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Design and Development of a Serious Game in Service of Higher Education

Abstract

Serious games are a commodity assisting students to better understand certain boring or very difficult parts of their curriculum. This is the reason why this practically focused article attempts to motivate educators to employ a serious game in their curriculum. There are two ways in which an educator can obtain a serious game: First, get hold of a relevant existing game and get the necessary permission to use it; and second, to create one with the help of a game engine and the right capable people. This article has opted for the second choice and takes the educator step by step through the process. This is an arduous task but so satisfactory in the end. However, this project is not for the *fainthearted*, but for those educators who are really committed to supplying the best education for their students.

Keywords

Serious games; education; digital game-based learning; deep learning; online; Fourth Industrial Revolution

1. Introduction

Serious games (SGs) is a 'game changer' within the Fourth Industrial Revolution (4IR), in student-centred education, training, and learning (cf. Almeida and Simoes, 2019, p. 122). SGs can fill a vital gap in the educational process of a student. This article serves as a practical introduction on the design and development of serious games and as a motivation for the reader to read more about this venture.

At this stage, we are living in the era of Education 4.0 (Brandl and Schrader, 2024), filled with 'novelties' like artificial intelligence (AI) (Popenici and Kerr, 2017), virtual reality (VR), augmented reality (AR), and the internet of things (IoT) (Shahroom and Hussin, 2018), to name but a few. Here the classroom (one-on-one or virtual) acts as the environment where skills are developed, while students do their learning wherever and whenever they want to. Being supported by technology enhanced learning (TEL), opens the door for educators to more easily apply serious gaming to their curricula (cf. Popenici and Kerr, 2017).

It is very easy to make statements about the pros and cons of a feature, and to stay theoretical about it. However, when it comes to the implementation process of an SG, things can very easily fall apart, depending on the attitude and inputs of the educator as well as the game designer and game developer who show an interest in the project. It could fall apart if these three intellectuals are not up to the task – not knowing enough or not being motivated enough, along with a long list of more reasons. However, it could also come together if the three intellectuals have done the necessary research and the right preparations.

These reasons necessitate an article like this, especially for the interested reader who needs to know how this venture or project can be launched. This article serves as an introduction on the design and development of serious games and as a motivation for the reader to read more about this venture.

The idiom 'talk is cheap' is very applicable when it comes to serious games, as the application of SG talk could be a very expensive one, specifically if the educator-*cum*-designer-*cum*-developer are very enthusiastic and want to 'go big.' It can therefore become a very negative denominator if the institution of higher education (IHE) where the educator is located, does not see eye to eye with them about this 'thing,' being totally ignorant about it or biased towards it, or simply does not have the funds for this project. To approach the private sector for funding would be the next logical step, which could be met with success (the necessary funding) IF the proposed SG is very applicable for a big company in their specific field.

Though it is a real novelty in South Africa for most IHEs, there are some educators who have already ventured on this path with real successful outcomes. It is rather not that new in the industry in South Africa, as big companies are already promoting it here, like Serious About Games (n.d.) – mostly industrial SGs; Serious Games Institute¹ – South Africa (n.d.) – training and development; Sea Monster (n.d.) – mostly developing games for the industry; and Games Development Training – South Africa (n.d.) – mostly for developers, to name but a few.

This article is very practically oriented and discuss the design and development of a serious game, without engaging in technical terms and processes. The basics will be debated, specifically how the initial phases of getting started should come off the ground. The article also refers to different formats of SGs that have been implemented around the globe, using e.g., the Socratic method (question and answer) and simulations.

2. The Design and Development of a Serious Game²

An educator can go one of two ways when being interested in presenting an SG as part of the curriculum to their students: They can either choose an existing relevant game and adapt it (with the permission of the original designer/developer, cf. Oliver, 2019, p. 4 of 8) or decide to design and develop their own SG, making use of a specific game engine like Unity or Unreal Engine. For the sake of this article, I have decided to go for the second option.

