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Serious Games in Service of Higher Education

Abstract

This article presents the reader with the concept of serious games. Definitions are given and the different kinds of games are discussed. Being in a country like South Africa where this concept still needs much introduction, this article serves as an outline for the reader about the application, utilisation, and execution of a serious game within an institution of higher education. Student-centredness and a new approach to curriculum are central to this article. From the article it becomes clear that the students do not have a problem with this. However, the challenge is the educators and institutions of higher education, stuck in the old ways of teaching and learning.

Keywords

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

1. Introduction[1]

Since ancient times, people are playing games, of which all of them were not only recreational by nature. According to Vankúš (2021, 1 of 10), the Hellenistic philosophers, Plato (428-348 BCE) and his student, Aristotle (384-322 BCE) devised the idea of educational games. We find it in Plato's *Timaeus* (Archer-Hind, 1888) and Aristotle's *Ethics* (Aristotle, 1999). During the early second century, Varro, called 'Rome's greatest scholar and a satirist of stature' (Brittanica: The editors of encyclopaedia, n.d.), wrote a book, *De lingua Latina* (*On the Latin language*). In this book (*De lingua Latina* 10.22 – Varro, 1938, p. 551) he referred to *Latrunculi*, which was a strategic war game between two players on a board with a grid of variable size – maybe the precursor of chess?

The term 'serious game/s' (SG/s) originates from Clark Abt in 1975 from his book with the title *Serious games* (Clark, 1975).[2] From the 1980s onward, scholars have started to deliberate about using games for educational purposes (cf. e.g., Malone, 1981; Kafai and Chin, 1996; Prensky, 2001) and wrote about the positive effects that SGs, specifically role-playing games, have on student outcomes (Yu, Gao, and Wang, 2021).[3] These effects include that

- students could be more engaged in the learning process[4] by playing educational games (cf. Gee, 2003);

[1] Cf. Yeşiltaş and Cevher (2022) for a good bibliography on educational articles about digital games between 2005 and 2021. The indication is clear that this is regarded as a very interesting object, as there were at least 760 articles written during that time (Yeşiltaş and Cevher, 2022, p. 40). In 2019, Ioniţă *et al*. demarcated it to 'the last decade' (Ioniţă *et al*., 2019, p. 270).

[2] At that time, Abt only had card and board games with educational purposes in mind (Brook, 2018, p. 1 of 8).

[3] Zhonggen (1919) has done a literature review on the ten years covering 2010-2019 and has reached the same conclusion.

[4] To define 'learning process' seems irrelevant, but is in fact imperative here, especially as an SG represents a 'new way' of learning. The learning process does not mean that this is a collection of knowledge, or that knowledge has been acquired or that is was transferred from one source to the student. The process in fact takes place where a student discovers inconsistencies between what is

- it would help students in the process of problem solving, make them more goal oriented, and give them more motivation to study (cf. Prensky, 2010);
- games would help students to think more strategically, giving them more cognitive skills (cf. Arnseth, 2006);
- games would also boost the students' constructive, situated, and experiential thinking (cf. Squire, 2008); and
- games generate a better comprehension of complex settings in the learning process (Gros, 2015, p. 36).

Although SGs were, according to Gheorghiţă and Anghel (2016, p. 222) initially created as experiments applied to corporate institutions[5] and certification authorities, the late 1990s saw an acceleration in academic interest in these games, with 2002 as the initiation of the Woodrow Wilson sponsored *Serious Games* initiative, launching their first Serious Games Summit in 2004 (Gros, 2007, p. 24; cf. Wilson Center, n.d.).[6] This has led to a huge interest in educational gaming by both educators and students as it became a promising method 'to achieve the active participation of students in learning activities and their higher motivation' (Vankúš, 2021, p. 1 of 10) with mostly very positive outcomes (Kim *et al*., 2022, p. 8; cf. also Clark, Tanner-Smith and Killingsworth, 2016; Noroozi, Dehghanzadeh and Talaee, 2020; Alonso-Fernández, Martínez-Ortiz and Caballero, 2019, p. 1). In 2020 the SG market was valued at $5.94 billion, and it is 'projected to reach $32.72 billion by 2030' (Vikas and Vineet, 2022), with a global growth rate of 22.4% (Brook, 2018, p. 1 of 8).

The arrival of COVID in the world (2019/2020 onward) caused a positive impulse for the implementation of serious gaming, as the in-person classroom had to make way for the virtual classroom, either by means of synchronous learning (where the educator has at least one

represented to them in a curriculum and their own experience, channelling the student to alter their personal conceptual model, not implying that it is a correct change, but 'the most viable one' (Drosos *et al*., 2018, p. 2).

