

# **SECURITY AND ETHICS IN SUSTAINABLE E-LEARNING AND GAMIFICATION FRAMEWORK FOR HIGHER EDUCATION**

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## **ABSTRACT**

The world is moving towards achieving sustainable development goals that benefit the environment, society, and the economy. The COVID-19 pandemic has forced many education institutions to shift from traditional learning to online learning. Since 1960, e-learning has been delivering through the website. However, there is a rise in e-learning security and ethical issues that lead to poor education quality and an unsustainable e-learning system. Thus, security and ethics components need to be integrated into a sustainable e-learning and gamification framework. Interestingly, e-learning needs to integrate the gamification context to increase online learning quality and secure learners' education while promoting lifelong learning. To identify the relationship between security and ethics in gamified e-learning, this paper examined and assessed various types of security threads and learners' ethics and well-being in the e-learning environment. The framework intends to increase e-learning strength in promoting a better e-learning environment, well-being, and lifelong learning among their learners. Thus, enabling sustainable education through a reliable e-learning system.

## **KEYWORDS**

e-Learning, Security, Ethics, Gamification, Sustainable Development, Sustainable Education

## **1. INTRODUCTION**

Earlier before the pandemic, sustainable development goals (SDG) have become an interest by many countries to move toward a more equitable, prosperous, and resilient society. However, according to the Sustainable Development Goals 2020 report, Covid-19 threatens the progress to the SDG on healthy well-being, end of poverty, end of hunger, economic growth, access to water and sanitation, and environmental sustainability (United Nations, 2020). The fourth SDG, which aims to achieve inclusive and equitable access to education, is also be affected by the Covid-19.

The Covid-19 pandemic has pushed many higher education institutions (HEI) to shift to an online learning environment since social physical distance needs to be practiced. Many educational institutions were closed across the world and many learners are out of the classroom. Thus, the pandemic may change education forever due to the rise of online learning. Both academicians and learners are experiencing rapid changes in their education process as they need to transform their physical learning into digital platforms dramatically. Academicians are drastically working on developing online educational content. At the same time, learners are coping with their 'new normal' learning in a digital environment.

E-learning secures learners' education by allowing learners to continue to develop knowledge and skills via digital platform. Yet, learners' participation and engagement using e-learning seemed to be low without integrating interactive contents and game-based learning. Game technologies create opportunities for HEI to redesign and innovate their e-learning models to secure learners' education. security in e-learning

Since the pandemic has transform education into digital environment, online security is essential to avoid threats such as account breaches, Web attacks, data security, data center breaches, and access control. In order to protect e-learning against attacks like these, there is a need for a reliable learning management system. It is essential to identify the threats to e-learning so that the security risk analysis can be addressed. Also, there is a need for concerns on the learners' ethics in using e-learning. Cheating cases have risen in the online learning environment. Furthermore, since Covid-19 has led many students out of the classroom, learners' well-being has become an impact on the education quality.

## **2. SECURITY IN E-LEARNING**

The concept of cybersecurity was introduced in 2008 which focuses on computer assets' integrity, confidentiality, and availability (Kaur and Ramkumar, 2021). Threats such as authentication, availability, confidentiality, integrity, and repudiation are increasing threats in e-learning platforms (Salimovna, Salimovna, and Ugli, 2019). In order to protect learners' authenticating credentials, security goals need to be identified. Policies, risk analysis, and training could increase e-learning security. Security policies that consider learners' home environment, technology usage, and instructor interaction need to be initiated and implemented.

Even though education is moving to the online environment, the dilemmas of learners' ethics, such as plagiarism and cheating in learning still occur in e-learning. The issue of cheating among learners is highly concerned among academicians. Bušíková and Melicheríková (2013) discovered that percentage of academic fraud has significantly increased in online programs. Many teachers have addressed the increase in cheating in online examinations. According to Wiley's recent survey, there are 93% of students suspect on cheating in online course. (Wiley,2020). Cases of unauthentic exams candidates have been experienced by many universities around the world. Since the students do not require to take attend physical examinations venue, they are paying an imposter to sat in for their online examinations and other assessments. The use of purchased assignments and sharing of answers were also has risen a new form of cheating. Thus, strict rules were established based on the e-learning environment due to such unethical practices among students. Wiley (2020) also suggested the implementation of monitor tests, integrate lockdown browser, use of webcams, and use plagiarism software to

prevent cheating among learners. Risk analysis and training on e-learning could engage e-learning security and privacy.