The first step of the plan to present an SG to one's students, is to decide on a team for the period in which the SG will be designed and developed. This would therefore be a multidisciplinary effort (Bakhtiari, 2022, p. 3 of 6). A common mistake made by educators is to either get a game designer or a developer, give them the content of the game and expect them to deliver the finished game in no time, leaving the designer/developer totally ignorant. Instead, the initial planning of an SG should already include a team, consisting of at least the educator,³ a designer⁴ and a developer⁵ who are really

¹ The Institute already started in 2012 at the North-West University, but sadly closed in 2016 (Hall, Watson and Kitching, 2017, p. 16 of 16).

² For an intense chapter on game design, cf. Bunt, Greeff, and Taylor (2024).

³ Nousiainen *et al.* (2018, p. 85) correctly argue that an educator should have four main competence areas in order to be qualified for starting with an SG: Pedagogical, technological, collaborative, and creative. If the educator misses out on one of these characteristics, failure is almost guaranteed.

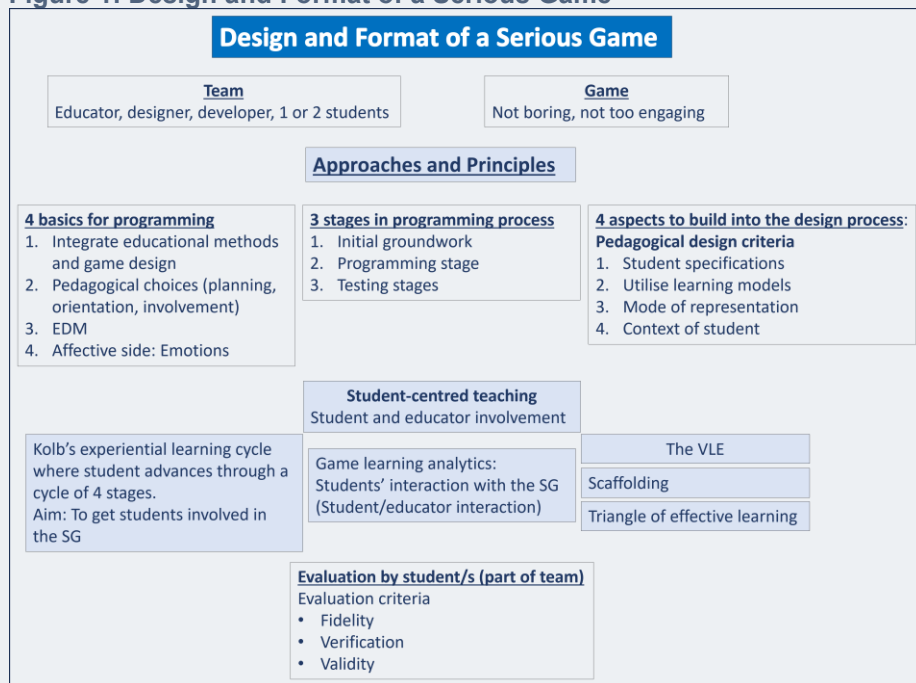
⁴ The game designer will design the game's concept, title, and theme, together with the educator. This includes the game's mechanisms and its rules. The designer therefore puts the thoughts and concepts of the educator into game language.

⁵ The game developer will develop the game from the mechanisms and rules given to them by the educator and game designer, in constant coordination with the two mentioned individuals. The developer will therefore make the game playable, thus creating the game itself.

interested and know one of the game engines, as well as a student or two⁶ who will also do the testing of the game and give feedback. To get the necessary funds to construct the SG, as referred to above, will also form part of the initial discussions.

Schematically, this section can be portrayed as in Figure 1 and will be discussed below:

Figure 1: Design and Format of a Serious Game



(Source: Personal archive.)