5 SGs are still applied in the business world today (Brook, 2018, p. 1 of 8).

6 Sipiyaruk *et al*. (2021b, p. 1 of 15) claim that 2018 started the 'increase in the use of serious games,' specifically for dental education.

contact session with the students, be it live or by means of a video conference or a webinar) or asynchronous learning (where the students can view all the instructional materials in their own time, but mostly without a live and interactive video lecture) (cf. Scheiderer, 2022). The situation made many educators more attentive to add something more to their curriculum, like an SG (cf. Sipiyaruk ***et al***., 2021b, p. 1 of 15). Within the technology enhanced environment, in which (mostly) the students (excluding many educators) are moving, and with the evidence of many successes in this field, the path was seemingly paved for SGs to become part of all curricula. However, it did not, as will be evidenced from this article.

The twenty first-century students (called a 'new generation of digital natives' by Lampropoulos, Anastasiadis and Siakas, 2019, p. 119) 'are seeking for more fun, interesting, motivating, engaging and interactive learning environments and experiences [as] they are no longer satisfied with and attracted by traditional educational methods' (Lampropoulos ***et al***., 2019, p. 117). The reason is that, from birth onward, they were/are influenced by the digital era and used to learn in unconventional ways, being exposed to rapidly flowing digital information, mostly obtained from the internet. As they grow up in flexible communities, they need prompt responses in an environment of social interaction, and love to learn by experiencing things (Lampropoulos ***et al***., 2019, p. 117). It is therefore obvious that their way of thinking and learning has changed rapidly, prompting the educator to act likewise (discussed below). This could be the reason why the field of SGs 'has shifted its focus from the connection of games and tangible skills like knowledge acquisition or concept understanding, to more intangible learning outcomes such as the development of 21st-century skills' (Kailani, Newton and Pedersen 2019, p. 1128),[7] linked to 'proactive learning by involving [students] in an immersive learning experience where they can apply their knowledge, learn from experience, and test complex or risky scenarios in a safe environment' (Alonso-Fernández ***et al***., 2021, p. 1 of 17). These skills include critical thinking and problem-solving, creativity and inter-activity,

[7] Kailani *et al*. (2019) have done a very good systematic review of the literature about SGs from 2008-2016.

communication and motivation, and collaboration. Doing this, the educator is (should be) teaching their students to 'meet the demands' of the twenty first century in order to adapt to the demands of a new era (Kim and Ifenthaler, 2019, p. 3). The main objective of an SG is therefore education (cf. Michael and Chen, 2006, p. 287; Drosos et al., 2018, p. 1 of 5).

However, when many academics/educators (even nowadays, specifically in South Africa) hear or see the term 'serious games,' they immediately overemphasise the 'games' part and associate it with 'children' and recreation. Here, the term 'serious' anyway does not make sense for them, as games are *just played for fun* ('a playful activity' – Almeida and Simoes, 2019, p. 121; Gros, 2015, p. 45), competition, and with light-heartedness. With both perceptions they are mistaken. First, statistics show that games, especially digital games, belong to the environment of adults. According to Jovanovic (2022), there are 3.24 billion serious[8] gamers on Earth, with the average gamers' age at 35 years(!), while the next group is in their 40s – with the male-to-female ratio very close to 50/50%. Jovanovic (2022) adds an interesting fact about people who are even older than these two groups: '[T]he crowd that witnessed the rise of arcades is still gaming to this day, too' – they are the so-called baby boomers.[9] Second, the term 'serious' is linked to 'games' in order to indicate a specific kind of digital game: Those that are used for educational purposes (it is therefore not only fun, but also serious stuff – cf. Sipiyaruk *et al*., 2021b, p. 2 of 15), with continuous education, training, and assessment ('where assessment and training are two sides of the same coin' [De Klerk and Kato, 2017, p. 34]) in focus. Nevertheless, these games, containing continuous training and assessment (Sipiyaruk *et al*. [2021b, p. 2 of 15] call it 'permanent assessment') are linked to some kind of recreation, and definitely have an element of fun in it.[10] The element of fun is

[8] The term 'serious' is used on two levels in this article: First, a 'serious' gamer is someone who indulges in games on a daily basis; second, 'serious' games are games designed for academic purposes.

[9] These are people born between 1946 and 1964 (Investopedia Team, 2022).

[10] Gros (2015, p. 45) wrongfully argues that a player plays for fun and not to learn. This may be partially true, but when one enjoys an educational game, the learning

actually a very significant factor as it acts as an important incentive for learning, which is mostly not present in the usual learning process (De Klerk and Kato, 2017, p. 34).

Well, why combining fun with education and training? This is what this article wants to explicate while discussing SGs in service of higher education (HE). SGs can really make education and training fun, called an 'excellent experience' by Anastasiadis, Lampropoulos and Siakas (2018, p. 139), arguing that an SG 'comprises an intense learning experience in which the participants voluntarily invest a lot of time, energy and commitment, while concurrently deriving great enjoyment from the overall experience.' Pérez-Colado *et al*. (2021a, p. 164) add to this: 'SGs provide immersive learning environments, where risky or complex scenarios can be tested in safety while keeping players engaged.'

