# The influence of gamified e-learning quizzes on students' motivation – a case of programming students at a South African higher education institution[1]

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## ABSTRACT

*Institutions globally have been grappling with the sudden shift to e-learning due to lockdowns related to the pandemic. However, challenges associated with motivation and student engagement continue to persist. While it is expected that e-learning will become more entrenched in higher education, ignoring these challenges can affect the sustainability of e-learning. Therefore, it is imperative to explore approaches to overcome the challenges. Utilising a case study approach, supported by a focus group, the authors explore how gamified quizzes influenced the motivation of programming students. In this study, it was found that participants experience increased motivation when afforded autonomy, are given a chance to learn socially, and rewarded. However, motivation decreases when students perceive pressure or are not rewarded. Findings also indicate that gamified quizzes contribute to increased understanding and confidence. Ultimately, gamified quizzes are more suited for low stakes learning activities that reward engagement but do not penalise non-engagement or poor performance.*

**Keywords:** gamification, motivation, gamified quizzes, engagement, educational technology

## INTRODUCTION

Across the globe, Higher Education Institutions (HEIs) have not harnessed fully the potential of e-learning due to lack of consensus on the value of e-learning and due to mixed results of using e-learning (Laufer et al., 2021). As a consequence, institutions and academics have adopted e-learning at different levels with many institutions not adopting e-learning altogether. In recent times, the rapid spread of COVID-19 served as a catalyst for the adoption of e-learning at HEIs (Kandri, 2020). In the face of the pandemic, most institutions were unable to plan their e-learning strategies, an endeavour that typically takes years to plan, design, and execute (Hodges et al., 2020). As a result, HEIs' e-learning attempts during the pandemic were bound together by threads delivering what Hodges et al. (2020) describe as emergency remote teaching rather than purposefully planned e-learning.

To exacerbate the situation, e-learning faces significant challenges relating to motivation and engagement (Zhang et al., 2004). The current situation presented by the pandemic demands urgency in finding solutions to these challenges to ensure sustainable utilisation of e-learning, as improper implementation could be e-learning's Achilles heel (Lederman, 2020).

In the South African context, HEIs also attempted to introduce some form of e-learning amidst infrastructure challenges and resistance from student bodies, since many students could not access e-learning during lockdown (Ngqakamba, 2020). From the onset of lockdown, e-learning is now more prevalent in the South African context. However, students enrolled in HEIs might still not engage online, even if they have access to the necessary facilities due to personal circumstances and socio-economic factors (Mukeredzi, Kokutse & Dell, 2020).

In exploring the role of gamified quizzes to address the challenges of motivation and engagement in e-learning, the authors provide a review of existing literature and then outline the research design and methodology adopted in this study. The findings of the study are then presented along with a discussion on the implications thereof. The authors then conclude with practical recommendations for lecturers, institutions, e-learning platform developers, and researchers, to implement gamified quizzes.

## LITERATURE REVIEW

### The evolution of e-learning

E-learning is a form of learning supported by technology aimed at improving the quality of teaching and learning (Tagoe, 2012; OECD, 2005). Selim (2007) builds upon this by explaining that e-learning facilitates the achievement of learning outcomes in an online setting. Urdan and Weggen (2000) further contribute by explaining that e-learning is the delivery of course content using various forms of electronic media and communication technologies – thus bringing the 'e' to e-learning.

E-learning can promote student-centred, self-directed learning free from time constraints and geographical limitations whilst encouraging knowledge re-utilisation and broad collaboration (Zhang et al., 2004). On the other hand, e-learning is confronted by challenges, including a lack of engagement and high dropout rates due to the increased demand for discipline, absence of real-time feedback, and the isolated nature of e-learning compared to traditional classroom-based learning (Karnad, 2014; Zhang et al., 2004). Additionally, the absence of suitable infrastructure, connectivity problems, and digital literacy skills, more particularly in developing contexts, also affect e-learning initiatives negatively (Bharuthram & Kies, 2013).

Like all technologies, e-learning has evolved since its inception. E-learning 2.0 harnesses elements of collaborative tools like social media to allow students to engage and learn with the help of peers and extended networks (Ehlers, 2009). Another evolution of e-learning was the shift towards MOOCs (massive open online courses) which were expected to disrupt and transform the higher education landscape (Vardi, 2012; Karnad, 2014). However, that transformation has not materialised (Reich and Ruipérez-Valiente, 2019). Notwithstanding the evolution over the past few decades, the challenges around motivation and student engagement continue to persist.

### Student engagement online

In a classroom setting, academics can utilise audience engagement platforms (AEPs) to engage with students, obtain feedback and test students' knowledge (Ayres, 2015; Rudolph, 2018; Vallely & Gibson, 2018). These platforms facilitate a teaching and learning environment where academics may interact with students in real-time through their own devices. On an AEP platform like Mentimeter, which was utilised in this study, an academic may initiate a live session from their device that students access with

a unique code using their personal devices. Open- and closed-ended questions may be posed via the platform to students. Using the responses obtained, an academic can ascertain student sentiment and levels of understanding, resulting in a more pro-active manner of teaching and learning (Rudolph, 2018). Beneficial to students is the fact that while responses are visible to all students, AEPs provide anonymity which is useful to students who are less likely to participate if their identities are known (Ayres, 2015; Rudolph, 2018). Using these web-based platforms, academics can harness the potential of widely-used mobile devices in their class rather than imposing restrictions on these devices (Rudolph, 2018).

AEPs allow students in traditional classroom settings to provide opinions, engage in discussion, and voice concerns (Vallely & Gibson, 2018). Furthermore, students can participate in formative assessments, provide responses, receive feedback and increase their understanding (Wong & Yunus, 2020). When considering the context of science, technology, engineering, and mathematics (STEM) courses, AEPs have been found to enhance students' learning experience, increase motivation, and foster collaboration (Crump & Sparks, 2018). However, AEPs are limited in that while they encourage engagement, they do not necessarily drive higher-order creative and critical thinking (Andriani, Dewi & Sagala, 2019). While AEPs unlock student engagement, those that incorporate gamification can engage students to an even greater extent.