Without going into the mechanical/technical and designing details of the development and design process (cf. e.g., Pérez-Colado *et al.*, 2021), I will discuss some reasons for the specific way in which, to my mind, an SG should be designed and developed. My aim here is to enlighten the educator about

⁶ The question is if the end user – the student – should be involved during the designing and development process of an SG. According to Maheu-Cadotte *et al.* (2021, p. 1 of 10) it gives them (a shared) 'power and control' over the curriculum and its contents. Cf. also Camilleri and Camilleri (2017) for a lengthy discussion. Bonnier, Andersen and Johnsen (2020:25) add that it is all about the usability of the game – something that the students are the best evaluators of.

specific things that should be taken into consideration when the team discuss, plan, and test the SG. Whereas entertainment is the main motivator for gamers to spend their time playing games, the main factors that keep them involved and playing, are the approaches and principles that are embedded in these game designs. Dernat *et al.* (2025, p. 1 of 14) refer to this as utility (cf. Abt, 1970). These factors should be kept in mind by the team when designing and developing the SG in order to 'facilitate and enhance positive learning outcomes' for the students (Lampropoulos, Anastasiadis and Siakas, 2019, p. 118).

When taking part in the designing and developing of an SG, the educator must take care not to present the game in a boring way, but also not by making it too engaging (Kato and De Klerk, 2017, p. 3). There must be a fine balance in all the activities that are presented on the screen. Additionally, the game must provide 'powerful motivators [to] fuel a [student's] desire to engage in unattractive activities, such as learning theoretical material' (Laine and Lindberg, 2020, p. 804). The intrinsic motivators that an SG should have, are challenges, fantasy, curiosity (sensory and cognitive), control, cooperation, competition, and recognition (Laine and Lindberg, 2020, p. 807).

There are at least four basic elements that the educator must definitely take into consideration: First, 'educational methods and game design [should] be successfully integrated [to connect] experiences, context and learning' (Gros, 2015, p. 35). Gros argues that '*multimedia design for training and education should combine the most powerful features of interactive multimedia design with the most effective principles of technologically-mediated learning*' (Gros, 2007, p. 23; original emphasis).

Second, while planning the SG, the educator, in coordination with the team, needs to make pedagogical choices and considerations that will fit their target group of students. In this concern, Kangas, Koskinen, and Krokfors (2016, p. 451) give special attention to the pedagogical activities of the educator regarding educational games, with the focus on planning, orientation, involvement when the students play the SG, and discussions after the game or parts of it is finished.

Third, the educator should also use educational data mining (EDM) for the outcomes of the game, finding meaningful relations in the 'big data that are logged by educational applications, [which include] techniques and (statistical) methodologies' (De Klerk and Kato, 2017, p. 33).

Finally, something that many educators and designers/developers are overlooking, is the affective side of an SG, where a student's emotional experiences are taken into consideration when designing the game. Bainbridge *et al.* (2022) have contributed to this subject in a very lengthy article, arguing

that the emotion of a student while playing an SG, contributes to their engagement and therefore to their learning processes and outcomes (Bainbridge *et al.*, 2022, p. 1 of 51).⁷ That does not mean that emotions like frustration and confusion ('negative affect') should be avoided at all costs, as these are not necessarily negative in complex learning, but 'can be beneficial to learning if managed well' and especially when it is linked to determination, curiosity, and cognitive reappraisal (Bainbridge *et al.*, 2022, pp. 1-2 of 51). The one condition is that a student must be committed, otherwise anything will demotivate them from playing the game.

There are usually three stages in the development of an SG (cf. Olszewski and Wolbrink, 2017):

- *First, the initial groundwork:* Apart from what has already been referred to, the team must determine what the learning objectives of the curriculum are. They must therefore define the goals of the SG and how the feedback and rewards will operate. Here the team must determine the needed knowledge and skills for the goals, in order for the students to reach these goals. The narrative and aesthetics of the SG should also be taken into consideration, as these features will determine the interactivity of the game.
- *Second, the programming stage:* When the programming starts, all the design elements must be combined to form definite prototypes.
- *Third, the testing stages* (therefore not only one testing stage): During these stages, the educator must map the experiences of the student/s (who form/s part of the team) as end user/s in the developing SG, while they are testing all the prototypes and must indicate what modifications should be done in the designing and developing process.

