a specialized work space, a place for experimentation, and that appeals to young people attracted by new technologies."

Ascension Vizinho-Country, MathWorks,
working group meeting, 22 November 2018

Classrooms increasingly feature computer equipment (computers, CD-Roms, virtual reality headsets, etc.). This equipment requires significant financial investments. In schools, budgeting for expenditure is a source of tension. To overcome this, teachers need to seek subsidies with the support of school heads and public authorities. This is confirmed by researchers at Sorbonne University, who have created an educational videogame portal called "Ikigai":

"The creation of Ikigai was financed by IDEX[82] at Sorbonne University. Its annual budget amounts to €300,000. To develop the portal imperatively means finding funding. We receive support from the ministry of higher education and research. But we're still awaiting official recognition in the form of a mid-term subsidy from the public authorities."

Bertrand Laforge, Sorbonne University,
working group meeting, 2 April 2019

ESTABLISHING A PARTNER NETWORK

The production of a game for learning often requires setting up a partner network. It "cannot be the work of a single individual who does everything from start to finish"[83]. This requires working on mobilizing and enrolling others to create alliances and associations between stakeholders. These "human resources", convinced of the interest of the recreational device, will support the project and its implementation. The "Ikigai" portal is a good example of this division of work:

"We developed Ikigai for almost two years before coming up with a functional prototype. Developing a range of games to cover all subjects will involve the collaboration and pooling of resources of several higher

education establishments and possibly private development studios. To date, we've received support from Ubisoft, which has provided skills-based sponsorship. An initial collective of 26 independent establishments, laboratories and development studios is currently helping us put together a project to take Ikigai up to national level with the support of the ministry for higher education, research and innovation (MESRI). I contacted these outfits because they're involved in serious game development activities. Our partnership runs smoothly, thanks to our mutual interest in the project and our shared view that this kind of platform can't be financed by a single organization. We'll therefore be forming a network to pool resources and costs. Each partner has accepted to share information and collect data so that we can set up a nominative recommendation, while respecting GDPR requirements[84]. But different partners identify with different obligations. Some have offered to integrate their technologies into the Ikigai platform. Others have participated in the design. Starting in 2020, our partner universities will bring an experimental terrain covering the whole country. Ubisoft produces a project review so that all stakeholders can adjust to quality requirements and set up arrangements to reach the objectives set by a steering committee."

Bertrand Laforge, Sorbonne University,
working group meeting, 2 April 2019

DEVELOPMENT OF NEW SERVICES

The use of games in the educational system generates a proliferation of new services and the creation of "public spheres"[85], as pointed out by Kasia Lechka, product manager at the company Rise Up, which specializes in further training management:

"The introduction of learning games has totally changed the way companies are organized. It's fundamental to accompany their reorganization. Rise Up has therefore set up a varied range of courses ranging from customized training to the creation of webinar-type videoconference tools, as well as virtual classes. Another Rise

82- Initiatives of excellence (IDEX) are part of the "investments for the future" programme launched by the French state. The aim is to create global-ranking multidisciplinary higher education and research groups in France.
83- Howard Becker (1982), Les mondes de l'art, Flammarion, edition 2010, p.37.
84- Regulation n⬚2016/679, known as the EU General Data Protection Regulation, is the reference in terms of protection of personal data.
85- In the sense given to the term by Jürgen Habermas. In other words, how through discussion and reading, it is possible to use one's sound critical judgement to affirm one's own opinion. Cf. Jürgen Habermas (1992), The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society, Polity Press.

Up innovation is the "Rise Up Café", which is a collaborative platform for sharing good practices."
Kasia Lechka, Rise Up,
working group meeting, 22 January 2019

These new services bring, on the one hand, organizational and teaching support for trainers keen to modernize their teaching practices. They can use them to train on their own by taking on new skills and autonomously carrying out pedagogical sessions. On the other hand, sociability spaces, which are on the rise thanks to new communication technology (blogs, forums, "Rise Up Café"), provide educators with psychological support. Some admit that they can feel professionally isolated due to lack of time and resources. Others say they feel powerless in the face of creativity demands, with hyperstimulation sometimes leading to stress, burn-out and addiction problems. In any case, these new communication spaces can be used to share emotions, experiences and knowledge, swap tips and give advice, boost damaged self-esteem and develop sociability.

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François Lecellier, lecturer at the University of Poitiers, has introduced the Minecraft videogame into his lectures. The result is a change in his teaching practices, involving: reorganization of skills, obtaining of financing, new collaboration with partners, adjustments and arrangements to neutralize resistance.

HOW MINECRAFT CHANGES TEACHING PRACTICES
FRANÇOIS LECELLIER, UNIVERSITÉ DE POITIERS

François Lecellier lectures at the university institute of technology (IUT) of the University of Poitiers. His lectures are based on a national teaching programme that is revised every six years. In 2013, a new module was introduced called "carrying out projects" (conduite de projets), aimed at fresher students at the university. The twofold objective is to: initiate students to a project approach, making them aware of time, communication and management constraints, and develop transversal skills.