## Gamification of learning

The foundations of gamification lie in the reality that games and playfulness have always been central pillars of human motivation (Nacke & Deterding, 2016). Gamification is defined as an objective-driven user-centred approach or methodology that integrates game elements into real-world contexts to motivate behaviour (Adam, 2017).

Examples of game elements that can be integrated into e-learning include the utilisation of points, badges, leader boards, progress bars, and storylines (Adam, 2017; Seaborn & Fels, 2015; Sailer et al., 2013). Points serve as a numerical measure of success or achievement, badges serve as visual titles of honour or achievement, leader boards provide insight into a player's success in relation to others in a game, progress bars depict level of success, and storylines provide a medium through which a scenario may be set to give context to a gamified activity (Seaborn & Fels, 2015; Iosup & Epema, 2014; Kim, 2015).

These elements may be incorporated into e-learning where students are rewarded for aspects like attendance, participation, individual submissions, group activities, constructing arguments, displaying critical thinking skills or completing assessments (Adam, 2017). Previous studies indicate that gamification can be a time-consuming activity for academics, particularly when attempting to reward higher-order skills (Iosup & Epema, 2014; O'Donovan, Gain & Marais, 2013). Since academics may opt to steer clear of gamification due to its time-consuming nature, this study sought to explore gamified quizzes which is a gamification approach that could be setup in a short space of time using a tool that resembles presentation software, that academics typically utilise (Rudolph, 2018).

## The nexus of gamification and AEPs

From the game elements described above, the most predominantly used game elements in gamified AEPs include leader boards, points and time limits (Rudolph, 2018; Vallely & Gibson, 2018). Examples of AEPs that incorporate gamification include gamified quiz tools like Kahoot and Mentimeter that allows academics to incorporate gamification into their sessions in the form of a quiz with a leader board (Rudolph, 2018). In a session, students are presented with quiz questions with predefined options and time limits (Figure 1). They are then able to provide their responses using a mobile device (Figure 2). Responses are then evaluated, and points are awarded based on correctness of answers and speed in responding, which then translate into points on a leader board (Figure 3).
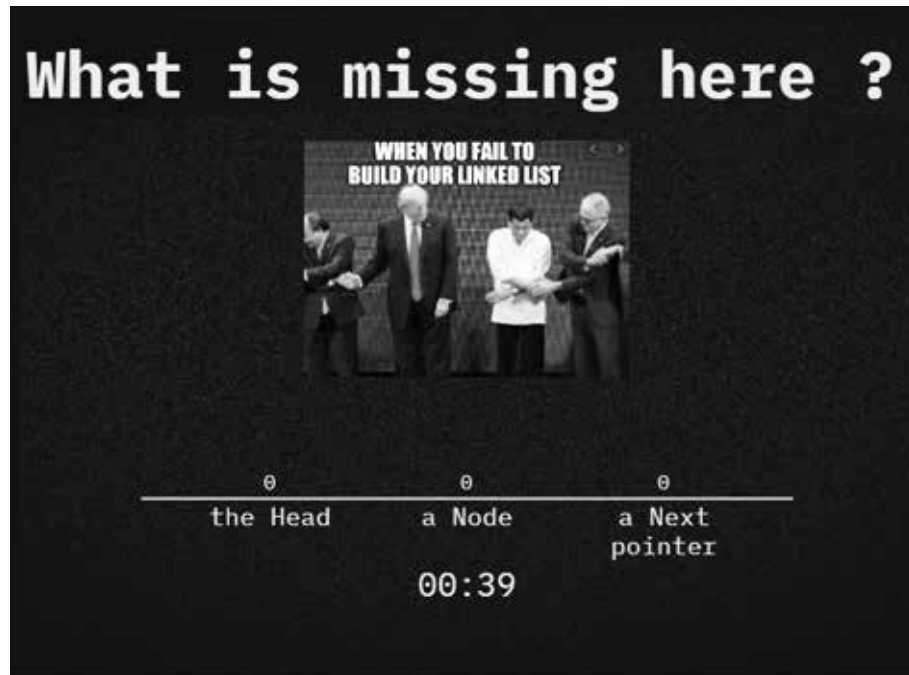
*Figure 1:*
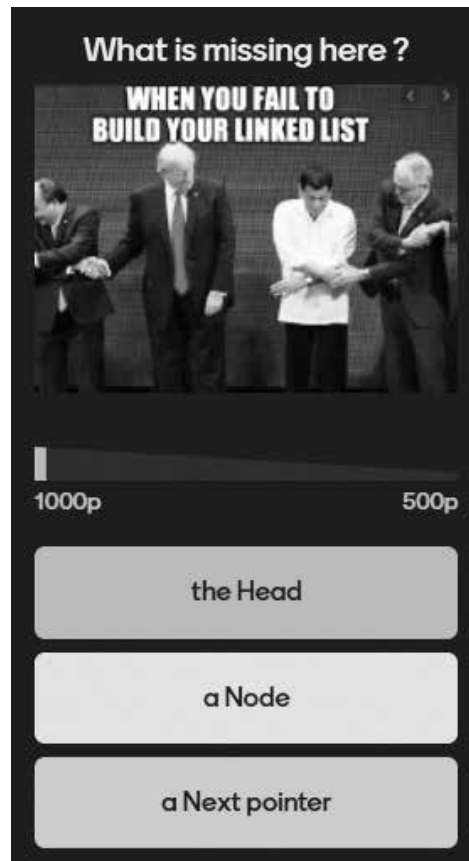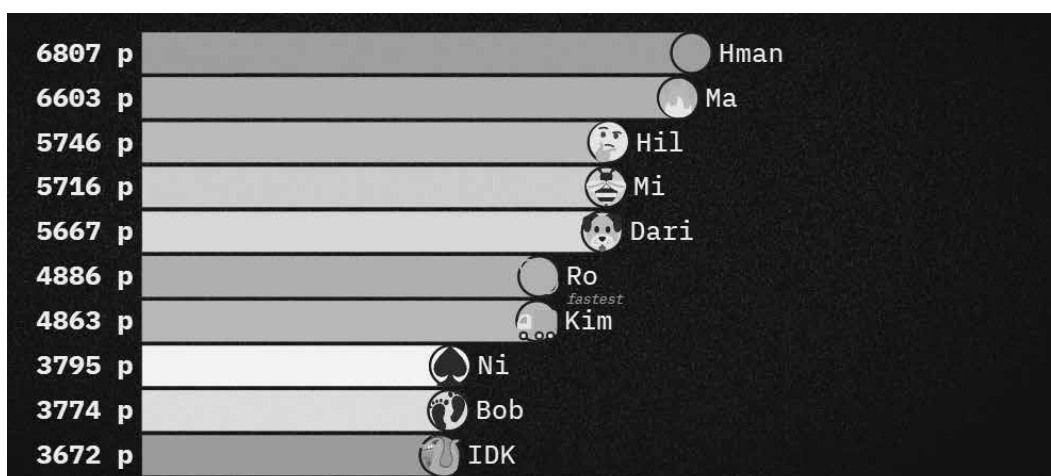*Presenter screen in Mentimeter*