De Freitas and Oliver (2006, p. 5 of 21) argue that the educator must take care that the following four aspects are built into the design process of an SG: 1) Student specifications and the role that pedagogical approaches should play in supporting their learning; 2) pedagogic considerations (learning models being utilised); 3) the mode of representation (representing the SG itself in light of fidelity and interactivity); and 4) the context (the space/s where and how learning takes place). Chandross and DeCourcy (2018, p. 12 of 27) refer to these as '[p]edagogical design criteria' which rest on the shoulders of the educator.

⁷ Aberšek *et al.* (2020:1) have the same conviction. They argue that if an educator wants a game to reach its educational goal, it should be designed with psychological knowledge of the target group in mind, well knowing that the group who will enrol for this subject may differ from groups who enrol from other subjects – thus quite an arduous task.

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As an SG is ‘associated with experiential learning’ (Bonnier *et al.*, 2020, p. 25), Kolb (1984, p. 21) presents his experiential learning cycle (borrowed from Lewin [1946]), which is very important to keep in mind when designing and developing an SG. Kolb indicates that during the design of the SG, the educator and designer should take care that the students advance through a cycle of four stages in order to reach efficient learning: Concrete experience, observations and reflections, formation of abstract concepts and generalisations, and testing the implications of concepts in new situations. An SG should therefore be designed accordingly: Initially, to encounter novel or modified contexts (experiences), followed by processed experiences, with ‘emerging theories and knowledge constructed through reflection’ (Bonnier *et al.*, 2020, p. 25).⁸

SGs must comprise of ‘the act of designing interactive learning activities that can gradually convey concepts and guide students towards an end goal’ (Anastasiadis, Lampropoulos and Siakas, 2018, p. 141). A good SG would revolve around problem-solving with real-life situations (cf. Hung and Van Eck, 2010). This is called ‘problem-based’ or ‘application-based learning’ (Dabbous *et al.*, 2022, p. 3 of 13), as well as ‘experiential learning’ (Thompson *et al.*, 2020). Different real-life situations (augmented reality) could be recorded and presented to the students who will then have to solve the problem (meet the challenge), either in their own words or by choosing the best solution. It can then afterwards be discussed in the game or in class.

Breuer and Bente (2010, p. 13) add: ‘Contextualization, personalization and choice positively influence a learner’s intrinsic motivation, depth of engagement in learning and learning performance.’ Because SGs are also entertaining, it would prompt students to choose spending their free time engaging with these educational activities, if the design is good and entertaining.

An integral part of SGs is game learning analytics, comprising the collection, analysis, assessment, and visualisation of players’ interactions with the game (cf. Pérez-Colado *et al.*, 2021). The design of the SG should therefore be done in such a way that the educator and students will have to work together to reach a deeper knowledge of the course and obtain the best results in the game, and therefore the best learning outcomes for the students.

An SG is applicable to both face-to-face and online education as it is a game that students are playing in their own time and wherever they are. Whether the education happens in the classroom or online, the educator must be fully involved and stay on track in the progression of each student, assisting

⁸ It is important to note here that a student is responsible for their own knowledge, skills, and understanding of a subject, obtained through experience.

them, giving guidelines, answers, and/or outcomes. Very important is that an SG should not be designed to cover the general knowledge of a subject. It must target a specific area and content and thus teach the students about a specific (difficult or boring) part of the subject or curriculum (cf. Vankúš, 2021, p. 2 of 10).