According to the Academic Misconduct within Higher Education in Canada, the authors discovered a few main factors that drive learners to cheat (Hughes and McCabe, 2006). These factors include personal problems, the culture of cheating, unfair evaluation methods, and lack of explicitly between academic dishonesty and the way to manage it. Then in 2017, a United States research on e-learning integrity, values, and behaviors should be considered as part of an effective solution to solve academic cheating (Lee-Post and Hapke, 2017). This leads to the concerns of learners' well-being, such as academic honesty, mental health, physical health, and digital well-being. Wiley (2020) finds that many instructors believe that open-book exams may reduce learner's academic dishonesty. Almseidein and Mahasneh (2020) suggest that the learners should be aware of ethical issues to avoid these unethical behaviors.

Learners' well-being also is due to satisfaction with academic performance and experience. Some learners with a poor financial background and lack of e-learning facilities such as laptops and internet connection are experiencing education inequality. E-learning is able to promote equality and diversity by providing equal learning opportunities (Kentnor, 2015) to all types of learners. The use of technology in e-learning may lead to inequality (Gladieux and Swail, 1999) as it may lead to a digital divide among learners. Thus, the technology needs to be proficient among e-learning users and support by institutional infrastructure (Emil, 2001). On the other hand, education equity ensures that all learners are able to achieve the same learning outcomes, receive support on academic, social, and finance, and have access to adequate learning opportunities and educational resources (OECD, 2012).

### **3. GAMIFICATION AND SUSTAINABILITY IN RECENT YEARS**

The use of gamification in e-learning also has a connection between learners' learning style, achievements, and behaviors (Zaric, Scepanovic, Vujicic, Ljuovic & Davcev; 2017). Gamification in e-learning does have a positive impact on learners' engagement; however, one of the primary concerns with gamification elements is the inability to induce motivation among learners (Hassan, Habiba, Majeed & Shoaib; 2019). Dale (2014) and Sailer and Homner (2019) found the combination of structural elements and social interaction among others were effective in fostering behavioral learning outcomes. The social interaction can be conducted by combining competition with collaboration among other learners, which can motivate the learner to learn.

There were several studies reported on gamification in higher education (Table 1).

Table 1. Studies on Gamification on Different Sustainability Context

Authors	Year	Sustainability Dimensions			
		Strategies	Education	Consumption	Practice
Lu and Ho	2020	x			
Mahmud et al.	2020		x		
Romero-Rodriguez et al.	2019		x	x	
Mattila	2019	x	x		x
Schiele	2018				x
Chui and Wai	2017				x
Nordby et al.	2016		x		
Polyak	2016		x		
Huber and Hilty	2015			x	
Hamari et al.	2014		x	x	x

The outcomes of the studies reported in Table 1 show that gamification was mostly found to be positive influenced for the learners which the learners showed increased motivation, engagement, and enjoyment in their learning. The inclusion of gamification in e-learning promotes the quality of education that can increase learners' motivation, experience, and engagement and achieve greater learning success (Strmecki et al., 2015).

### 3.1 Existing Studies on Gamification Framework

In general, gamification is about designing game elements in a non-game context to promote user engagement (Susan, 2015), motivation (Roy & Zaman, 2018), and satisfaction (Urh, Vukovic, Jereb & Pintar, 2015). The key elements in gamification (Dale, 2014) are:

- Game mechanics - describes the use of elements such as points, badges and leader boards that are common to many games.
- Experience design - describes the journey players take with elements such as gameplay, play space, and storyline.
- Gamification - is a method to digitally engage rather than personally engage, meaning that players interact with computers, smartphones, wearable monitors, or other digital devices rather than engaging with a person.
- The goal of gamification - is to motivate people to change behaviors or develop skills, or drive innovation.
- Gamification focuses on enabling players to achieve their goals. When organizational goals are aligned with player goals, the organization achieves its goals because of players achieving their goals.

Palamino et al. (2019) separated the gamification framework in education into two; structural and content framework. Structural elements are focusing on game mechanics, and content elements are concentrating on the narrative concept. They found out that narrative characteristics have resembled user experience, which is important to influence engagement among learners.