*Figure 2:*
*Participant screen in Mentimeter*

*Figure 3:*
*Mentimeter leader board (adapted to maintain students' anonymity)*



| | |
|---|---|
| 6807 p | Hman |
| 6603 p | Ma |
| 5746 p | Hil |
| 5716 p | Mi |
| 5667 p | Dari |
| 4886 p | Ro *fastest* |
| 4863 p | Kim |
| 3795 p | Ni |
| 3774 p | Bob |
| 3672 p | IDK |

**Earlier studies on gamified quizzes**

Earlier studies show that utilising gamified quizzes enhances e-learning by increasing academic performance, enhancing attendance, developing greater understanding, driving engagement with online resources, and ultimately, enhancing student motivation (Fotaris et al., 2016; Buckley & Doyle, 2016). In utilising a combination of gamified quiz platform Kahoot, interactive elements within CodeAcademy and a classroom version of *Who wants to be a millionaire?*, Fotaris et al. (2016) found that students who were exposed to gamification and game-based learning tended to display better attendance, accessed material more often and performed better academically. Furthermore, motivation among students and academics were enhanced.

Another concept which emerges in literature is the notion that social learning and connectivism, enabled by gamification, can positively motivate students. The role of gamified quizzes for social learning, particularly in the context of Mentimeter was explored by Crump & Sparks (2018) who utilised the tool to allow students to anonymously rate peer-presentations in real-time. It was observed in their study that students were more honest in their responses and consensus was reached more easily (Crump & Sparks, 2018).

In another study on the utilisation of a customised gamified social platform, de-Marcos et al. (2016) found that allowing students to connect with each other as an important ingredient in the learning process. It was also observed that students who fared well in a gamified environment are more motivated than peers by virtual of their social position (de-Marcos et al., 2016).

If we are to consider the findings of Wong and Yunus (2020) that Mentimeter is perceived as useful to students and that participants would be likely to share it with friends, it emerges that students appreciate the opportunity to learn with peers provided that the learning activity is perceived as beneficial and engaging (Wong & Yunus, 2020).

As can be gleaned from the literature above, gamified quizzes do allow students to improve their academic performance, motivation and engagement whilst also enabling social learning. Social learning integrates strongly with gamification since gamification can allow participants to earn rewards from engaging from one another.

**Gamified e-learning in a developing context**

The integration of gamified quizzes can bring about several benefits to e-learning. However, in a South African context, the challenge of Internet connectivity and accessibility for students may inhibit the effectiveness of e-learning initiatives (Adam, Blewett & Wassermann, 2015; Ngqakamba, 2020).

When South Africa went into lockdown, it was observed that institutions transitioned to online learning to varying degrees with some institutions moving online in a matter of weeks whilst others lagged behind for longer periods of time predominantly due to the availability of content, devices, and broadband connectivity (Ngqakamba, 2020). Whilst institutions shifted the academic calendar partnered with technology providers to lessen the impact, the shift to online learning was described as elitist as many students were unable to engage online (Mukeredzi et al., 2020).

The situation poses significant implications for the utilisation of gamified quizzes in the context of South African e-learning. It may be argued that if students cannot access online lectures and resources, they are also excluded from participation in any gamified learning activity. This widening of the digital divide could demotivate students who are already excluded from e-learning due to their circumstances.

**THEORETICAL FRAMEWORK**

Since a central tenet of this study is motivation, it follows that it would be appropriate to adopt a theory that is centred in motivation. Self-Determination Theory (SDT) explores factors that enhance or inhibit motivation through the lens of the socio-contextual conditions that may influence motivation (Deci & Ryan, 2000). As depicted in Figure 4, Deci and Ryan (2000) posit that autonomy, relatedness, and competence are three essential needs that should be fulfilled in order to motivate an individual intrinsically. SDT acknowledges that motivation is not static. Instead, motivation sits on a continuum ranging from intrinsic motivation towards extrinsic motivation and amotivation (Deci & Ryan, 2000). In individuals, motivation fluctuates on the continuum based on the extent to which each of a person's essential needs are fulfilled (Deci & Ryan, 2000).