The addition of serious gaming to one's curriculum and teaching strategy stands in glaring contrast to the 'old way' of teaching, which was educator-centred, also referred to as 'parroting.' In the past, and still in South Africa, many educators are not really teaching their students in an effective way as they are still mostly parroting them. The students have to know a certain amount of facts by heart in order to pass the grade or obtain the certificate, diploma, or degree. In most instances, they also have to be of the same conviction about 'facts' as the educator. No real learning therefore takes place, not to mention deep learning (discussed below). Parroting goes hand in hand with a 'surface approach' (Platow, Mavor and Grace, 2013, p. 272) where teaching just becomes a form of a 'mechanistic transfer' from the educator or the text to the student (Platow *et al*., 2013, p. 272). This prompts a student to just do enough to please their educator in order to pass the year. This kind of approach mostly do not produce good outcomes as it does not help the student to better understand the subject and its relevance, or change the student or their outlook on the subject and its content. Both parroting (educator) and the surface approach (student) are detrimental to lifelong and lifewide learning and

part comes automatically with it. With every game one learns something and remembers it for a long time.

in fact to the student's development (cf. Priyaadharshini *et al*., 2020, p. 468).

Whereas many educators in South Africa oppose the implementation of 'games' in their curriculum, the best solution to this challenge could be to give SGs another name. As it is all about training and continuous assessment and as it takes place within the environment of technology enhanced learning (TEL), we could maybe call it 'technology enhanced training and assessment.' However, for the purposes of this article and because the term 'serious games' is used worldwide, I will keep it that way. Let us now look at a short overview of the different stages of education up till now.

2. Education 1.0 to 4.0

The four stages of education are also called four paradigms by Almeida and Simoes (2019, p. 122), linking it to the emergence of information technology (IT), specifically over the past 20 years (cf. Demartini and Benussi, 2017). During Education 1.0, assessment was mainly done orally and only sometimes in written form. It was done in an authoritarian way (educator-centred) with the students being the passive recipients of information – receiving, responding, and regurgitating (parroting), therefore being receptacles of the knowledge transferred to them (Makrides, 2019). Education 2.0 presented the students with projects done in groups, using certain technologies, thus communicating, connecting, and collaborating with each other (Makrides, 2019). The exams were the pinnacle, depending mostly on hours of teaching, instead of hours of learning (Makrides, 2019). According to Makrides (2019), most education done currently has stuck here, aiming to reach the likes of Education 3.0 somewhere in the future.

Social networks were key to Education 3.0 where it was implemented, as students started to move outside the boundaries of their prescribed courses. Educator-centred education started to make way for student-centred education (defined below). Self-learning started to take place, as the educator became the coordinator, facilitator, and advisor inside the environment of a flipped classroom (Makrides, 2019).

In the current Education 4.0 era, many educators adapt and customise learning models to fit their students best, with artificial

intelligence (AI) emerging strongly (cf. Popenici and Kerr, 2017). To this, Shahroom and Hussin (2018) add virtual reality (VR), augmented reality (AR), and the internet of things (IoT). This 'paradigm' (as was the case with its predecessor) moves away from educator-centred (passive student) teaching to student-centred (active, engaging student) teaching (Almeida and Simoes, 2019, p. 122), where the educator is no longer the 'sage on the stage,' but the 'guide on the side' (King, 1993), being 'the facilitator of skills development, with a greater focus on higher-order thinking skills such as analysing, synthesis, application of knowledge and problem-solving' (Pascoe, 2022). This takes place inside the environment of the Fourth Industrial Revolution (4IR), which does not only impact and change what we do, but also change who we are (Pascoe, 2022). Student-centredness is therefore key, with the classroom (one-on-one or virtual) as environment where skills are developed, while learning takes place everywhere else.

Despite all these novelties, despite the declaration by many educators that they now have implemented student-centred education, teaching and learning are mostly (specifically in South Africa) still stuck in Education 2.0, as the parroting mostly did not stop. So, right through all these 'paradigm shifts,' many educators clung on to educator-centred education. Whereas these 'paradigm shifts' should affect the role of the educators and the students, this is still a pipe dream in most institutions of higher education (IHEs) in South Africa.

3. South Africa's current Situation

Why should SGs make their appearance in the classroom (in-person or online) and why is it necessary? It came as a novelty in line with the 4IR and Education 4.0 (E4.0) (Almeida and Simoes, 2019) to bring innovation and even disruption to the classroom – a new way of teaching and learning, in fact of deep learning (see below). Digital game pedagogy (teaching with the assistance of an SG – cf. Becker, 2021, p. 3 of 4) is necessary because most classrooms still display a very old method of teaching and learning (called 'monotonous based teaching techniques' by Priyaadharshini *et al.*, 2020, p. 468), mostly by means of parroting, with almost no personal research or deep learning done, and therefore no real learning. In fact, for the past 200 years, this

method of education did not really change in the classroom. Gous (2022, p. 215; cf. also Caruth and Caruth, 2013, p. 12) describes this situation fittingly:

> [R]esistance to change has also always been part of our world. The 'better the devil you know than the one you don't'-syndrome often kept people, societies, and industries in their comfort zones. Education in general and…higher education in particular are prime examples…The classroom of 2022 and the classroom of 1922 and 1822 looks disconcertingly similar, with the guiding pedagogies inside the classroom also fairly comparable.