According to Majuri, Koivisto, and Hamari (2018), they found that based on the previous studies - behavioral outcomes were comprised of grades, participation in a system, and speed of conducting tasks and assignments. This is in line with the educational context which the aim is to achieve learning objectives that have been set by the organization (Dale, 2014). Figure 1 shows a summary of gamification elements in the e-learning context.

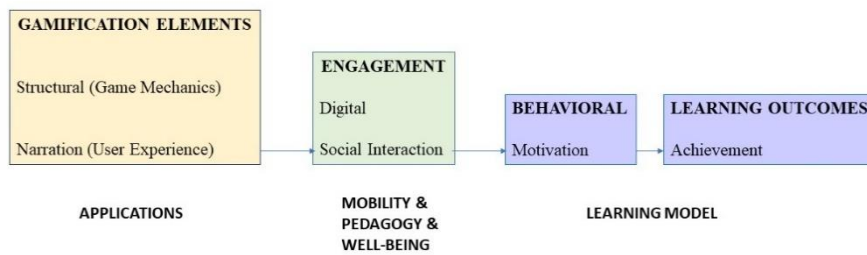


Figure 1. Studies on Gamification on Different Sustainability Context

#### 4. SUSTAINABLE E-LEARNING

Sustainability is defined as a long-term innovation process that benefits the triple bottom line: people, environment, and economy (Foo, 2013). One of the sustainable development goals listed by the United Nations is quality education. In response to the pandemic, UNESCO launched the COVID-19 Global Education Alliance to ensure that learners can continue their studies. The Global Education Alliance aims to assist "countries in mobilizing resources and implementing innovation and Contextual solutions, using high-tech, low-end technology and non-technical methods to provide education remotely" (UN.org). This shows that from now on, education is maintained by providing "innovative and context-appropriate solutions." Through distance or e-learning platforms for learners to continue their studies in higher education institutions to avoid dropping out.

It is important to define sustainable e-learning because sustainable development has a wide range of meanings in different contexts. According to the research of Gunn (2010), e-learning is sustainable if 1) the online learning design is developed and implemented in the curriculum, and 2) other people can adopt the concept, design, system or resources of online learning, the sustainability of online learning can be realized and 3) the e-learning concept, design, maintenance and improvement of the system or resources are independent. Sustainable e-learning aims to ensure that the quality of education is maintained while minimizing costs and environmental impact (Sofiadin, 2013). In 2020, sustainable e-learning is defined as an e-learning system that ensures the development of learning goals and sustainable practice while supporting the dimension of sustainability (Sofiadin, 2020).

## **4.1 The Concept of Game-Based Learning in Sustainable e-Learning**

Game-based learning was introduced in the 1970s, which integrates games into a learning process to deliver certain skills and achieve certain learning objectives. Later in 2008, gamification was introduced which used game-like rule systems, entertainer skills, and characters for the gamification development (Su & Cheng, 2013). Qian and Clark (2016) defined game-based learning as an environment in which game content and gameplay enhance learners' knowledge and skills acquisition. The game-based learning activities provide problem-solving spaces and challenges that provide learners with a sense of achievement. Wardoyo (2020) indicates that game-based learning able to increase learners' learning interest which creates a significant impact on the learning outcomes. Furthermore, game-based intends to promote learners' engagement (Bartel & Hagel, 2014) and motivation (Zabala-Vargas et al., 2019) in higher education institutions, which will sustain online learning experience.

## **4.2 Existing Sustainable E-Learning Framework**

There are various of existing e-learning frameworks that focused on e-learning quality, content, implementation, and governance (Georgouli et al., 2008; Yunus and Salim 2008; Chatti et al.2010; Alkhatabi et al.,2010; Sumranwong, 2011; Glancy and Isenberg, 2011; EPSA, 2011; Fang et al. 2012; Ramakrisnan et al. 2012; Hadullo et al. 2017). However, there is a few existing studies on sustainable e-learning framework.