USING THE MINECRAFT GAME FOR EDUCATIONAL PURPOSES

The challenge was to involve students who did not yet have the technical skills in a collaborative creation process, and in only eight hours of tutorials. For François Lecellier, Minecraft was the obvious solution. According to the lecturer, the game offers a number of advantages:
- it includes an automated system and mistakes can be corrected easily.
- it can be used on the IUT premises or remotely. This gives students the possibility of continuing with their work outside lessons.
- it is rewarding for users because of the pleasure to be had from the situation.

MOBILIZATION OF SOCIO-ECONOMIC PARTNERS

The students are invited to work in groups of five or six and to appoint a project leader. The first step is to approach socio-economic entities, such as the François Mitterrand library in Poitiers, and offer them a modelling project corresponding to their needs. The following stages are organized around technical specifications, a timetable, and an architectural production based on Minecraft.

The final assessment takes into account students' work planning and their capacity to effectively communicate with stakeholders. François Lecellier says that what matters most is the work method, not the final Minecraft construction. For the students, working with socio-economic entities opens up an opportunity. It means that they have to behave like true professionals while promoting their knowhow and interpersonal skills in environments that are in a position to offer them a professional career.

THE LIMITS OF MINECRAFT

François Lecellier identifies four limits to using the Minecraft game as part of his teaching practices:

1 **Students' familiarization with the Minecraft environment** encourages "deviant" behaviour that can be a source of conflict. For example, some of them know how to illicitly hack into the productions of the other groups and then destroy them.

2 **The lack of time bothers students.** They regret not being able to extend the knowledge brought by the game. They claim that the eight hours of tutorials are insufficient to master the game and see their project through.

3 **The financial costs and internal organization are obstacles.** Using Minecraft in lessons requires purchasing efficient computers and setting them up in a freely accessible IT room in blocks of six work stations. It also means investing in licences and hosting on a server. Another non-negligible obligation is to obtain authorizations from the academic administration to ensure that service staff and maintenance technicians will devote

time to training on how to use Minecraft. François Lecellier admits that he would have given up on his initiative without the financing granted by the Idefi Paré project as part of the investments for the future programme (PIA) and the collaboration of the university's technical staff.

4 **Lack of enthusiasm, even rejection** from a small number of students, and resistance from some parents and colleagues can discourage the most motivated teachers. To resolve this, François Lecellier works on communication to explain the educational value of the Minecraft videogame. He would like to see Minecraft training courses set up on a national scale, for teachers.

NEW PERSPECTIVES

The use of Minecraft goes beyond the University of Poitiers. François Lecellier has formed partnerships with primary, middle and high schools through the Poitiers school administration, and with Espace Mendès France[86]. He also participated in the launch of the ScienceCraft competition for the 2018 science festival. François Lecellier is now looking to:

- adapt the procedure for renewing teaching practices in universities and schools, with the support of ministries (for education and higher education, research and innovation).

- launch a project on virtual mobility in the form of a virtual Erasmus, as part of the activities of the Coimbra group, which groups European universities.

86- A scientific, technical and industrial culture centre created in Poitiers in 1989.
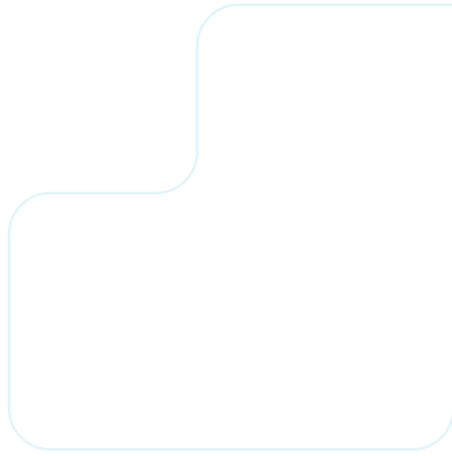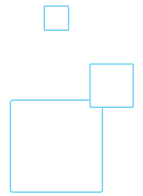
5 SUSTAINING AND DEVELOPING INITIATIVES

RETURN ON INVESTMENT AND ON EXPECTATIONS

As the accounts of the ANRT working group members illustrate, creating games for educational purposes requires investing time and resources and the cooperation of numerous actors (learners, colleagues, management, technicians, developers, etc.). This then raises the question of the return on investment. The arguments put forward by Hélène Michel, professor at Grenoble School of Management, are clear. She prefers to speak of a "return on expectations":

"It may seem surprising, but very little research today makes a detailed evaluation of the return on investment from using games in education. The data are centred on feedback on experiences and practical examples, with uneven information. At the same time, broader evaluation criteria are emerging, like the return on expectations."
Hélène Michel, Grenoble School of Management, working group meeting, 2 July 2019

Florent Teyras, educational consultant at My-Serious-Game, and Kasia Lechka, product manager at Rise Up, also insist on the need consider the "return on expectations":