There are at least three 'good' reasons why IHEs, specifically in South Africa, are presenting a '200-year old classroom environment' (both in-person and online) to their students: First, as Gous states, the resistance to change is always present; second, it takes much hard work with the investment of many hours to create a new curriculum, especially when an SG is incorporated; and third, the educators are not schooled in the creation and presentation of SGs or student-centredness, therefore being naturally biased against it. In many cases, because of ignorance, the educators in South Africa are sticking to the old ways of presenting their courses, an ignorance on at least three levels: 1) Many of them do not even know of the existence of SGs; 2) the educators think that games are not fitting for adults (therefore an ignorance about the age of game players worldwide); and 3) most of them think that an online course just equals paper behind the glass – just putting their normal (educator-centred) courses online (cf. Ncube, Dube and Ngulube, 2014, p. 360).

On quite another level, an additional reason why many educators and even IHEs would not like to incorporate SGs in their curriculum, is the shortage or non-existence of Wi-Fi or bandwidth among many students and even some educators in South Africa. However, already in 2013, Rhodes University started with a project to connect the 'Eastern Cape with the rest of the world' (Rhodes University, 2013), enabling their students to have Wi-Fi and to connect. During the lockdowns, the government of South Africa went in partnerships with smart phone service providers like Vodacom, MTN, and Cell C to

provide 'zero-rated[11] applications and educational websites' to, among others, IHEs (Mhlanga and Moloi, 2020, pp. 5-6 of 11). Students from various universities made use of this concession, many of them getting free electronic readers from their IHEs (Mhlanga and Moloi 2020, p. 6 of 11). There were, however, still students who did not have access to a smart device or had broadband problems (Mhlanga and Moloi 2020, p. 6 of 11), but they constituted a minority.

4. Terminology[12]

Already in 1950, Huizinga (1950:28) has defined the broad term 'game' as 'a voluntary activity or occupation executed within certain fixed limits of time and place, according to rules freely accepted but absolutely binding, having its aim in itself and accompanied by a feeling of tension, joy, and the consciousness that it is different from ordinary life.' Becker (2021, pp. 1-2 of 4) elaborates on this, stating that a game has the following properties: It is interactive, has rules, has one or more goals, has a quantifiable measure of progress (or success), and has a recognisable ending.

With this in mind, let us take a look at the distinction between different key-terms in the gaming industry. Let us first look at the different kinds of games. Roedavan *et al*. (2021, p. 292) distinguish four types of games:

- SGs – educational games, using game-based learning[13] with an assessment component.
- Digital games – played for pure entertainment.
- Non-digital games – traditional board games.
- Non-game context – gamification, using game elements in non-game contexts (also cf. Deterding, 2012).

[11] An application/website can be defined as 'zero-rated' when the mobile operator to whom it belongs, does not add up user's data per month. Effectively this means that the user is using it for free (ITWeb, 2020).

[12] One cannot refer to 'SGs' and 'digital game-based learning' without a reference to Prensky, who can be regarded as the father thereof (cf. Prensky, 2001).

[13] For a good article on game-based learning, see Priyaadharshini *et al*. (2020).

Some scholars use the terms 'gamification' and 'simple games' when they in fact refer to SGs (cf. Ioniţă *et al*., 2019, p. 270; Gros, 2015, p. 39), while others refer to it as 'training games' (Salvador-Ullauri *et al*., 2020, p. 1 of 15), 'edutainment,' and 'edugames' (educational games) (Brook, 2018, p. 1 of 8). Whereas the mentioned terms are only fitting a part of the picture of SGs, gamification in fact refers to a *method* used to play a game, just like digital game-based learning (DGBL) (Roedavan *et al*., 2021, p. 292). Gamification is therefore something different: It does not need any digital devices, as it acts as a support to learning processes, using game mechanics like competitions, narratives, and achievements (coupled with levels, stages, and rewards) within a specific environment to enhance the teaching method (cf. Wiggins and Simkowski, 2014, p. 2050). Kapp (2012, p. 12) defines gamification as the 'careful and considered application of game thinking to solving problems and encouraging learning using all the elements of games that are appropriate' within a non-game but *funlike* scenario. Shortly stated, it is 'the use of game elements in non-game contexts' (Roedavan *et al*., 2021, p. 292). Gamification is therefore an umbrella term including a bunch of instructional activities using game elements in a non-game locale (Chandross and DeCourcy, 2018, p. 1 of 27). The main purpose is to motivate the students more and get them more engaged (Gros, 2015, p. 39).