In 2013, a sustainable e-learning framework was developed for higher education institutions in Malaysia (Sofiadin, 2013). The initial framework consists of four main categories that intend to support sustainability. These categories are:

- a) Teaching and learning principle: refer to meeting the learner's education needs through lifelong learning.
- b) Technology: focuses on the technology that will reduce, recycle, and reuse e-learning resources.
- c) Application: This is related to the application that will promote mobility and learning personalization.
- d) Sustainable development: refers to delivering sustainable education and a sustainable e-learning environment.

The sustainable e-learning framework will provide a good basis for the study to integrate the gamification approach in higher education, which it should be extended to include gamification dimensions that could promote lifelong learning and sustainable e-learning. The gamification in e-learning platform able to promote engagement among learners to continue learning and at the same time, to avoid drop-out or lessen other issues of conducting learning.

## **5. METHODOLOGY**

Design thinking can be described as a development of artifacts (Simon, 1969) and meanings (Johansson and Woodilla, 2010). This study adopted the design thinking approach. This approach consists of five stages that involve understanding the users, problem-definition and problem-solving, brainstorming new ideas, developing prototypes, and testing (HSG, 2018; Lewrick et al., 2018). Design thinking promotes the innovation of new models that intend to

improve and visualize creative processes conducted by multidisciplinary teams (Clemente et al., 2016). Thus, this study started by understanding the users' problems and generate new ideas through literature review. Literature research can be considered as a comprehensive summary of existing literature and could lead to a new framework developed for the specific area of study (Vom Brocke et al., 2009). As a result, this study proposed a framework for sustainable e-learning by adding the gamification aspect in the framework. However, this paper does not conduct the testing phase. The testing phase will provide results that rethinking one or more problems. The proposed framework will be tested and validated by e-learning stakeholders through surveys and online interviews and will be reported in another paper.

## 6. THE PROPOSED SUSTAINABLE E-LEARNING AND GAMIFICATION FRAMEWORK

Based on the literature review, there are a few criteria (see Table 2) that will assist the researchers in developing the initial sustainable e-learning and gamification framework for higher education. The initial framework (see Figure 2) represents the element in designing the framework, which needs to be focused on transforming education as part of surviving the pandemic. The components of the initial sustainable e-learning and gamification framework are shown in Table 2.

Table 2. Components of Gamification Sustainable E-Learning Framework

Key Element	Components	Description	References
Teaching and Learning Principles	Curriculum	The curriculum is intended to develop knowledge and skills among players through online quizzes, assessments, and learning activities. Play metrics can be captured to differentiate instruction and assessment that can be personalized to a learner. The gamified course curriculum should improve learner's engagement and enjoyment. A Teacher-centred curriculum defines learner ability through technique expertise, understanding of rules, and game participation. A learner-centered curriculum is where the students will determine what and how it is processed and how it is learned. The curriculum should focus on learning content design to a learning experience that is motivating and captivate to learners.	Doyle, 1978; Udosen and Ekpo. 2016
	Pedagogy	Pedagogy approaches include constructive, collaborative, critical thinking, problem-solving, reflective, and inquiry-based learning. Pedagogical knowledge practices such as project-based group work can be used as game-based teaching.	Nousiainen et al. 2018; Hanghøj 2013.; Becker.2009

	Learning Model	Use of the Game Achievement Model that defines the learning objectives for the game and defines the storyline that will encompass these objectives. It should promote intrinsic motivation for the learners to play.	Amory and Seagram. 2003
	Sustainable Education	Provide interactive game-based learning that promotes sustainability literacy skills and sustainable practices.	Cheah, Wei, Kee, and Mohamad. 2013; Emblen-Perry. 2018.
Technology	Simulation	Simulation is able to create students' mental models of complex situations and their strategies in problem-solving.	Gredler 2002
	Virtual reality	Provide a safe environment to experiment with the curriculum concepts. Virtual reality intends to increase learner's satisfaction, enjoyment, creativity, audio, and graphics quality.	Rizzo et al. 2011; Pallavicini et al 2019; Shelstad et al. 2017
	Artificial intelligence	Artificial intelligence (AI) is used for various parts of the game and aspects of nonplayer characters. AI is applied in behavior modelling aspects such as situation analysis, target selection, resource allocation, learning, and simulated perception.	Tozour. 2002; Prakash et al. 2009
	Mobility	Smartphones offer more practical, easy access, and easy to carry anywhere. Mobile devices allow learners to play the mobile game anywhere at any time.	Schmitz et al. 2012; Nuryanti, 2015; Rojas-Mancilla et al. 2019
	Game Engines	Provides a powerful utility that helps in game development such as player interaction, graphics, animation, artificial intelligence, modeling, and networking.	Prakash et al. 2009
Applications	Points	Points are the rewards that are collected based on what learners earned during gameplay when they achieve a certain goal.	Byl. 2013; Dale, 2014
	Levels	A level in a game represents a story chapter, a set of challenges, or a separate subdivision in a game environment. Levels refer to a reward for loyalty where players received gifts, privileges, and benefits.	Deterding, Khaled, Navke, and Dixon. 2011; Byl. 2013