*Figure 4:*
*Self-Determination Theory*
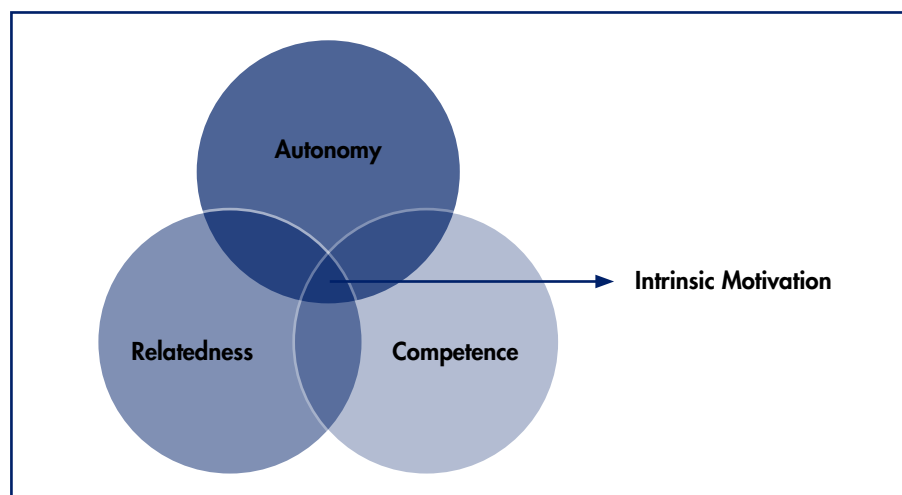


Adapted from Deci and Ryan (2000)

Autonomy is defined as an individual's ability to exercise volition over their decisions; relatedness refers to an individual's perceived likeness with counterparts when engaging in a task; and competence is an

individual's perceived effectiveness in completing a task (Deci & Ryan, 2000). In the context of learning, when students perceive choice in what and how they learn, without external pressure or undue constraints being placed on them, then autonomy prevails (van Roy & Zaman, 2017). Relatedness is established through collaborative and shared experiences, and mastery is developed through progression and achievement, with meaningful feedback (van Roy & Zaman, 2017). SDT has been used in e-learning and gamification studies previously where the three essential needs, when achieved through gamification, led to positive outcomes (Chen & Jang, 2010; Suh, Wagner & Liu, 2016).

Within the context of the existing literature that has been reviewed, it emerged that study of gamified quizzes to enhance student engagement in a developing context is necessary. Thus, it was apparent that there is a need to understand the influence of gamified quizzes on students' motivation in the context of e-learning – the purpose to this study.

## RESEARCH METHODOLOGY

Having explored the existing literature, focus can shift towards the methodology. In order to fulfil the purpose of the study, two specific dimensions were explored: students' experiences of gamified quizzes and how gamified quizzes motivate students in an e-learning context. This gave rise to two research questions underpinning this study:

- What are students' experiences of participating in an online gamified quiz?
- How do online gamified quizzes motivate students in the context of online learning?

The first research question stemmed from the fact that students were experiencing a change in how they were learning due to the lockdowns as a result of the COVID-19 pandemic. As such, their experience might affect their motivation to learn. This question sought to explore participants' experiences of the gamified quizzes as well as their experiences of the game elements used in Mentimeter. The second research question sought to understand how students are motivated by online gamified quizzes through the lenses of the three essential needs as identified by SDT.

On the basis of an interpretivist paradigm, the authors aimed to understand the subjective experiences and motivational drives of students in the context of using gamified quizzes in e-learning. An interpretivist paradigm has been used previously to understand students' interactions with tools like Kahoot & Mentimeter across other disciplines (Xi & Chen, 2020; Ristiniemi, 2019) and when working with programming students (Heni, Nurdin & Suparman, 2019). Adopting an interpretivist paradigm has implications for the research design and methodology selected (Patel, 2015).

In this study, the aim was to gain in-depth insight of the phenomenon under investigation, rather than to establish generalisable results. As a result, a qualitative case study approach was adopted in line with the recommendations of Leedy and Ormrod (2016b). Since the authors aimed to understand the influence of gamified quizzes in an e-learning context, it follows that the population for this study include tertiary students in a module offered with e-learning as a significant component, which was widely prevalent during lockdown. Therefore, the population utilised in this study encompassed 91 students registered for a Programming Module at a South African HEI.

From these 91 students, a sample of seven students was selected purposively on their participation with the gamified quizzes that were used in online lectures. The researchers contacted potential participants through a class-wide WhatsApp group inviting participants to express interest to participate in a study. The potential participants were informed of the nature and aims of the study as well as the commitment that would be required from their side. Potential participants contacted the researchers to express their interest,

and the purposive sample of seven were selected. This purposive sampling approach was necessary to ensure that research participants were able to provide insight into their experiences of online gamified quizzes having actually experienced them.

Given the lockdown, a 90-minute online focus group discussion was held, with video and audio, to allow participants to provide insights irrespective of their physical location (Sekaran & Bougie, 2016). Furthermore, an online focus group with video and audio minimises human contact whilst still having the potential of yielding required research data (Ravitch, 2020). Whilst the authors were cognisant that some participants might have been reluctant to share insights online, this was not a hindrance, as all participants had already established rapport with the author who conducted the focus group and were also familiar with each other as they attended classes together pre- and during lockdown.

The authors maintained credibility and trustworthiness by ensuring that the focus group discussion schedule aligned with the theoretical framework and did not deviate from the research questions as recommended by Leedy and Ormrod (2016b). As outlined by Leedy and Ormrod (2016b), prior to conducting the focus group discussion, feedback was obtained from other researchers with experience in designing qualitative research instruments and recommendations to avoid leading, unnecessary or confusing questions, wihc was implemented. Participants were also provided with confidentiality with their names being redacted during analysis and each participant being referred to using a number (e.g., P1, P2, etc.). Thus, whilst they were known to the authors, their identities are not published.

Before commencing data collection, written permission was obtained from the institution where students were enrolled to conduct this study. Additionally, informed consent was obtained from each participant and participants were provided with details of the study and informed that participation was voluntary, and they could withdraw at any time without repercussion. Written permission was obtained from participants to record the focus group discussion to make provision for subsequent transcribing.