In DGBL, which is the 'theory of how learning happens' (Becker, 2021, p. 3 of 4),

> game mechanics…(the components of a game that are strategically implemented by the development team…to achieve a playful experience)…and learning mechanics…(the components of a game that are strategically implemented by the development team to achieve a…learning activity)…define the interactivity possibilities between the player and the game [–facilitating] the design and development of DGBL activities[14] (Patino, Romero and Proulx 2018, p. 1 of 4).

[14] Learning theories are sustaining these mechanics. These are thoroughly discussed by Patino *et al*. (2018).

The mechanics are the forerunners to game dynamics, which are the interactions between the gamer and the game (in light of the game and learning mechanics).

With reference to digital games: If a digital game is only presented for entertainment, we call it an entertainment game; if the game is implemented to teach students and it has features outside of entertainment, but does not have an assessment component, we call it an educational game, also called a game for learning.[15] If this game also has a training and assessment component, then it is called an SG.[16] Michael and Chen (2006, p. 16) define 'SGs' as those games 'in which education (in its various forms) is the primary goal, rather than entertainment.' Maheu-Cadotte *et al*. (2018, p. 1 of 7) argue that '[s]erious games…are interactive and entertaining digital software with an educational purpose [– engaging a student] by proposing challenges and through various design elements.' Girard, Ecalle, and Magnan refer to SGs (calling it video games or educational computer games) as 'effective learning tools' (Girard *et al*., 2013, p. 207), referring to Annetta *et al*. (2009), thereby indicating that this is no new form of learning, at least not for certain countries. According to them, 'multimedia technologies [experienced a] rapid growth' for already 20 years (Girard *et al*., 2013, p. 207). What lacks from these definitions is that training and assessment are not explicitly indicated.

Certain scholars like Caserman *et al*. (2020) divide the term 'SG' into 'serious' and 'game' and then argue that the presenter of an SG must find a balance between the two terms in order to present a good game. The 'serious' part, according to them, describes the goal of the game (i.e., learning and training) and the method to achieve that goal (including a check on the correctness of all the facts, as well as a good feedback to the player – this is called game learning analytics [Pérez-

[15] Becker (2021, p. 3 of 4) argues that the term 'educational game' is too narrow and should be replaced with 'game for learning.' Her reason is: 'Educational game typically implies a game used in a formal educational setting, whereas games for learning can include professional development and informal learning as well.'

[16] An SG should not be developed as a *black box system*, where only the results (scores) of the assessments are indicated, thereby 'limiting its educational usefulness' (Pérez-Colado *et al*., 2021, p. 164).

Colado *et al*., 2021b, p. 1 of 8]). This also includes a quality check of the game (focus on its effectiveness) (Caserman *et al*., 2020, pp. 4-5 of 14). The 'game' part consists of the 'core elements for appropriate game design and suitable interaction technology' (Caserman *et al*., 2020, p. 6 of 14). This includes engagement and experience as well as social interaction as part of the enjoyment of the game. The 'game' part also includes a media presentation, focused on attractive graphics and appropriate sound effects (Caserman *et al*., 2020, p. 6 of 14). Ter Vrugte (2016, p. 2) adds the obvious part, namely that it contains game-characteristics, combined with instructional elements, providing a medium for high quality cognitive learning, offering the student some interactive decision-making in a safe environment where they can analyse their own decisions and assess the effects of the decisions they have made. This gives the student a feeling of control, competency, and situatedness, adding to the motivation of the student to study.

To find a balance between all the abovementioned elements, the presenter must embed the goal of the game into the gameplay by relating the game elements to the learning tasks. Interaction is very important and the learner must be and feel involved the whole time (Caserman *et al*., 2020, p. 8 of 14).

My emphasis will purely be on SGs, in fact acting as an umbrella term which includes educational games and simulations (cf. Brook, 2018, p. 2 of 8). The term 'game' can be regarded as anything in which a person engages themselves for the purpose of fun and amusement. The term 'SG' describes a game-based initiative focused on education[17] (academic and industrial, including both training and assessment), using a component of entertainment (Anastasiadis *et al*., 2018, p. 140), with the aim to achieve better learning outcomes for students (Maheu-Cadotte *et al*., 2021, p. 2 of 10; cf. also Ter Vrugte, 2016, p. 2). It uses the pedagogical approach ('teaching and learning method' – Vankúš, 2021, p. 1 of 10) of DGBL (cf. Roedavan *et al*., 2021, pp. 291-292; Anastasiadis *et al*., 2018, pp. 139, 141; Yusoff bin Syed Hussain, Hoe and Zaffwan bin Idris, 2017), being described by Lampropoulos *et al*. (2019, p. 117) as the 'connective bond between interactive

[17] Chandross and DeCourcy (2018, p. 5 of 27) refer to it as 'serious educational games.'

entertainment and serious learning.' This happens in an interactive student-centred learning environment where 'students' mental and psychological wellbeing and soft skills are cultivated in a dynamic, entertaining and creative manner' (Lampropoulos *et al*., 2019, p. 117). In a sense, an SG permits escapism, but unlike a book or social media, it is 'immediately interactive' (Hall, Watson and Kitching, 2017, p. 2 of 16).