The best space to create for SG interaction is a virtual learning environment (VLE) – an internet platform containing all the information about the course content and assessments as well as a space for interaction and engagement between students mutually, and between students and the educator (Gros, 2015, p. 43; cf. also Dabbous *et al.* 2022, p. 2 of 13). Communication and interaction, therefore an active engagement between the educator and the students is here of the utmost importance (cf. Priyaadharshini *et al.*, 2020, p. 469). There must be an active and bidirectional communication between the VLE and the SG, exchanging data between the two platforms (Gros, 2015, p. 43). Obviously, the way in which this communication will take place, rests in the hands of the educator in cooperation with their team. Avatars (virtual characters) can be used if necessary (cf. Chandross and DeCourcy, 2018, p. 13 of 27). The educator must keep in mind that the inherent goal of the SG is to motivate students to engage in lifelong and lifewide learning (Gros, 2015, p. 38).

What is therefore important here, is that the educator-*cum*-designer-*cum*-developer must have the twenty first-century student in mind and at heart when doing the internal design of the game, which will determine the game itself in order to totally accommodate their students and their needs in every respect (Gros, 2015, p. 40). A game must always be designed just above the skill's level of the students – called scaffolding (cf. Priyaadharshini *et al.*, 2020, p. 469) – in order to maximise their engagement and keep them challenged and engaged (Gros, 2015, p. 40; cf. also Maheu-Cadotte *et al.*, 2021, p. 2 of 10). Jalongo (2007, p. 401) explicates 'scaffolding': 'The key is to set the level of difficulty at the point where the learner needs to stretch a bit and can accomplish the task with moderate support.' The SG must contain the necessary elements 'to engage students and help them enter a state of flow where they are fully immersed in their learning environment and focused on the activity they are involved in' (McClarty *et al.*, 2012, p. 14 of 35).

Here the triangle of effective learning once again comes to the fore (Oliver, 2024, p. 5 of 10). Educator-centred teaching, as it was done during the Education 2.0 era (most educators have not yet engaged with the Education 3.0 or 4.0 era!), is not good enough anymore, as it should be *student-centred* teaching. Learning does not contain all the elements it should if it is not *interactive* learning (consisting of time, place, media, and activity), while the

pinnacle – assessment – does not serve any good if it is not *transformative* assessment. Apart from the formative, summative, or continuous assessment, transformative assessment inside the game consists, among others, of three components: Game scoring, more formal assessment, and embedded assessment (Kim and Ifenthaler, 2019, p. 4). If the educator wants to integrate an SG into this structure, the game will have to be supportive, therefore in service of every part of the triangle.

After all these rules and systems of play have been implemented, the SG should be thoroughly evaluated/tested, especially by the student/s forming part of the team, and not just be accepted on face value. Three very good criteria to evaluate a game are fidelity, verification, and validity (Fox *et al.*, 2018, p. 64; cf. also Pérez-Colado *et al.*, 2020). According to Fox *et al.* (2018, p. 64), ‘fidelity refers to the amount of realism in a simulation.’ As *fidelity* is all about the amount of realism that is present in the game, it should be created in such a way that it keeps the student engaged while also enjoying the game. *Verification*, being the quality of the technical design of the game, must be done to ensure that the simulation is working correctly and that the real-life scenarios are challenging enough. *Validation* means that the simulation/s in the game must be a true reflection of the real-life situation. There must therefore be a coherence and alignment between the simulated reality in the game and the real-life situation (Fox *et al.*, 2018, pp. 64, 66). Alonso-Fernández *et al.* (2021) aver that evaluation by means of questionnaires could also add to the quality of an SG.

Having stated all these elements forming part of the designing process, it is imperative that there should be an established and continuous dialogue and collaboration between the members of the team – the instructional educator, the game designer, the developer, and the student/s – about the objectives and learning goals of the SG (Gros, 2015, p. 41). Specific steps should be followed to get the SG in line with the framework of the curriculum and Bloom’s taxonomy (cf. Gros, 2015, p. 41). This will all attribute to a great SG.