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	Badges	Badges can be earned through positive effort that present recognition and status of completed challenges.	Antin and Churchill 2011; Deterding, Khaled, Navke, and Dixon. 2011. Byl. 2013
	Quests	A quest refers to the sub-tasks that need to be completed as part of the ultimate goal of the game.	Byl. 2013
	Social network	The game should be designed for social interaction elements.	Deterding, Khaled, Navke, and Dixon. 2011; Byl. 2013
	Leaderboards	Based on the accumulated points, the game leaderboards will display a list of high scores in a game.	Deterding, Khaled, Navke, and Dixon. 2011; Dale, 2014
Security	Authentication	User verification to protect user's privacy.	Kang and Kim (2015)
	Availability	Online education activities and resources should be accessible and available.	Bernik et al., (2017)
	Integrity	Use of digital tools such as Artificial Intelligence to detect misconduct and cheating.	Khan et al. (2021)
	Confidentiality	Identify the users' rights to privacy and data security.	Schulz, Isabwe, and Reichert (2015)
	Equality and equity	Game design should be intended for both males and females. Also, the game should be designed for players with cognitive disabilities. The game should be designed for a diversity of learners.	Earp et al. (2018)
Ethics	Cheating	Illegal activity that leads to security threats that may impact other players.	Robles et al. 2008
	Well-being	User passion to learn for more skills, competition, social interaction, healthy lifestyle, and skill development.	Kim and Werbach (2016)

Table 2 shows that gamification can be applied in all four key elements of the initial framework: Teaching and Learning Principles, Technology, Applications, and Security and ethics. These all four key elements require support not only from the management of higher education, but also from the lecturers, learners, and government. The implementation of sustainable e-learning and gamification is the innovative solution that intends to promote education equality among learners, lifelong learning, and lower the drop-out rates.

Table 3. The Key Elements Sustainable Dimensions

<b>Key Element</b>	<b>Sustainable dimensions (supporting SDGs)</b>
Teaching and Learning Principles	SDG#4. Quality education- to comprehensive and equitable to quality education
Technology	SDG#4. Quality education- to ensure equitable access to quality education SDG#5. Gender equality – learning games should be designed for both men and women. SDG#9. Foster innovation – transform e-learning to game infrastructure. SDG#10. Reduced inequalities – accessing e-learning through an interactive mobile game.
Applications	SDG#4. Quality education- promote lifelong learning through motivations
Security & ethics	SDG#3. Promote well-being – develop learning passion through interactive learning games.

To become sustainable, the key elements of the framework need to support the sustainable dimensions. In the paper, the key elements aim to support the SDGs (see Table 3). As shown in Table 3, the main SDG for this paper is on quality education. This is to ensure that e-learning provides comprehensive and equitable access to quality education through the gamification approach. Due to the COVID-19 pandemic, many learners have to experience stress and depression issues due to the lockdown and restricted movement. Therefore, this paper aims to improve learners' well-being by proposing interactive e-learning through gamification, which also intends to support SDG on promoting well-being. Since games were mostly designed for males, it should also be designed for females. Thus, this will support the SDG on gender equality. The SDG on foster innovation can be supported through the transformation of e-learning to game-based learning. Due to a number of learners who afford to own a smartphone than a desktop or a laptop, the idea of gamified e-learning intends to reduce inequalities by offering e-learning access through an interactive mobile game.

Table 4. Potential solutions for e-learning security

<b>Security potential solutions</b>	<b>Descriptions</b>
Digital watermarking	Add hidden copyright signs that protect multimedia database servers against unauthorized use.
Biometric authentication	Authentication techniques that are not easily stolen or copied.
Cryptography	Convert data in a scramble format.
Digital Rights management	Rights associated with intellectual property.
Firewall	Security software that protects network's servers and end-user devices against security breach.
E-learning for all	Securing learners' education by providing e-learning that is designed for all types of learners.