"The quality of our services depends on our capacity to satisfy our customers. That's why the first thing we set out to do is to measure the return on expectations. What matters is to design educational tools adapted to the specific needs of our clients. The key to retaining them is to build their trust, and that takes time. You have to get to know each other and work together. And the way to do that is to listen to their needs, agree about what targets to reach, respect timing and commitments, and analyse the final results."
Florent Teyras, My-Serious-Game, working group meeting, 2 April 2019

"Rise Up has put together a process to facilitate scaling up. It's based on measuring the return on expectations of our customers. The process is organized in three phases. The first is about defining the framework, which means understanding clients' needs and proposing the right solution. The second is devoted to preparing training courses and launching them. The third phase involves analysing the results using indicators with the aim of optimizing the training courses."
Kasia Lechka, Rise Up, working group meeting, 22 January 2019

Once this point is agreed on, and if the games have proved successful, the next question is whether it is worth scaling up development in order to extend their usage in schools and businesses. This stage requires drawing up a business model and defining commercialization possibilities and different distribution channels. However, although developing educational games can offer the opportunity to make money, for school and university teachers, taking the plunge is not so simple. In fact, the French education system generally makes it difficult for teachers to employ "economic reasons" to justify their actions. Some of them esteem that the support of a market

49

economy, through the intermediary of their fun creation, goes against the spirit of public service and the teaching profession.

PUBLIC AUTHORITIES

"In any case, developing games and marketing them calls for financial means"[87]. As an example, the price of recreational devices available from My-Serious-Game ranges from €10,000 to €80,000[88]. In order to relax the financial constraints, it is common to turn to public aid. Despite a tight budgetary situation, the French state and local authorities actively support cultural and creative industries. These include the actors of videogame industries and EdTechs, devoted to educational technologies and training[89]. The significant support provided by public authorities is justified by the central role played by these sectors in technological innovation, in the creation of value, and more broadly in economic growth. Sébastien Genvo, professor at the University of Lorraine, recognizes that public investment has paid off. It has given impetus to local business.

"The municipality has chosen to focus on games, in particular videogames. With the creation of the third place "Blida", it wants to build up a gaming identity. The games developed there are also sold in "Blida" stores, which makes upscaling easier. But that's not all. Thanks to increased public investment, independent development studios are opening up all over the local area. Quite a few of them have been really successful, for example "NeuroVoider", created by the Moselle company Flying Oak. It has sold 50,000 copies, which is a lot for an independent game. There's also been a real boom in start-ups. In the Lorraine area, numerous companies have opened up in the gaming sector. For example, "Cogaming", which specializes in e-sport. The ministry has also validated the creation of a "videogames" Master's course at the University of Lorraine. This post-graduate degree will bring even more local impetus."
Sébastien Genvo, University of Lorraine,
interview, 25 March 2019

For Bertrand Laforge, professor at Sorbonne University, public funding is a natural way of making games more democratic, which is indispensable in the education system:

"It's important to remember that there is some return on investment for the state. Our videogame portal, Ikigai, establishes its legitimacy based on a democratic conviction. Supporting the development of Ikigai means allowing a high number of students to access it."
Bertrand Laforge, Sorbonne University,
working group meeting, 2 April 2019

Nevertheless, obtaining this public financing depends on how effective educational games creators are in putting themselves forward to political leaders as "legitimate and incontestable spokespeople of these entities"[90], and in convincing them to support their action despite its unusual nature, and to collaborate with partners.

PUBLIC-PRIVATE PARTNERSHIPS

"In the games filed, like all industrial sectors, new forms of innovation are characterized by their capacity to get researchers and companies to work together"[91]. These partnerships have the advantage of pooling expertise along with additional human, technical and financial resources. The trouble is that researchers from public organizations do not always automatically turn towards the business sphere. A degree of mistrust, or even a taboo, still exists among some of them when it comes to establishing relations with the private sector. Nevertheless, according to Sébastien Genvo, professor at the University of Lorraine, games are worth it:

"It's vital to support university researchers to help them promote gaming research results. The commercialization of games means they can penetrate distribution circuits and increase their visibility. For academics, it's a rewarding experience. They can share it with their students and make it easier for them to professionalize."
Sébastien Genvo, University of Lorraine,
interview, 25 March 2019

87- Pierre-Jean Benghozi, Philippe Chantepie (2017), Jeux vidéo : l'industrie culturelle du XXIe siècle ?, Département des études, de la prospective et des statistiques, French Ministry for Culture, p. 85.
88- Frédéric Kuntzmann explains: "For a high price, the number of students can be unlimited. Which makes it worth amortizing the game in several schools to bring down the costs."
89- Note the creation of the Réseau Thématique French Tech #EdTech #Entretainment, a technical network comprising 15 ecosystems from all over France. Cf. https://edtechentertainment.lafrenchtech.com/
90- To quote Michel Callon. Cf. Michel Callon (1999), "Ni intellectuel engagé, ni intellectuel dégagé : la double stratégie de l'attachement et du détachement", Sociologie du travail, n°41, p. 65-79.
91- Pierre-Jean Benghozi, Philippe Chantepie (2017), Jeux vidéo : l'industrie culturelle du XXIe siècle ? Département des études, de la prospective et des statistiques, French Ministry for Culture, p. 82.