3. Application of SGs⁹

Something we did not discuss up to this point, is the format of an SG. SGs can vary from quiz mechanics (Socratic style) to ‘educational simulations with high immersion’ (Chandross and DeCourcy, 2018, p. 12 of 27) and everything in between. All of these SGs have their own pros and cons, and every kind of game is functional within a specific environment (subject) and space. Almost

⁹ SGs are not only used for educational purposes, but are also used in the military, health, and business (Kara, 2021, p. 1 of 13).

at every department at IHEs an SG can be well implemented. Under this section, a few departments will be discussed, where it is recommended to implement an SG, while other departments, where SGs are already utilised, will serve as examples for the reader.

Theology is presented at most of the religion faculties of universities as well as seminaries (cf. Oliver, 2020). In Theology, the original languages, church history, and much academic and dogmatic wisdom are conveyed, but the practical 'church' situation, involving the congregants, field work, and church administration is neglected at many faculties. When a student arrives as a preacher in a specific congregation, they are equipped with all the academic knowledge and dogma they need to have for their church institution, but most of the time they have little knowledge, except for personal experience, about situations like divorce, early pregnancies, school or cyberbullying (Van der Merwe, 2020), adoption, LGBTQ+ congregants (Rasmussen, 2022), congregational admin, youth challenges and the youth sector of the church, and the like. They also do not really know how to become part of the management of a congregation. By 'confronting' the student with these everyday challenges in a congregation by means of an SG, it will activate their brains to think away from the academy and into their congregants' hearts. Obviously the students will have many questions, which should be directed to the educator as well as the SG, expecting prompt and direct answers from at least one of them (Anastasiadis *et al.*, 2018, p. 141).

In Pharmaceuticals (cf. Dabbous *et al.*, 2022, p. 3 of 13), experiential learning is key to mastering the basics of the subject, assisting students 'to apply taught knowledge and develop personal attributes and professional skills' (Dabbous *et al.*, 2022, p. 3 of 13; cf. also Thompson *et al.*, 2020). These form an essential part of their education as these students need to know e.g., what kind of medicine would serve the best in curing a specific illness or condition. It will also help the students to identify specific symptoms and give them the know-how on when to rather send an individual to a doctor or specialist. Dabbous *et al.* did an experiment with pharmacy students, applying an SG with two groups of students: The one group was called the 'traditional learners,' while the other was called 'game-based learners' (Dabbous *et al.*, 2022, p. 6 of 13). The second group outscored the first group effectively in all the outcomes (Dabbous *et al.*, 2022, p. 10 of 13).

Still in medicine,¹⁰ for medical students it is very important to know how to do surgery, i.e., how to 'practice manual skills in surgical specialties'

¹⁰ For an extensive review on serious games in medicine, refer to Arif *et al.* (2024),

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(Antoniou *et al.*, 2020; cf. Chon *et al.*, 2019).¹¹ Antoniou *et al.* discuss such an SG, utilising the Microsoft HoloLens VR/MR platform. Another ‘medicine’ SG: In 2012, Marchiori *et al.* (2012) initiated the First Aid Game, and implemented it in 2017 by simulating three emergency situations – unconsciousness, choking, and chest pain. Each of the different scenarios then supplies the students with relevant questions about the theme, followed by specific options to choose from – both pictures and text. These are supplemented by short video clips, showing the correct procedure/s. A score at the end of each level indicates to the players what their competency is.

For the business world, entrepreneurship education (cf. Fox, Pittaway and Uzuegbunam, 2018; Almeida, 2017) requires from the educator and their team to make use of real-world simulations, thereby modelling real-life situations to prepare the students to ‘generate their self-employment and develop key soft-skills’ (Buzady and Almeida, 2019, p. 1 of 19; cf. Fox *et al.*, 2018, p. 62). The aim is to ‘increase knowledge, improve skills, and enable positive learning outcomes’ (Fox *et al.*, 2018, p. 62; cf. Prensky, 2001). Their improvement of skills are ‘mainly in terms of innovation, leadership, strategic thinking, problem solving, business launch and risk management’ (Almeida, 2017, p. 69). Very important is to distinguish between being an entrepreneur, being a freelancer, and being a business person with a (big) company. Additionally, the student should be taught in how many different ways entrepreneurship can be executed – ‘on the streets,’ therefore actually being a street vendor, is just one small section of the entire picture.