Once data were collected and transcribed, different themes and categories were identified in alignment with the theoretical framework and existing literature (Leedy & Ormrod, 2016a, 2016b). The transcript was then coded in the NVivo software package and irrelevant information was discarded in line with recommendations by Leedy and Ormrod (2016b). Thereafter, the remaining data were analysed, and findings were recorded.

## ANALYSIS OF RESULTS

### Students' experiences of gamified e-learning

As stated, in the first research question, the authors sought to understand students' experiences of gamified quizzes. To answer this question, the students' experience, their perceptions of their own learning online using gamified quizzes, and their perceived academic success due to gamified quizzes, were explored. Furthermore, insights were sought from participants relating to specific game elements like points, time-limits, and leader boards.

When participants were given an opportunity to share their experience of e-learning during the COVID-19 lockdown, it emerged that some participants appreciated the convenience of being able to study from home flexibly whilst others struggled with e-learning during lockdown.

Some participants shared the following positive feedback relating to online learning:

> I actually liked it because we could be comfortable at home… you can wear what you (are) comfortable wearing, you can eat like a full lunch at home.  So, I thought the online lectures were really nice in terms of that. (P1)

> When it came to stuff like you know the actual online lectures, I did not mind it being online, the group work was quite fun and even then, because it was online lectures and stuff like you watching from your laptop whatever you could do like eat while you were working, you just worked as time fitted for you. (P2)

As can be observed in the data, some participants described themselves as self-motivated individuals who felt that they could exercise self-discipline.

On the other hand, other participants indicated that online learning was not beneficial to them due to several reasons:

> I did not like online learning at all. I prefer coming to campus than learning online. I mean learning face to face. (P3)

> I found it very difficult to be at home. (P4)

> I just could not discipline myself. (P5)

On further investigation, it became clear that these participants were affected negatively by distractions of the environment at home and preferred coming onto campus due to the conducive environment with peers and lecturers. They shared the following experiences:

> I like being with friends … who can help and share the same ideas. (P4)

> I love bouncing off ideas off my lecturers and getting feedback instantly. (P5)

Thus, it seems that the campus environment which facilitated social interaction with peers and academics were beneficial, and these seemed to be missing in e-learning. Given the varied experiences of shifting into e-learning, results suggest that motivation and self-discipline are a concern in the online space and other students who struggle with this cannot adjust to e-learning.

Furthermore, as the lockdown progressed, some participants experienced a positive shift into a new routine with online classes and gradually created their own ability to work independently. They shared the following experience:

> After you get a good flow, it starts to get a little bit easier, and you obviously learn how to research on your own. (P6)

> As time went by, we actually got used to it. (P7)

The findings above suggest that students experienced the shift to online learning in different ways, with some finding the experience positive, some taking a while to adjust but eventually finding their feet and others struggling to adjust altogether. These varying levels of experience in the shift to online learning undoubtedly affected students' motivation and had an effect on whether to engage online. It also signals the need to accommodate students in an online space and to, in future, prepare students more adequately for online learning.

When exploring gamified quizzes as an online tool to motivate students, results suggest that the use of Mentimeter can increase students' interest and engagement when learning online. One participant offered the following experience:

Menti sort of broke up like the monotony of class because like you sitting doing the lecture following around and all of a sudden you are part of it so like I feel that it is also something that helped in keeping students engaged. (P2)

This finding suggests that students ordinarily lose interest easily when learning online due to the seemingly passive nature of online classes. However, being engaged actively is beneficial to their learning - a phenomenon we observe commonly in traditional classes as well. A similar phenomenon was observed by Heni et al. (2019) and Crump and Sparks (2018) in their studies which reported that students' level of engagement and interest were increased when using gamified quizzes. However, there emerges contention on the extent to which Mentimeter encourages active participation. On the one hand, students benefitted from using the reply of peers to learn and correct their own knowledge:

It made me learn better because we were doing it while we were doing online (classes) … and Mentimeter helped because I learnt more from seeing other people's responses. (P3)

If you put up an answer and it was wrong and you wondering what other people think. (P4)

This finding aligns with the findings of Crump and Sparks (2018) and Wong and Yunus (2020) who also found that their students benefitted from the social interaction offered by gamified quizzes.

On the other hand, it became apparent that not all participants benefitted from participating as some preferred to simply spectate or utilise answers from the Internet without critically reflecting:

Sometimes because you know someone is going to answer you can just keep quiet. (P1)

People will just Google and like take the first thing that they find (on Google) and paste it so that they have an answer there. (P6)

While students were given the option on whether or not to participate in the gamified quizzes, it emerged that non-engagement by some students tended to demotivate their peers:

The demotivating aspect is when people do not participate. I just feel if they not doing it, why am I doing it? (P5)

These findings suggest that students benefit from what they perceive to be collaborative learning where all peers participate actively. Tension is experienced when some students opt not to invest in their participation or not to participate at all. The authors maintain that if one were to make participation compulsory to overcome this issue, it will increase the stakes of the learning activity and participation but will not result in invested participation from students.

When exploring the game elements used, participants focused predominantly on the utilisation of the leader board within Mentimeter, which materialised as the most apparent and controversial element. Some participants found that being given recognition on the leader board among peers was motivating to them:

I just want people to know that if come out front it is me. (P6)

Nacke et al. (2011) explain that this may be attributed to the fact that this individual may be motivated by being recognised and that other participants may be motivated differently. This was evident in this

study as there were participants who were not motivated by leader boards since only high achievers were displayed:

> Let's just say that I came out last personally I would feel bad, I would feel horrible, I am the dumbest person in this room. (P5)

This participant went on to reason that there was the still value of only showing top participants to avoid demotivation:

> Not having the last person (is) really nice because you have the best and the people (only and those) who would not make the cut just wouldn't be displayed there. (P5)