Partnerships can take several forms. They might involve occasional contracts that respond to analysis needs or specific skills (consultancy), or longer partnerships whose objective is to explore a particular domain (Cifre theses, researcher mobility). But to ensure that these partnerships evolve in a climate of trust, Hélène Michel, professor at Grenoble School of Management, says that it is important "to explain and agree on each member's objectives and interests in terms of intellectual property and revenue model"[92].

"Evidence of efficacy" of a serious game developed by Manzalab

Alexis Souchet, Cifre doctoral student (Manzalab / Paris 8 University), comments on the "evidence of efficacy" of serious games required by Manzalab's customers:

"The return on learners' expectations is important. To achieve it, Manzalab has to be able to provide evidence of the efficacy of serious games. To provide this evidence means setting up partnerships involving researchers from public research organizations and companies. This scientific backing is a sign of quality for Manzalab customers.
For example, Manzalab works with the Paragraphe laboratory at Paris 8 University. Their objective is to demonstrate the efficacy of the serious game "Mon entretien d'embauche" (my job interview) produced for Pôle Emploi (job centres)[93]. This innovative experience is one of only a few in the world[94]. It is based on analysis models devised by experimental psychology and neuroimaging[95].

We therefore attempted to analyse the impact of imaging by comparing groups playing on PCs with players using a virtual reality headset.
The sample comprised 69 people, including 41 women and 28 men. We asked them to play twice in a row for 30 minutes. A sub-population of this study played a third time in their homes.

The players were presented with several scenarios. All of the games took place in four phases:

1 *Provision of information: What is the job available? What skills are involved?*

2 *Discussion with a friend (represented by an avatar) before the interview.*

3 *Interview with a recruitment officer.*

4 *Overview of the interview with a coach based on three skills criteria.*

The final score then comes up, giving a percentage of the accomplishment of the three skills.
Following the experiment, several main observations can be made:
• *Players' performances improved both on PCs and with virtual reality headsets.*
• *Playing on a PC leads to better overall learning, whereas the learning curve is steeper with a virtual reality headset.*

• *The quality of the experience (flow, presence) reported by the subjects is comparable for each group.*

• *The retention of knowledge has a greater impact with a virtual reality headset.*
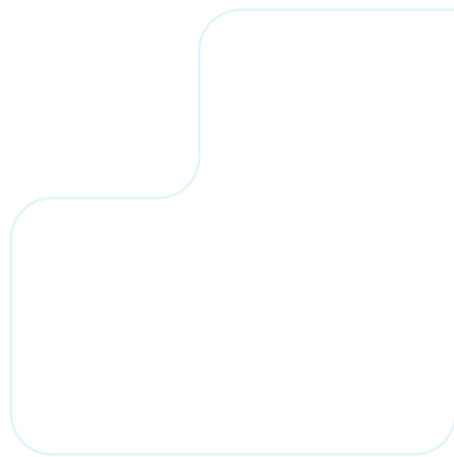
We can therefore conclude that serious games are effective both on computers and with virtual reality headsets. They adapt to technological developments."


92- Hélène Michel, Grenoble School of Management, working group meeting, 5 March 2019.
93- Alexis Souchet describes the serious game "Mon entretien d'embauche" as follows: "The interaction with the player takes place in a 'point and select' format with dialogues. The player can rotate the camera 360°. He or she has to choose from four options. Each choice has a different score depending on its relevance in relation to the question asked, the context, and the job interview codes listed by the job centre's human resources department. The real-time score changes depending on the players' choices. To select a response, the player wearing a virtual reality headset places the cursor on one of the dialogue boxes with a move of the head. On PCs, this is done by moving the mouse. The response time is limited." Cf. Alexis D. Souchet, Stéphanie Philippe, Floriane Ober, Aurélien Lévêque, Laure Leroy (2019), "eu Sérieux en Réalité Virtuelle pour Apprendre l'Entretien d'Embauche : Expérience en Double Aveugle", in 3e Colloque International Game Evolution : Management et Pédagogie Ludique.
94- The work carried out in a partnership between Manzalab and Paris 8 University aims to compare the efficacy of games using a PC or a virtual reality headset. Cf. Alexis D. Souchet, Stéphanie Philippe, Dimitri Zobel, Floriane Ober, Aurélien Lévêque, Laure Leroy (2018), "Restrain impacts on learning job interview with a serious game in virtual reality: a randomized double-blinded study", in Proceedings of the 24th ACM Symposium on Virtual Reality Software and Technology (VRST '18), Tokyo.
95- Stanislas Dehaene (2018), Apprendre !, Odile Jacob.
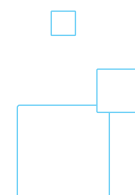
6 — PROFESSIONNALIZATION OF OCCUPATIONS AND EMERGENCE OF THIRD PLACES