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Table 5. Potential solutions for e-learning ethics

<b>Ethics potential solutions</b>	<b>Descriptions</b>
Online training	Promote ethical values and create awareness about the rules and consequences of unethical behavior.
Code of ethics	Ethical rules and policies in using the e-learning system.
Digital well-being	Digital platforms that deliver proactive care to learners to support their mental health.

Security and ethics in e-learning system need to be addressed to ensure a sustainable e-learning. Table 4 and Table 5 above are a few solutions for e-learning security and ethics. Trainings or seminars could create awareness on security and ethics among learners. The consequences of legal issues such as preventive privacy, plagiarism, and copyright need to be realized. Academic honesty, mental health, and physical health can be improved through online training, clear e-learning ethics rules and policies, and digital well-being platforms. In conclusion, the initial framework (see Figure 2) shows the elements of designing the sustainable e-learning and gamification framework for higher education.

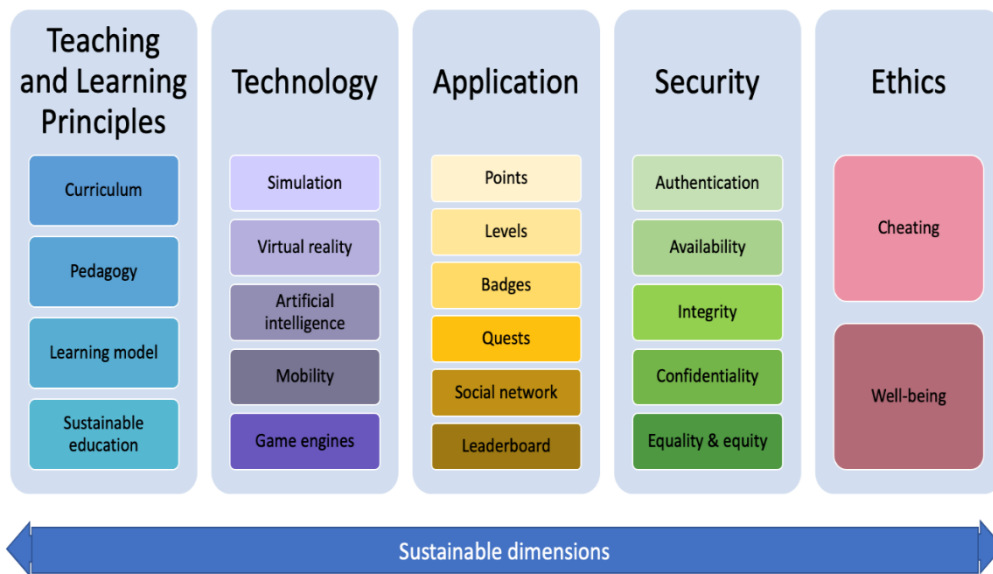


Figure 2. The Proposed Security and Ethics for Sustainable E-Learning and Gamification Framework

## 7. CONCLUSION

The paper presents gamification in e-learning platforms can increase learners' engagement and motivation during their learning process. The initial sustainable e-learning and gamification framework clarifies that gamification can be implemented in higher education institutions to sustain and provide quality education among learners, especially during the pandemic. In order for gamified e-learning to be operationalized in a real education setting, security and ethics

elements need to be measured to secure learners' education. Students should be aware of ethical and security issues to avoid unethical behavior. This can be done through training or seminars on awareness of ethics and security in e-learning. Thus, this study intends to provide guidelines and recommendations on how teaching and learning principles, technology, applications, security, and ethics can be used to achieve a sustainable gamified e-learning. In addition, the study intends to support SDGs on promoting well-being, gender equality, innovation, and inequality reduction. Based on the literature review, there is slight or no research on developing an initial sustainable e-learning and gamification framework that adopts security and ethics components. The framework should be further tested and validated by conducting the test stage of the design thinking approach to identify more problems that may lead to improvements. In conclusion, this research will work toward developing and evaluating a sustainable e-learning and gamification framework that will transform e-learning for the new norm.

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