The game mechanics of SGs can be divided into two parts, namely game attributes and game elements. The game attributes create the player's interest in the game, consisting of the rules and goals of the game, and competition. The game elements are motivational stuff like rewards, badges, levels, and trophies, adding to the player's 'accomplishment and satisfaction' (Dabbous *et al*., 2022, pp. 1-2 of 13).

DGBL 'focuses on the development of games that are designed with specific learning objectives in mind' (De Carvalho and Coelho 2022, p. 1 of 4), therefore linking interactive entertainment with academic learning. In other words, DGBL refers to 'the use of digital games with educational value, that is, games for learning and educational purposes' (Oliver, 2018, p. 3 of 8), using a digital device like a smart phone, tab, laptop, or even desktop to play it on.[18] Boeker *et al*. (2013) like to call it 'game-based e-learning,' while Gomez, Ruipérez-Valiente, and García Clemente (2022, p. 1 of 23) refer to this as game-based assessment (cf. also Kim and Ifenthaler, 2019).[19]

4. Why Serious Games?

For a twenty first-century student who lives in the environment and inside the space of the 4IR, parroting and educator-centred education are totally outdated, as 'they are seeking for more interesting, fun, motivating [games] and…prefer learning based on experiences' (Anastasiadis *et al*., 2018, p. 139). They want to be directly connected to each other and have social interaction, and they want prompt

[18] Making it more complex than it really is, Roedavan *et al*. (2021, p. 291) refer to SGs as 'applied games,' defining it as 'a digital game applied in serious fields such as education, advertising, health, business, or the military.'

[19] For a more recent literature survey on digital game-based assessment, see Gomez *et al*. (2022).

responses on their inquiries. It is obvious that the students' 'way of thinking, their concept of effective learning as well as their educational needs and requirements have drastically changed' (Anastasiadis *et al*., 2018, p. 139). Obviously, an individual concentrates more and absorbs more information when enjoying and playing an educational game, than being involved in parroting or reading a book.

Looking at the current situation, there is a significant divide between the traditional educator and the twenty first-century student:

Table 1: Difference between traditional educators and twenty first-century students

Traditional Educators	Twenty First-Century Students
They are stagnant, thinking that they have learned things this way, so it is best for their students as well.	They are 'disruptive' and look for new ways to do things.
Resistance to change.	Resistance to remain the same.
It takes much hard work and many hours of precious time to create a new curriculum, not to mention an SG.	Spend many hours of precious time and hard work to get acquainted to a new game or situation.
Educators are not schooled in the creation and presentation of SGs, therefore being naturally biased against it.	Students are not schooled in playing digital games, so they school themselves to enjoy and master it in full.

During the lockdown periods of COVID-19 when most IHEs changed to online education in order to just keep going (cf. Mpungose, 2020), the space was created for the educators to present real online courses, but because it would take far too much time to do so in these circumstances, they just presented their courses 'as is' online. Despite the fact that many IHEs boasted that they are now presenting their courses online, it is actually only 'paper behind the glass.'

So, why SGs? Almeida and Simoes (2019, pp. 121, 124) declare that 'serious games in an educational context promote the development of skills and abilities through immersive experiences, [while offering] a significant number of benefits, such as making players feel responsible for success according to their actions, combining high-quality content, showing great involvements, and turning errors into learning elements.' According to Anastasiadis *et al*. (2018, p. 139), '[s]erious games offer motivating and engaging experiences, interactive learning environments and collaborative learning activities[, putting students] in a position of conflict and confrontation as they often have to compete or cooperate with each other [within] a constructivist learning environment.' All of these take place in a virtual and safe environment (Anastasiadis *et al*., 2018, p. 141). On quite another note, Hall, Watson, and Kitching (2017, p. 2 of 16) indicate that SGs 'permit escapism,[20] and offer environments in which players feel comfortable to explore complex challenges and situations safely…without experiencing social stigma.'

I have indicated above that there are many points of contact between teaching and learning on the one hand, and SGs on the other. Chandross and DeCourcy (2018, p. 2 of 27) refer to it as 'elements core to higher education,' which include working in groups or teams, social connectedness and planning, decision-making, and resourcefulness. These 'core elements,' if recognised by the educator, are part and parcel of SGs and will therefore enhance both the teaching and learning process. Gee (2003, p. 23) argues that educational gaming provides semiotic domains which are then shared by groups of students ('affinity groups') who share with each other their acquired 'knowledge, skills, tools and resources' (Gros, 2007, p. 30). This way of gaining resources from fellow-students or -groups, accelerate learning and problem solving. This is a good example of active learning and brings the students to the point where they find themselves *encapsulated* inside a subject.