REORGANIZATION OF EDUCATOR SKILLS

"Simply making a game available does not change what players learn. The mediation of an educator who takes a learning approach to using the game is indispensable"[96], as illustrated by the words of Ascension Vizinho-Coutry, principal technical marketing pre-University at MathWorks:

"For the TPEs that take place in high schools, students are supervised by teachers who act as guides with multiple skills, capable of being educators, facilitators and organizers. They communicate 'practice' by instilling a technical approach and 'theory' by transmitting knowledge. At the same time, they help these young people to express their personalities by developing their curiosity, sense of observation, and voicing of personal opinions."
Ascension Vizinho-Coutry, MathWorks,
working group meeting, 22 November 2018

This account shows how the use of educational games is changing the teaching profession. "Educators now wear several hats: creator of content and session facilitator; spokesperson and community moderator; administrator and manager"[97]. Their knowledge responds not only to a new type of educational need from learners, who want individual and creative learning methods. It also represents a new organization of educational skills. Their implementation requires a combination of intellectual and pedagogical knowledge acquired through their experience, coupled with expertise (personal familiarity with the games), organizational qualities (material, administrative and financial management), and interpersonal skills (energy, enthusiasm, capacity to adapt to personalities and stakeholder expectations). To sum up, in the words of Jean-Marc Ferrandi, professor at Oniris Nantes, "Educators become 'super coaches', or put another way, 'facilitators'"[98]. Guillaume Isaac, educational engineer at the University of Pau and Pays de l'Adour confirms:

"Educators' personal qualities contribute to successful learning. They help build an affective environment that reassures the learners, some of whom are worried that they 'won't manage to do it', and by the same token disqualify themselves. Throughout the recreational experience, the gamemasters answer questions, give guidelines and tips."
Guillaume Isaac, University of Pau and Pays de l'Adour,
working group meeting, 2 July 2019

PROFESSIONALIZATION OF NEW OCCUPATIONS IN THE GAMING SECTOR

The development of fun teaching practices in the education system goes hand in hand with the professionalization of new occupations. As pointed out by Bertrand Laforge, professor at Sorbonne University:

96- Yvan Hochet (2012), "Jeux vidéo et enseignement de l'histoire et de la géographie", in Samuel Rufat, Hovig Ter Minassian, Les jeux vidéos comme objet de recherche, Questions théoriques, pp. 103-112.
97- Kasia Lechka, Rise Up, working group meeting, 22 January 2019.
98- Jean-Marc Ferrandi, Oniris Nantes, working group meeting, 2 July 2019.

"We are now seeing totally new jobs appearing in corporate organization charts, like: game designer, play experience designer, creative director, videogame programmer, etc."
Bertrand Laforge, Sorbonne University, working group meeting, 2 April 2019

The fact that these occupations are new, and do not yet have any codes, makes them easier to access for individuals with no qualifications other than a school education, personal motivation, curiosity and a love for games. However, these new occupations remain unstable in the absence of any certified training programme, competition or nationally recognized job title. This is what Sébastien Genvo, professor at the University of Lorraine, points to:

"Jobs in the gaming sector are changing all the time or don't yet exist. They aren't stable yet. Skills are being invented every day to take up these new jobs. My career path is a good illustration. I did film studies, and was then recruited as a game designer at Ubisoft. But I never had any training in game design. To carry out my work, I used a whole range of skills acquired in different domains. I mobilized them to invent a new job. I developed a way of being and a critical approach that equipped me to adapt to varied situations. The problem is that legal frameworks don't recognize these changes. For the ministry of higher education and research, training courses need to be increasingly skills-focused. But that's not always the best way of doing things, especially in the digital world. Thinking in terms of knowledge often makes it easier to adapt to change."
Sébastien Genvo, University of Lorraine, interview, 25 March 2019

Sébastien Genvo drew from his personal experience and decided to create a Master's course on "videogames" at his university. But the journey has proved long and difficult:

"I've been fighting for years to develop videogames research, studies and courses at the university. Progress has been slow. After setting up a Bachelor's, I'd now like to open up a Master's course. That means creating a new lecturer position focused on videogames to work on projects by my side. The idea is that

we would act in tandem. After three years of repeated requests (it's increasingly difficult to obtain support workers), we finally managed to secure a post that will be open for applications this year. In September 2019, the Master's course will be up and running at last."
Sébastien Genvo, University of Lorraine, interview, 25 March 2019

The research lecturer went on to describe his Master's degree course:

"Students who enrol on the Master's will be partly taught on videogames. The syllabus has an unusual feature: it's part of a broader course oriented towards digital development, digital project management and web design. Two programmes are on offer to Master's students along with this core syllabus: the first has a focus on web design, project management and ergonomics. The second is centred on developing recreational devices. My aim is to offer not a specialized course on game design or programming, but a transversal course rooted in digital communication, with a specialization in creating recreational experiences. Students will therefore be able to build their knowledge in different activity sectors, such as videogame mediation, events, game design and development, etc. I think this is the best approach to respond to the challenges of the videogame industry. In this fast-moving sector, students should be trained to be able to adapt, innovate and invent their own jobs. Take YouTubers: five years ago, who would have thought it would be possible to professionalize yourself by posting videos on YouTube?"
Sébastien Genvo, University of Lorraine, interview, 25 March 2019

