AN INITIAL SUSTAINABLE E-LEARNING AND GAMIFICATION FRAMEWORK FOR HIGHER EDUCATION

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ABSTRACT

The movements towards achieving sustainable goals among many countries have risen throughout the years. A part of the sustainable goals – the COVID-19 pandemic has forced many universities to move to online learning to sustain students' education. Indeed, e-learning has been delivering through the website since 1960. There is a need to develop new e-learning models that transform education to support sustainable development goals and achieve education's objectives. Interestingly, e-learning needs to integrate gamification context to increase learners' engagement and passion while promoting lifelong learning. To identify the relationship between e-learning and gamification, this paper examined and assessed various e-learning and gamification models and frameworks, specifically in sustainability, to develop an initial sustainable e-learning and gamification framework for higher education. The framework intends to assist higher education institutions in designing a gamified e-learning that promotes better learning engagement, education equity, skill development, social engagement, well-being, and lifelong learning among their learners. Thus, enabling a sustainable education throughout surviving the pandemic.

KEYWORDS

Lifelong Learning, E-learning, Gamification, Sustainable Development, Sustainable Education

1. INTRODUCTION

Since the announcement of the 17 sustainable goals by the United Nations Summit Post (President of United Nations General Assembly 2015), many higher education institutions (HEI) are working towards achieving sustainable development goals, especially in terms of providing eco-friendly campus environments and delivering sustainable education through courses. Also, Covid-19 crisis has impacted HEI to shift to online education as an alternative to resume learners' learning. Higher education institutions play a significant role in promoting e-learning to be an effective platform to deliver education. The decision to shift to online education has forced academicians to develop online learning materials and conduct online classes. However, the use of e-learning unable to sustain learners' participation and engagement. Thus, to survive this pandemic crisis, higher education institutions need to deliver education through e-learning that can increase learners' participation and learning engagement, promote skill development, social engagement, and lifelong learning.

Higher education institutions have invested much money in e-learning development to make it successful in being implemented. Most higher education institutions (HEI) focus on the five trends of e-learning implementation, which are e-learning policy, e-learning governance, Learning Management System (LMS), e-learning training, and e-learning integration into teaching and learning (Al-rahmi, Othman, and Yusuf 2015). HEI also focused on developing knowledge and skills among learners throughout their experience using e-learning. However, learners' participation and engagement using e-learning seemed to be lower than expected. The HEI should aim to provide an online learning initiative that can develop learners' passion for learning, and at the same time to increase learners' participation and engagement.

Gamification has become a technique to transform learning experiences into a game. In contrast, game-based learning refers to games' integration into a learning process to develop specific skills (Scepanovic, zaric, and Matijevic 2015). Game technologies create opportunities for HEI to redesign and innovate their e-learning models that able to sustain learning experiences among learners. Thus, gamification is a potential technique to increase learners' participation and engagement, which HEI should innovate the e-learning models and strategies that could also promote lifelong learning.

2. GAME-BASED LEARNING AND GAMIFICATION

2.1 The Concept of Gamification in E-Learning

The concept of gamification was introduced in 2008, and many studies on gamification in various contexts have been published (edulearning2 2015). Gamification offers rewards, personal achievements, and challenges as ingredients of game success. These ingredients will motivate students learning engagement through e-learning (Smiderle et al. 2020). From the educational perspectives, game-like rule systems, entertainer skills, and characters are used for the development of gamification (Su & Cheng, 2013). Most educational games were developed for primary schools compared to higher education institutions.

2.2 Gamification and Sustainability in Recent Years

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 in education that can increase learners' motivation, experience, and engagement and achieve greater learning success (Strmecki et al, 2015).

2.3 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 game play, 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.
- 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 resembled user experience, which is important to influence engagement among learners.

The use of gamification in e-learning also has connection between learners' learning style, achievements, and behaviors (Zaric, Scepanovic, Vujicic, Ljucovic & 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.

According to Majuri, Koivisto, and Hamari (2018), they found that 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 an organization (Dale, 2014). Figure 1 shows a summary of gamification elements in the e-learning context.