An SG, being in fact (based on) continuous training and assessment – consisting of 'high-engagement learning' (Chandross and DeCourcy, 2018, p. 2 of 27) – can very easily replace many formative

[20] 'Escapism' is the 'tendency to seek distraction and relief from unpleasant realities, especially by seeking entertainment or engaging in fantasy' (Pinterest, n.d.).

and summative assessments and assignments, making life much easier for both students and educators. Especially for the student, SGs are much needed, as learning and assessment, be it formative or summative, 'are not yet aligned' ('well integrated' – Kuindersma, Field and Van der Pal, 2016, p. 2 of 9) because most students do not find it enjoyable to do a test or exam, thereby experiencing test anxiety (De Klerk and Kato, 2017, p. 34). Shute (2011, p. 503; cf. also Sipiyaruk *et al*., 2021b, p. 2 of 15) refers to educational gaming assessment as 'stealth assessment' because students are not really aware of the fact that they are assessed while enjoying the game.

Pérez-Colado *et al*. (2021a. p. 165) warns against developing an SG as a *black box system*, where only the scores for assessment are given, without any discussions or corrections. The required assessment can be referred to as game-based assessment (cf. Kato and De Klerk, 2017, p. 1). Game-based assessment is interactive and can make use of role playing (also called 'fantasy'), providing 'more meaningful and authentic…contexts for assessments through interactive immersive environments' (Kato and De Klerk, 2017, p. 1) – called a 'white box evaluation' by Pérez-Colado *et al*. (2021a, p. 165). This kind of assessment normally reduces a student's test anxiety[21] 'through a "stealth" approach,' where the student's behaviour is inconspicuously logged – giving them a chance to act more spontaneously – rather than explicitly asking them to self-report their knowledge in a written test (Kato and De Klerk, 2017, p. 1). According to Kato and De Klerk (2017, pp. 1-2), 'assessment methods that rely on non-verbal indices of certain constructs…have greater predictive validity compared to self-report measures…These skills and constructs include competencies that have been identified in various domains as important for success in the "real world".' Real-world competencies include decision-making, creativity, leadership, critical and strategic thinking, and teamwork. SGs therefore have the 'potential to reveal [k]nowledge, [s]kills, and [a]ttributes…of students that are "invisible" or hard to detect when assessed with more traditional assessment methods' (De Klerk and Kato, 2017, p. 32). Another advantage that assessment through SGs has, is that one

[21] It is well-known that test anxiety negatively influences a student's assessment performance (Kato and De Klerk, 2017, p. 2).

assessment is immediately linked and compared to all the others already being done on the system, having a data base ('user data') of each student.

In SGs, authentic alignment[22] is (or should be) the 'core determinant,' being the 'coherent and explicit linking of educational practice to established educational theories with a view to improve the quality of outcomes of training' (Chandross and DeCourcy, 2018, p. 2 of 27; cf. Macht and Ball, 2017). With this 'tool' in hand, the student is able to enter real-life situations in the game and determine the outcome/s of each.[23] It is also important to take note that the presentation of SGs for a specific subject in most cases draws students to that subject and eventually changes their attitude positively towards the subject (Vandercruysse, Vandewaetere and Clarebout, 2012).

6. The Elements/Characteristics/Advantages of Serious Games[24]

Roedavan *et al*. (2021, p. 294-295) distinguish four integral elements of an SG, depicting a player's engagements on the level of affection, behaviour (motivation), and cognition, complimented by a social/cultural level. On the level of behaviour, students are emotionally involved and change their behaviour to indulge in this learning experience (cf. also Beranič and Heričko, 2022, p. 2 of 17); second, the behavioural aspect necessitates the students to become curious and have a will to survive in the course; third, on the cognitive level, the students experience the content of the course from another angle; and lastly, if a game has a social or cultural aspect, it would pave the road for cooperation and collaboration, even for competition, and pose a familiarity with its environment to the student.

[22] This term was 'evolved' by Macht and Ball (2017), who wrote an entire article dedicated to authentic alignment (cf. Macht and Ball 2017, p. 1 of 27).

[23] This is why Bonnier, Andersen, and Johnsen (2020, p. 24) state that '[a]lthough referred to as "games" they are often closer to real life simulations.' They correctly add that this is a practical way to escape all the costs and impracticability of taking students to the real situation (Bonnier *et al*., 2020, p. 25).

[24] Already in 2003, Gee has laid down 36 learning principles on the creation of an SG to be in line with the characteristics of the game as mentioned below (Gee, 2003).

One of the main characteristics of SGs, according to Protopsaltis *et al*. (2011, p. 6 of 10), is that the educational content is mixed with entertaining and engrossing elements. This creates a win-win situation for the student: On the one hand, the learning experience is positive and enjoyable, promoting 'excitement, stimulation, engagement and the feeling of accomplishment,' while on the other hand, it is more effective and efficient than 'normal learning,' thereby creating a 'more interesting and interactive learning environment' for the student (Anastasiadis *et al*., 2018, p. 140).