THE DEVELOPMENT OF "THIRD PLACES"

Hélène Michel, professor at Grenoble School of Management, observes the emergence of third places in France devoted to developing games, like gamelabs and playgrounds:

"Over the last few years, these "makerspaces" have been popping up all over France. Like for example TCRM-Blida in Metz, Gem Labs in Grenoble, the CRI Game Lab in Paris. These

are hybrid, collaborative spaces. They bring together different audiences (researchers, companies, associations, etc.), activities, skills and occupations that don't normally cross each other's paths. They make services and technologies freely available, along with authoring tools. The result is that anyone can find out and learn more about games and develop their skills. The aim is to produce a recreational device together, but outside the academic and corporate world."

Hélène Michel, Grenoble School of Management, working group meeting, 2 July 2019

Sébastien Genvo runs the Expressive Game Lab in Metz, in the third place TCRM-Blida. In his point of view, "setting up in this location is a golden opportunity". The initiative corresponds to three strategies:

- **A visibility strategy** to get students to hear about the Expressive Game Lab and attract them to the University of Lorraine's "videogames" Master's degree course.

- **A partnership strategy** to build up connections with local companies and become part of the local dynamics.

- **A legitimization strategy** in the eyes of the public authorities.

What lies at the heart of this action, though, is without doubt student training on videogames:

"We've come up against a new challenge: how can we keep Expressive Game Lab going? One solution is to set up training. As part of the 'Information and Communication' Bachelor's, I helped set up a course on 'videogames and interactive media'. It comprises several modules, like on the history of videogames, analysis of videogames, narration and videogames. The objective is to get students to analyse games. To do this, they come to the Expressive Game Lab one morning a week. They're supervised by a student recruited to act as a monitor or tutor. The Expressive Game Lab also gives students a chance to access a game list that's not always accessible to the general public. The room is really well equipped. In total, over the two semesters, we host three groups of about

40 students. Unfortunately, we don't have enough funding to increase the time slots. Half a day a week is not enough."

Sébastien Genvo, University of Lorraine, interview, 25 March 2019

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The recreational training available to Décathlon staff is a perfect example of the professionalization process. Décathlon is a "learning company". Its culture is based on sporting values, like passion, trust, surpassing personal limits and cooperation. The company considers that all employees have expert knowledge of a sport that they practise during their leisure time. These "specialists" are therefore the best trainers to help their "teammates" develop their skills. The training sessions that they organize are becoming more modern and game-centred.

DÉCATHLON'S "EXPÉDITION INNOVATION" TRAINING SESSIONS
JÉRÉMY CORNOLO, DÉCATHLON

DÉCATHLON'S TRAINING CULTURE

Training is part of Décathlon's DNA. The group has set up training courses aimed at upgrading the skills of all staff to prepare them for the changing job market. This range of courses is organized with three objectives:

- Offer short formats and easy-to-access knowledge, similar to customized coaching.

- Make sure it has meaning: this is essential to ensure staff investment. The difficulty lies in anticipating their personal needs and evaluating the constraints, for example how much time they have to take part.

- Foster responsibility and autonomy: staff are free to choose to follow or teach training sessions. When they feel the need, they simply go to the "Décathlon Academy" website, and type in the skill they want to acquire or transmit.

IMPROVE THE EFFICACY OF SERIOUS GAMES

Some of the training available is gamified. This includes digital games with virtual reality headsets, a board game and escape rooms. But the games are not enough on their own for learning. Five conditions need to be respected to increase their teaching efficacy:

1 a skills list is produced upstream for the eighteen lines of activity and 350 occupations in the group. The aim is to help staff position themselves.

2 training media are complementary and diverse to ensure that they can be adapted to match different profiles.

3 resources are available and accessible to all, everywhere, all the time.

4 Courses are individual so that employees can follow them at their own pace.

5 A training supervisor is involved to generate regular, rapid feedback. This gamemaster plays an important role. She must be able to help learners identify their training needs, define the objectives and indicators of success, interact throughout the learning process, ensure that everyone participates, juggle different expectations and approaches, and establish a climate of trust.