The influence of the leader board as being motivational to some and demotivational to others was also found by Adam (2017) who attributed this to the different motivational drives of each student. Furthermore, the perception that someone placed last is not making the grade suggests that students perceive gamification rewards as being a direct reflection of how well a student has learnt. This finding suggests that if a leader board is limited to top participants, it can demotivate students who were correct as they would not receive recognition due to receiving less points which could have happened as they might have taken longer to respond. This could in turn affect their self-confidence. This is reinforced by an argument put forward by a participant that there is a downside to showing a leader board limited to only top participants:

> I just wanted to mention that not getting a reward from getting the right answers, I am sure that demotivates most people. (P7)

Another factor to consider is that some students may feel a degree of indifference towards a leader board:

> I am not competitive, so I don't care where my name is in on a leader board. (P2)

As can be gleaned from the findings discussed above, the tension experienced with the leader board is difficult to overcome. Regardless of the choices made, it seems as though there will always be a demotivated student. An approach to mitigate the demotivation faced when using leader boards is to incorporate other game elements like points, badges, storylines, and progress bars into the learning activity but this may prove time-consuming (Adam, 2017). Notably, in this study, whilst Mentimeter also integrates points and time limits that determine who is placed on the leader board, the leader board itself seemed to have taken centre stage, with participants not always focusing on the points for each question whilst also not always considering the fact that questions had time limits associated with them.
Other than simply being placed on a leader board, there was a call for rewards to bear real-world value:

> If like in the long term you could get extra marks, bonus points that would actually be good. (P7)

The use of real-world rewards ties into earlier studies where examples include de-Marcos et al. (2016) providing the ability to use in-game rewards to purchase extra marks and avatars and Adam (2017) allowing students to use badges to purchase freedom to choose their own project groups and to request recommendation letters from lecturers.

In essence, it emerged that students adjusted to e-learning during lockdown in different ways and gamified quizzes increased engagement and motivation, but at different levels. While students were exposed to different game elements, the leader board was predominant and most controversial with the potential to motivate some strongly and to demotivate others equally strongly. Lastly, associating real-world value to gamification rewards can prove to be an additional motivating factor.

**Influence of gamified quizzes on students' motivation**

In the second question, the authors sought to understand how gamified quizzes influence motivation through the lens of Self-Determination Theory (SDT). These findings provide deeper insight into students' perceived autonomy, relatedness, and competence, and in turn provide understanding of students' motivation and the reasons behind their motivation.

*Autonomy*

When considering autonomy, several themes emerge including the choices to control their identity, the choice of whether to participate in the gamified quiz, and the choice to engage in a learning activity without necessarily risking their marks.

In terms of identity and expression, participants indicated preference to use an alias when signing into a gamified quiz as it eased the pressure on them in a social setting:

> I feel like using your real name will put a lot of pressure on you and a lot of people would not actually want to do that because if they got a question wrong everyone would know exactly who they are. (P7)

This finding ties in with a finding of Rudolph (2018) who explains that a central feature of Mentimeter is the use of aliases.

A level of autonomy was experienced by a participant which was termed as 'freedom of input' since the platform allowed them to include ASCII characters that allowed creation of ASCII art to be more expressive among peers:

> Thing was the freedom of input. You could even put ASCII there, the wildest things. (P5)

Findings also indicate that participants experienced a strong degree of autonomy when choosing whether to participate in the gamified quiz and whether to answer all questions or only those they wished to answer:

> Freedom of choice was nice because I could have just watched you streaming your Mentimeter instead of actually engaging with it. So, I got the choice whether or not I was going to use it and I felt that was nice. (P1)

> When you put up a question for us to answer there is nothing forcing you to answer the question. You can answer it, or you can leave it blank because the next question will pop up and you could leave the question blank. (P6)

When exploring the reason for perceived autonomy, it transpired those participants viewed gamified quizzes as a fun learning activity due to the nature of a gamified quiz (i.e., not counting for marks). Participants indicated that had marks been associated with a gamified quiz, it would have affected the dynamic of how learning takes place by making the gamified quiz a serious activity:

> Making it extremely high stakes would make you ignore the fact that you know it is a game and it is meant to be enjoyable. (P5)

This is in direct contrast to the earlier finding that gamified quizzes should yield real-world value. Thus, it seems like participants are motivated by gamified quizzes that allow them to earn extra marks or recognition whilst not exposing them to the possibility of losing marks. This suggests that gamified quizzes

are better suited to low-stakes learning activities as opposed to higher-stakes activities. This finding is also supported by Crump and Sparks (2018).

*Relatedness*

When considering relatedness, several themes emerge including the benefits of social learning, the need for anonymity in a social setting, and possible negative perceptions of being given rewards where peers are not rewarded.

It was found that participants were motivated by seeing the responses of peers whilst engaging in a shared learning activity:

> I really liked how it managed to bring the whole class together and engage everyone at once. I think seeing everybody coming together and working on the same thing was really motivating. (P4)

> The motivating factor for me was seeing everyone engaging with the learning material. There are different people, different point of view so giving your point of view and receiving other peoples' points-of-view was actually motivating for me because you get to see how other people think about a particular concept and how you could also try to adjust to see how you could do better in a particular concept basically. (P7)

These findings suggest that gamified quizzes drive social learning, encourage participation, increase reflection, and allow students to tweak their understanding of content. Similar results are observed in literature where students exhibited similar experiences as a result of gamified quizzes (Crump & Sparks, 2018; de-Marcos et al., 2016; Heni et al., 2019; Wong & Yunus, 2020).

Whilst social learning is beneficial, it exists against the backdrop that some participants appreciated anonymity:

> Mentimeter is a good platform that allows students to engage without fear because of the fact that it is anonymous. (P7)

The value of anonymity in gamified quizzes was also observed in literature (Vallely & Gibson, 2018), which suggests that students do not want to be judged for wrong answers and that introverted students also can engage without feeling a sense of intimidation (Crump & Sparks, 2018).