Another SG in the business world: To enhance a business and economics curriculum, Beranič and Heričko (2022) use the ERPsim business simulation which is based on SAP ERP (systems applications and products in data processing, enterprise resource planning). They use this ERP system with real-life scenarios as an introduction to their course because in the market its ‘use is inevitable to remain competitive’ (Beranič and Heričko, 2022, pp. 1, 2 of 17):

SAP ERP...covers different business scenarios, and simulates a real business environment in which students have to make business decisions according to gathered data and collaboration between the various business roles in the company. This allows a holistic view of the business environment, which is highly desirable by the global business community.

¹¹ Sharifzadeh *et al.* (2020) report about 2,313 studies *re* SGs that are employed in the service of health education.

For science, an SG should provide simulations or experiments that students can do, without physically working with the potentially dangerous elements (Kara, 2021, p. 2 of 13; cf. Riopel *et al.*, 2019). These kinds of games must be interactive to a very high degree, showing the students what will happen when two or more elements are added together and in which portions. This will be great fun, as the explosions will happen on screen and not in real life. This is but one small part of science. In this concern, Zaki *et al.* (2020) have decided to create an SG specifically for science, technology, engineering, and mathematics (STEM) in Malaysia to get students more interested in these subjects.

For marine personnel, the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) in Los Angeles, developed CRESST (cf. Iseli *et al.*, 2010). In this game-based assessment, their reactions ‘to a variety of [real-world/realistic] emergencies that could occur on a marine vessel’ were assessed (De Klerk and Kato, 2017, p. 32), as they manoeuvred their avatars through the scenarios. The game analysed all their actions and reactions (including decisions taken, plans made to solve the situation, and prioritising of actions) in log files (De Klerk and Kato, 2017, p. 32).

From marines to airline pilots: Kuindersma, Field and Van der Pal (2016) discuss the use of high fidelity flight simulators for prospective pilots.¹² During the late 1980s, the ‘fourth generation’ of airliners was introduced, having ‘automated systems and flight envelope protection’ (Kuindersma *et al.*, 2016, p. 1 of 9), prompting a significant change in the training of pilots and therefore opening the door for an SG to be implemented in the process. The most significant change was the ‘increased amount of automation in the cockpit’ (Kuindersma *et al.*, 2016, p. 1 of 9). Due to the reliability of these systems, ‘pilots are very rarely subjected to a situation where they must intervene manually,’ requiring from the game to not only test the pilot’s manual skills, but also their cognitive skills (Kuindersma *et al.*, 2016, p. 1 of 9).

Bonnier *et al.* (2020, pp. 26-31) discuss ‘The Project Management Game’ (being developed by the Media Engineering Institute in Switzerland), having a ‘project manager’ who, together with their group, grapple with a project. The educational concepts found in this game, are computer-based simulation, real-world role-playing, and teamwork. The game is based on Kolb’s experiential learning theory, being discussed above. The students are formatively assessed in the game, and summatively assessed through a written report, which both determine their grading.

¹² Cognizance is taken of the view of Hall, Watson and Kitching (2017, p. 2 of 16) who argue that a simulator is not an SG because they feel that a simulator replicates a real-life situation, whereas an SG is a ‘*form of escapism with an underlying altruistic intention*’ (original emphasis).

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Still in management, López *et al.* (2021) discuss the SG, Lego® Serious Play® (cf. also Zenk *et al.* 2018). This game is widely used because it recognisably improves students' motivation, as well as their attention and their empathy during the game (López *et al.*, 2021, p. 2 of 13).