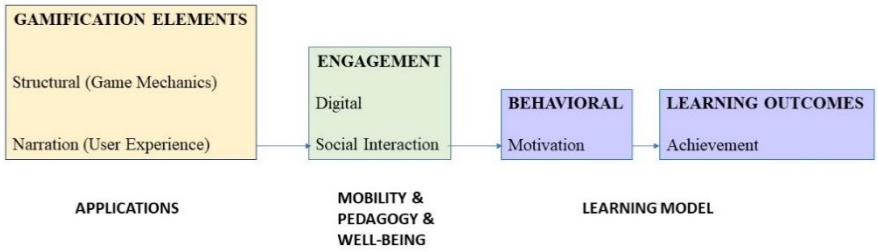

Figure 1. Studies on Gamification on Different Sustainability Context

3. 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 (SDG) listed by United Nations is Quality Education. In response to the pandemic issues, UNESCO has launched the COVID-19 Global Education Coalition – to ensure learners have access to continuous learning. The Global Education Coalition aims to assist "countries in mobilizing resources and implementing innovative and context-appropriate solutions to provide education remotely, leveraging hi-tech, low-tech and no-tech approaches" (UN.org). This shows that from now onwards, to sustain education is by providing "innovative and context-appropriate solutions" through remote or e-learning platform - for the learners to continue their learning in higher education institution to avoid drop-out.

It is important to define sustainable e-learning since sustainability has a broad meaning in a different context. According to Gunn (2010), sustainability in e-learning is achievable if 1) the e-learning design has been developed and implemented within a course, 2) the e-learning concept, design, system, or resources can be adopted by other development, and 3) the maintenance and improvement of the e-learning concept, design, system, or resources are independent. Sustainable e-learning aims to ensure education quality is maintained while minimizing the cost and environmental impact (Sofiadin, 2013). In 2020, sustainable e-learning is defined as e-learning system that supports the sustainability dimensions while ensuring the learning goals development and sustainable practice (Sofiadin, 2020).

3.1 Existing Sustainable E-Learning Framework

There are various 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; Alkhattabi 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 are 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 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 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.

4. 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 to 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.

5. 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 initial sustainable e-learning and gamification framework.

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. Leaner-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 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 define 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 can 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 modeling 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 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 collected based on what learners earned during gameplay when they achieve a certain goal.	Byl. 2013; Dale, 2014
	Levels	A game level 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
	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 & ethics	Cheating	Illegal activity that leads to security threats that may impact other players.	Robles et al. 2008
	Well-being	User passion on learning more skills, competition, social interaction, healthy lifestyle and skill development.	Kim and Werbach (2016)
	Social justice and equality	Game design should be intended for both males and females. Also, the game should be designed for players with cognitive disabilities.	Earp et al. (2018)

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

Key Element	**Sustainable dimensions (supporting SDGs)**
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 experiencing stress and depression issues due to the lockdown and restricted movement. Therefore, this framework 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 a 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. In conclusion, the initial framework (see Figure 2) shows the elements of designing the sustainable e-learning and gamification framework for higher education.

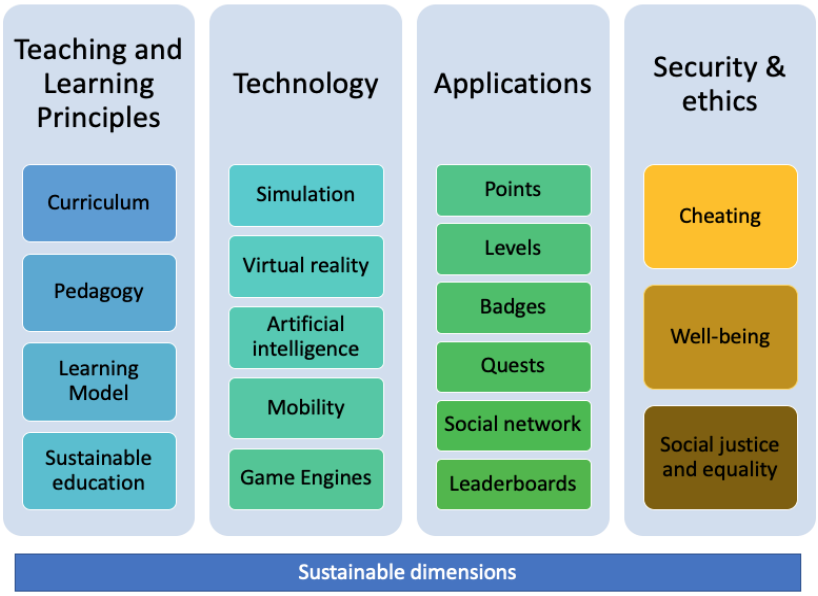

Figure 2. The Proposed Sustainable E-Learning and Gamification Framework

6. CONCLUSION

The paper presents gamification in e-learning platform 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 gamification to be operationalized in a real education setting, gamification ingredients such as badges, rewards, and personal achievements should be integrated into e-learning to motivate students learning. Thus, the proposed framework intends to provide a guideline and recommendations on how teaching and learning principles, technology, applications, security and ethics can be used to achieve sustainable e-learning through gamification. In addition, the framework 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. 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 develop and evaluate a sustainable e-learning and gamification framework that will transform e-learning for new norms.

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