Anonymity was also beneficial to participants who scored highly on the leader board but did not want to be known to peers:

> I slightly prefer being anonymous like if they are going to put your names on a leader board just because like if you score really high then you have all of these students like looking at you. (P2)

A similar finding by Adam (2017) found that being in first place could be likened to a target on one's back.

*Competence*

When considering competence, subthemes emerge relating to engagement and mastery. Participants experienced increased attention and enhanced engagement when using Mentimeter for learning activities:

> I found the entire experience really engaging as well like it really had my full attention when we were doing those sessions. (P4)

> When you put like a Mentimeter quiz up I was like oh yes, we get to do this, it is exciting, I want to see what everyone else says, and I want to actually see how I understand the concept because I knew you would go through it and like talk about each answer. (P6)

The notion of increased attention has precedent in earlier research (Crump & Sparks, 2018). From these findings, it becomes apparent that besides increased attention and enhanced engagement, gamified quizzes inculcate a sense of excitement and confidence within students who feel as though their learning is being enhanced. One participant offered the following anecdote:

> I felt like I would take what I learnt from the lessons and just apply it to my work because I found it easier to remember sometimes because it was just fun. (P4)

The notion of using gamified quizzes for knowledge mastery has precedent as these quizzes can help with remembering facts and enhancing the understanding of new concepts (Andriani et al., 2019; Heni et al., 2019).

When exploring mastery at a deeper level, participants were motivated by getting credit when they answered correctly and when seeing others recognised as well:

> There is definitely a little bonus when you answer the question right and like okay cool, I actually understand this section, so it helped me feel more competent as a learner. (P1)

> Seeing everyone's answers come together and seeing it as a whole and seeing it being addressed by the lecturer, I think that made me a better student. (P5)

The phenomenon of being awarded for mastery has been observed in previous studies where students celebrating smaller achievements have been found to boost confidence (Crump & Sparks, 2018; Wong & Yunus, 2020).

Ultimately, when considering autonomy, it emerged the students are motivated by anonymity and choice on whether to engage in gamified quizzes. When considering relatedness, students prefer the social interaction enabled by gamified quizzes but may wish to enjoy anonymity. When considering competency, rewarding learning can lead to mastery and inculcate a sense of confidence in students.

### DISCUSSION

In this study, we sought to understand students' experiences of online gamified quizzes and how gamified quizzes influence motivation. The key findings in the context of literature are discussed.

### Students' experiences of participating in an online gamified quiz

In terms of experience with gamification, participants reported varying experiences, with some participants being motivated by learning and obtaining rewards. This finding is not unheard of as students who earn rewards are more motivated than those who do not (Adam, 2017). A question of re-engaging these demotivated students emerges here and the authors propose the frequent use of quizzes or follow-up quizzes to re-engage demotivated students.

It was also observed that from all game elements, in strong part due to its visibility, the leader board emerged as a game element that elicited varying levels of motivation. This finding corresponds to the

finding of O'Donovan et al. (2013) and Seaborn and Fels (2015) who also reported varying levels of motivation. This can be explained by different students' preferences since some individuals are motivated by being triumphant or being recognised among peers whilst others are motivated by personal mastery or shy away from the spotlight (Nacke et al., 2011; Adam, 2017).

### How gamification influences motivation

When considering autonomy, students were motivated when afforded autonomy in how to engage the gamified quizzes and findings in this study correlate with that of Adam (2017) who observed that students preferred choice in how they participate in gamified e-learning.

As was discussed in the literature review, the role of social learning enabled by gamification is integral, even in this study. Most participants in this study, much like participants in the studies by de-Marcos et al. (2016), Vallely and Gibson (2018) and Wong and Yunus (2020) were highly motivated by a sense of relatedness and by opportunities for voluntary collaboration. It also emerged in this study that students were demotivated by peers not engaging, a concept not widely explored in the literature. Furthermore, participants were motivated by being rewarded in low stakes activities and learned better with gamified quizzes. A similar finding was observed Vallely and Gibson (2018) who observed value of gamification in formative assessments where students tended to participate at a higher level.

### RECOMMENDATIONS

This study contributes to the broader discourse and raises awareness on gamification as an approach for the effective use of e-learning tools to engage students in higher education, which is even more relevant in the current circumstances that will continue to influence how our students learn.

Based on the results and discussion, there are several implications for lecturers, institutions, e-learning platform developers, and researchers on adoption of gamified online quiz tools to motivate and engage students. Having considered the findings of this study, the following recommendations are made:

### Recommendations for lecturers and institutions

The results indicate that gamified quizzes are effective to engage students in an e-learning setting, but there needs to be cognisance of the factors that could demotivate students. The authors recommend that lecturers begin to integrate gamified quizzes gradually into their teaching to better understand how their students might respond. Such integration can be within the context of an individual lecture or class activity and can grow with time and in line with what students find appealing.

When integrating gamified quizzes, it is recommended that lecturers afford students anonymity and adopt gamified quizzes for low stakes learning activities that reward participation but do not penalise non-participation. Moreover, it is also recommended that HEIs need to provide the necessary subscriptions and educational technology support to their teaching staff. There are also free platforms like Kahoot and Socrative that can be explored further.

### Recommendations for future research

In this study, the authors explored the influence of gamified quizzes on student motivation at an HEI in a developing context. There are several areas for potential future research. Firstly, this study may be extended across institutions to begin to understand how the phenomenon unfolds with different students. Secondly, this study may be extended into developed contexts to understand multiple students' experiences. Lastly, this study was conducted among programming students who were arguably confident with technology, but further cross- and inter-disciplinary research is needed.

**Recommendations for e-learning platform developers**

Results suggest that e-learning platform designers and developers need to ensure that gamified e-learning platforms are transparent in scoring mechanisms and reassuring to students in order to ensure that they remain engaged and motivated. Additionally, it is recommended that gamified quiz tools continue to offer anonymity whilst providing opportunities for social learning. Furthermore, it is also recommended that platform developers integrate anti-plagiarism mechanisms into their platforms to prevent 'copy-pasting' from the Internet to gain an edge in a gamified quiz.