Karthan *et al.* (2022) discuss a game that was created for the pandemic in Germany, called PeterPandemic. In this game the student learns how pandemics spread, as well as how to manage a pandemic situation. It is a multi-player game, where each student gets a specific role in a specific country with a pandemic situation (Karthan *et al.*, 2022, p. 161). Team members have the opportunity to discuss the pandemic with each other before they complete their personal part on the game.

Hügel and Davies (2022) have engaged themselves in the development of an SG to teach young adults about climate adaptation planning in Dublin, Ireland. They used the iAdapt game as the capstone component. This game is now available on the internet (Climate Smart, n.d.). The aim of this SG is to help students (and other adults) 'to understand and engage with the complexities, uncertainties, and processes of climate adaptation planning by using scientifically validated flood data predictions, grounded in a place-based setting and with diverse examples of diverse adaptation interventions...in this way integrating real-world flood data with gamified elements' (Hügel and Davies, 2022, p. 306).

SGs that are available on the internet are Meister Cody (helping children with Maths and reading) (Meister Cody, n.d.), Exercube (games for health and fitness) (ExerCube, n.d.), World Geography by Atom Games (including USA Geography and German quiz game; Socratic games for Geography) (Google Play, n.d.), MATH by Atom Games (helping people with Maths) (Google Play, n.d.), Animal Kingdom (helping people with animals) (Google Play, n.d.), FLIGBY (mostly for entrepreneurs – Buzzady and Almeida, 2019, p. 1 of 19).¹³

These SGs serve as examples and motivations for the reader to let their minds go on what they could accomplish. Although we are talking about an arduous task, the satisfaction afterwards outscores all the efforts being put in.

4. Money-Time-Satisfaction

As referred to in the introduction, the disruptive bridge to cross in the invention or creation of an SG is the time-and-money bridge, as this project is really cost

¹³ That article serves as a very handy tool for educators to learn more about FLIGBY and all its characteristics and advantages.

intensive and time consuming (De Klerk and Kato, 2017, p. 33). These two commodities are the first two points on the agenda of the team who wants to design a game. To set up and decide on an amount to support the design of the SG, requires a long discussion within the team. Having decided on an amount, the burning question is if the IHE where the educator is working, will be willing to release financial support for this project. Do they have enough funds for it, and do they believe that this will really serve the broader goals of the university? If the outcome is negative, then there is still the corporate market. Here the team will have to make a presentation and make sure that it serves the (big) company's goals, aims, and objectives. Fortunately the private sector mostly has enough money for endeavours like these; so hopefully the team will not leave empty-handed (cf. Hall, Watson and Kitching, 2017, p. 12 of 16).

The glorious and accommodating 'quiet waters' are called satisfaction and student-centredness. The educator must keep in mind that this is the twenty first century in which we are living, inside the environment of the 4IR and Education 4.0, going for Education 5.0. The creation or adaptation of an SG really needs commitment from the educator, well knowing that money – financial support – will play an active role in the creation of the SG, accompanied by the absence of money (for the educator), getting no incentives for being part of the designing of the SG. Despite these drawbacks, the devoted educator will stay on their mission and make the most of it. The satisfaction after the SG is completed, is worth much more than the incentives that would fill the pocket.

5. Conclusion

To design an SG is a big project with many challenges. It requires commitment and perseverance, the power of conviction, and lots of patience. The educator will not always have their way, as their 'colleagues' are a designer, who has a will of their own, a developer who has an own image of the game in their head, and a couple of students who think quite differently, actually disruptively – hopefully outside the box. However, this strange 'mix' of personalities, wills, and ways of thinking, will precisely add to the success of the planned SG. The members will have to find common grounds among each other, work together for the greater good, AND make it worth the while for all parties. Afterwards, the educator will most probably have a long-life friend (enemy?) in both the designer and developer, and a student who will definitely do post-grad studies.

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It also needs to be stated that in this article no reporting checklists are applicable. The writer of this article did not use AI or an LLM to write this article or correct it.

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