THE "EXPÉDITION INNOVATION" GAME

With the help of an external company, Jérémy Cornolo, R&D director, set up two sessions of the game "Expédition Innovation", which he describes as follows:

"We decided to create the game "Expédition Innovation" because some employees expressed a need for training on Décathlon's innovation culture. It was an immediate success and we're going to be programming more sessions. I co-run the game with some other colleagues. The objective is to help staff understand how innovation emerges within the group. The main challenge was to identify and translate in a fun way the skills to transmit to make them accessible. We chose to organize the narrative structure of the game into five stages:
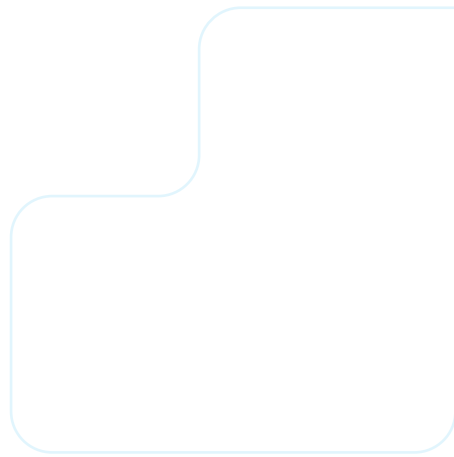
- *The first two are devoted to transmitting the group's innovation culture. Learners are invited to watch a two-minute video. Then the recreational experience begins. Team members play out a role for two hours. They're put into the shoes of another employee who is participating in innovating a Décathlon product. The contact gamemaster attributes the roles, coordinates and supervises. Eight enigmas are then proposed. To solve them, learners are taken through all the phases of an innovation process (workshops, testing labs, etc.).*

- *The last three phases aim to transmit knowhow. Learners attend a half-day session featuring presentations of all of the actors who contribute to an innovation in one way or another.*

To guarantee the success of the training, it's crucial to devote some time to going back over what's been learned. Learners need to be able to immediately transfer what they have learned. Throughout the process, colleagues go through different emotions. It's a real human experience. They realise that we share a common history at Décathlon. They feel responsible and take initiatives. They're aware of the means available to them to prepare an innovation. What I'd like to do now is to partner up with a university to validate this training with a diploma."
Jérémy Cornolo, Décathlon,
interview, 22 May 2019

THE DÉCATHLON FABLAB

Décathlon has created its own FabLab. The lab is a place for employees to get away from their working environment and decompress. It also offers training, skills and support. In Jérémy Cornolo's opinion, "This Fablab is the perfect place to use games to train people. It's the right environment for injecting educational innovation."
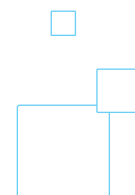
CONCLUSION

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With this Cahier FutuRIS, the ANRT working group does not intend to end its reflections on teaching through games. To fully grasp the complexity of this active method and at the same time encourage teachers to reassess their practices, it would be interesting to pursue the qualitative approach initiated in this work, and extend it by taking a quantitative approach. Before we do that, though, we are already in a position to make several recommendations aimed at schools, universities, companies and public authorities.

RECOMMENDATIONS TO SCHOOLS AND UNIVERSITIES

1 Establish a list of the knowledge and transversal skills to acquire as part of education on emerging professions in the gaming sector.

2 Create a module on training to educate through games in the permanent syllabus of the teaching profession, from primary schools to university. This initiative would help interested teachers in their action, convince other educators of the worth of teaching games, propose a genuine "quality charter", and at the same time modernize teaching methods.

3 Recognize, when evaluating teachers, that the creation of an educational game is an intellectual contribution. On their career paths, a "gameography" could constitute a positive criterion for moving up to a higher grade.

4 Offer courses on the value of educational games to teachers and knowledge transfer firms (e.g. technology transfer acceleration companies: SATTs). This would involve accompanying game developers, from the definition of a partnership project through to its commercialization, including brand creation, the business model and intellectual property management.

RECOMMENDATIONS TO COMPANIES

5 Develop partnerships with higher education establishments to facilitate the promotion of games produced by public laboratories. This could involve organizing events like independent games festivals and TEDx conferences. These events are opportunities for developers, companies and potential investors to meet. The aim is to encourage research laboratories to make educational innovations and accompany them right through to the market launch.

6 Increase the recruitment of Cifre doctoral students on topics related to educational games (e.g. on the issue of developing "evidence of efficacy"). Cifre theses are a suitable channel for mutual assimilation of knowledge and disseminating good practices.

7 Encourage entrepreneurs to seek accompaniment. Support programmes exist to get through the kick-off, development, production and commercialization stages. For example, BpiFrance has set up numerous devices to grant funding and share experiences and good practices.

8 Improve the financing conditions of start-ups specializing in educational games. The objective is to create a whole financing ecosystem around young start-ups (crowdfunding, business angels, venture capital funds and capital development funds).
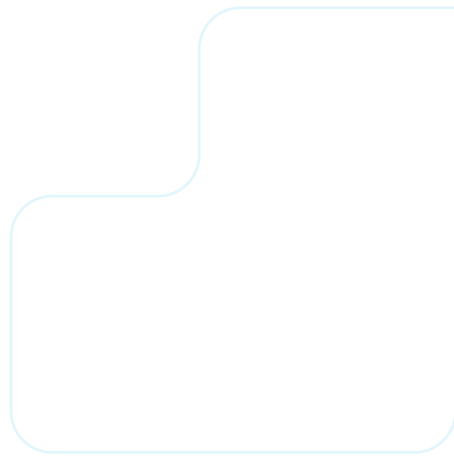
RECOMMENDATIONS TO PUBLIC AUTHORITIES

9 Extend videogame tax credits to all educational games. In 2007, "France developed a tax policy through a videogame tax credit. In 2017, this credit increased from 20% to 30% of the total amount of eligible expenditure invested in videogame development by the company. It is capped, initially at €3M and now at €6M per company per year. The game must not have development costs of over €150,000, must be commercialized, and be produced by French and European creative partners"[99]. A reform of this tax measure to include the production of all educational games would have a positive impact on the attractiveness of France.