Added to these, SGs are widely accepted for promoting creativity, students' problem solving skills and critical thinking, their spatial ability and conceptual understanding, as well as collaboration and automaticity (doing things without occupying one's mind with any low-level details required, therefore acting 'automatically'), among other skills related to higher order thinking. Problem-solving is intrinsic to the playing of an SG (Gros, 2015, p. 41).

Chandross and DeCourcy (2018, p. 16 of 27) point to the following characteristics of an SG:

- It should have a 'high impact on motivation, attention, and learning outcomes.'
- The game should have ample 'player and gameplay characteristics.'
- The game should motivate the player to continue playing.
- 'Gender and cultural determinants' must always be kept in mind.
- True-life simulations must be done in a credible way with as much as possible interaction built in.

The advantages of an SG depend very much on the kind of game that the students play, although it should be associated with the following characteristics of educational games: Most educational games teach students critical thinking and strategising to improve their visual attention, to contribute to socialising and working in groups, to solve problems through trial and error, experiential learning, to enhance their motivation and learning progress as well as both their working memory (the storage of temporary information for immediate use) and long-term memory skills (the storage of information for some time), to concentrate

better (creating better attention skills), supporting students to obtain better cognitive skills (Drigas and Pappas, 2015, pp. 62-63). An SG also adds to the communication between students mutually (collaboration), and between students and their educator, and therefore to interactivity (Anastasiadis *et al*., 2018, p. 142). These games have 'an intrinsic motivational factor that fosters curiosity, encourages students to become involved in games in a personal, emotional and cognitive way and makes them believe that they are in control of their own learning' (Lampropoulos *et al*., 2019, p. 123). This factor of motivation makes learning much more effective and efficient, while the process of internalisation becomes more compelling, engaging, and enjoyable, incited by the challenge and realism of the game, the discovery of new information or ideas, and control (Lampropoulos *et al*., 2019, p. 123).

Let us go back for a moment to 'trial and error.' In die old paradigm, mistakes would cost a student marks in the assessments, whether it was formative or summative, leading more than not to the student failing the subject or even the year, or to the student quitting the course. In firm contrast to that, during the learning process in an SG, failure plays a very important role, as it allows the player to make mistakes, thereby improving their competence, in order to get better in the game (Sipiyaruk *et al*., 2021b, p. 2). Over against the self-centred educator, the SG is therefore very forgiving, 'teaching' the student how to overcome the mistakes they make by redoing a certain stage of the game and then winning that stage and eventually the game.

An SG also absorbs students in 'deep and engaged learning' (Lampropoulos *et al*., 2019, p. 124). The engaged process refers to the student being consciously and meaningfully involved in the process of learning. With reference to deep(er) learning, CMC (2019:1 of 4) defines it as follows:

> Deeper learning is the process of learning for transfer, meaning it allows a student to take what's learned in one situation and apply it to another…When engaged in deeper learning, students think critically and communicate and work with others effectively across all subjects. Students learn to self-direct their own education and to adopt what is known as 'academic mindsets' and they learn to be lifelong learners.

Deep learning needs an interaction between three factors: First, there are factors and information that students already obtained when starting to study at an IHE; then there is the learning context and the way in which it is presented; and lastly, there is the way in which students interpret the material that is presented to them (Platow *et al*., 2013, p. 272).

According to CMC (2019, p. 1 of 4), deep(er) learning involves, among others, the examining of new facts, making links to previous knowledge; MIT (multi, inter-, and transdisciplinary research); active interaction and learning; and allowing students to make mistakes in a low-risk environment without being penalised (cf. Lampropoulos *et al*., 2019, p. 123). When students, therefore, adopt the approach of deep learning, they delve into the 'dynamic and interrelated structure' of the subject and its content (Platow *et al*., 2013, p. 272). Instead of just transferring some knowledge from the curriculum to their head, students start with a process of exploration and discovery to understand the dynamics of the subject better, requiring a huge amount of self-involvement or self-investment in the learning process from them (Platow *et al*., 2013, p. 272).

All these characteristics mentioned above play in the hands of serious gaming. Serious gaming should therefore be implemented as a very effective instigator and add-on to deep learning. However, to just start with an educational game will not solve the problems in the classroom if the curriculum is not fully adapted to a modern style of education (cf. Platow *et al*., 2013).

7. Conclusion

Having stated all the above facts and given all the information about SGs, one has to get the conviction that SGs could be well implemented in service of HE, although this is at present not the case (Sipiyaruk *et al*., 2021a, p. 243). Despite all the negatives around the educators, their biases, and competence in this concern, the positive side is so overwhelming that every IHE should really make an effort to establish an institute for gaming in order to train educators to get on the band wagon and to get designers and developers who will be able to create the games together with the educators.

One can easily say that SGs will do all the abovementioned things for students *if perfectly presented*. Fact is that when we are referring to traditional formative and summative assessment, we also assume that these are perfectly done. In both cases we know that the educator can only strive for perfection. It is therefore no counter-argument to state that SGs are not as perfect as presented in this article, as the same argument holds for both traditional formative and summative assessment.

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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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