10 Adopt a single VAT rate for educational games, identical to the 5.5% tax on books.

11 Create a national award for educational games. This prize would identify quality games and indirectly generate companies' interest in commercializing them.

99- Pierre-Jean Benghozi, Philippe Chantepie (2017), Jeux vidéo : l'industrie culturelle du XXIe siècle ? Département des études, de la prospective et des statistiques, Ministry for Culture, p. 226-227.
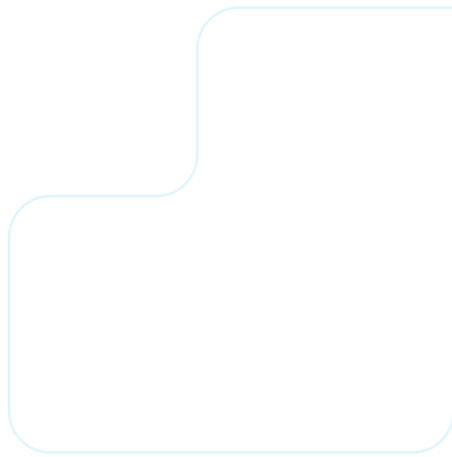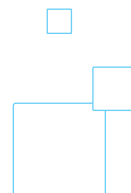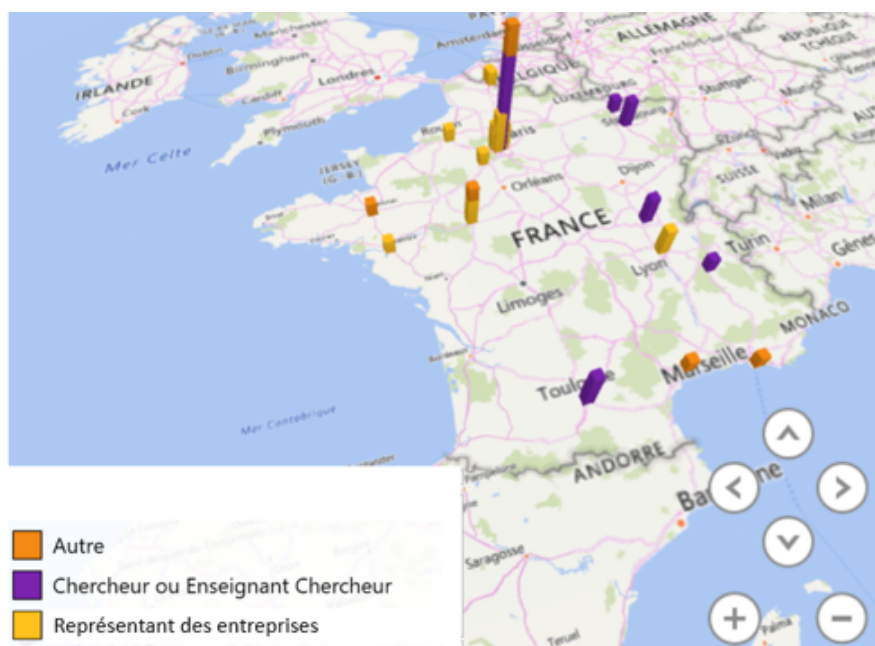
APPENDICES

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**APPENDIX 1 :** Map featuring teaching through games working group members

Source: Stéphane Goria (University of Lorraine), February 2019.
Members who joined the group after the above date do not feature on the map.

APPENDIX 2 : Presentation of the five performance criteria for training programmes according to Donald L. Kirkpatrick and Jack J. Philips

Source: Donald L. Kirkpatrick and Jack J. Philips
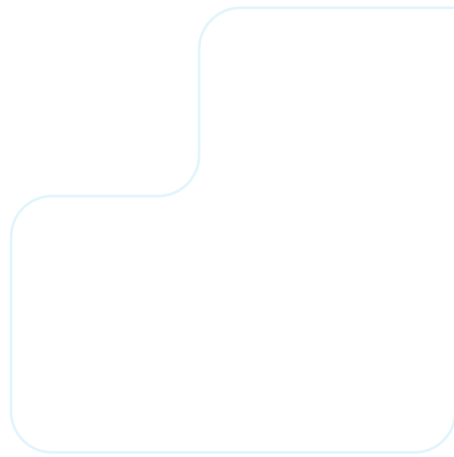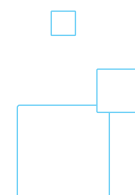
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