Lastly, it is recommended that the design of gamified platforms allows academics the opportunity to reward students using a variety of game elements, rather than giving weight to a single game element, to keep all students motivated. In encouraging personalised e-learning experiences, students could be asked to select a game element they prefer and that could be the way they are given feedback. For example, students motivated by a leader board are presented with the leader board to measure themselves against peers while students motivated by badges are presented with badges and individual feedback as they get answers correct, with an optional leader board.

## CONCLUSION

In this study, the authors sought to understand the influence of gamified quizzes on student motivation. It became clear that gamified quizzes can motivate students to varying degrees. After analysing these findings against the backdrop of existing literature, we provided recommendations for lecturers, HEIs, future research, and e-learning platform developers.

Ultimately, it is essential that, in a local and global context where e-learning will continue to hold a more central role, academics seek out approaches to engage and motivate students. Gamified quizzes are one of several available tools. It is anticipated that future studies will explore gamified quizzes, other gamified quiz tools, and other gamified e-learning tools and techniques even further.

## REFERENCES

Adam, E. (2017) *Gamification of e-learning: An investigation into the influence of gamification on student motivation.* Master of Commerce dissertation, University of KwaZulu-Natal, South Africa.

Adam, E., Blewett, C. & Wassermann, J. (2015) Investigating UKZN students' adoption and utilisation of personal cloud technologies. *South African Journal of Higher Education* 29 pp.13-38.

Andriani, A., Dewi, I. & Sagala, P.N. (2019) Development of blended learning media using the mentimeter application to improve mathematics creative thinking skills. *Journal of Physics: Conference Series*, 1188, 012112.

Ayres, R. (2015) Lecturing, working with groups and providing individual support. In H. Fry, S. Ketteridge & S. Marshall (Eds.) *A handbook for teaching and learning in higher education: Enhancing academic practice.* New York (NY): Routledge.

Bharuthram, S. & Kies, C. (2013) Introducing e-learning in a south african higher education institution: Challenges arising from an intervention and possible responses. *British Journal of Educational Technology* 44 pp.410-420.

Buckley, P. & Doyle, E. (2016) Gamification and student motivation. *Interactive Learning Environments* 24 pp.1162-1175.

Chen, K.-C. & Jang, S.-J. (2010) Motivation in online learning: Testing a model of self-determination theory. *Computers in Human Behavior* 26 pp.741-752.

Crump, V.P.F. & Sparks, J.A. (2018) Game of phones: Integrating mobile technology into science and engineering classrooms. *4th International Conference on Higher Education Advances (HEAd'18)*. Universitat Polit`ecnica de Val`encia, Val`encia, Spain.

De-Marcos, L., García-López, E., García-Cabot, A., Medina-Merodio, J.-A., Domínguez, A., Martínez-Herráiz, J.-J. & Diez-Folledo, T. (2016) Social network analysis of a gamified e-learning course: Small-world phenomenon and network metrics as predictors of academic performance. *Computers in Human Behavior* 60 pp.312-321.

Deci, E.L. & Ryan, R.M. (2000) The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry* 11 pp.227-268.

Ehlers, U.D. (2009) Web 2.0 – e-learning 2.0 – quality 2.0? Quality for new learning cultures. *Quality Assurance in Education* 17 pp.296-314.

Fotaris, P., Mastoras, T., Leinfellner, R. & Rosunally, Y. (2016) Climbing up the leader board: An empirical study of applying gamification techniques to a computer programming class. *The Electronic Journal of e-Learning* 14 pp.94-110.

Heni, J., Nurdin, I. & Suparman, A. (2019) Developing a hybrid learning strategy for students' engagement in object-oriented programming course. *Universal Journal of Educational Research 7* pp.78-87.

Hodges, C., Moore, S., Lockee, B., Trust, T. & Bond, A. (2020) *The difference between emergency remote teaching and online learning* [Online]. Educause. https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning (Accessed 22 April 2020).

Iosup, A. & Epema, D. (2014) An experience report on using gamification in technical higher education. *45th ACM Technical Symposium on Computer Science Education*. Atlanta, Georgia, USA.

Kandri, S.E. (2020) *How covid-19 is driving a long-overdue revolution in education* [Online]. World Economic Forum. https://www.weforum.org/agenda/2020/05/how-covid-19-is-sparking-a-revolution-in-higher-education/ (Accessed 10 June 2020).

Karnad, A. (2014) *Trends in educational technologies*. The London School of Economics and Political Science: UK.

Kim, B. (2015) Game mechanics, dynamics, and aesthetics. In B. Kim (Ed.) *Understanding gamification. Library technology reports: Chicago* 51(2) pp.17-19.

Laufer, M., Leiser, A., Deacon, B., Perrin De Brichambaut, P., Fecher, B., Kobsda, C. & Hesse, F. (2021) Digital higher education: A divider or bridge builder? Leadership perspectives on edtech in a covid-19 reality. *International Journal of Educational Technology in Higher Education* 18 p.51.

Lederman, D. (2020) *Will shift to remote teaching be boon or bane for online learning*? [Online]. https://www.insidehighered.com/digital-learning/article/2020/03/18/most-teaching-going-remote-will-help-or-hurt-online-learning (Accessed 30 March 2020).

Leedy, P.D. & Ormrod, J.E. (2016a) Analyzing qualitative data. In P.D. Leedy & J.E. Ormond (Eds.) *Practical research planning and design.* (11th ed.) Pearson: Boston, Chapter 8, pp.211.

Leedy, P.D. & Ormrod, J.E. (2016b) Qualitative research methods. In P.D. Leedy & J.E. Ormond (Eds.) (11th ed.) Pearson: Boston, Chapter 9, pp.251.

Mukeredzi, T., Kokutse, F. & Dell, S. 2020. *Student bodies say e-learning is unaffordable and elitist* [Online]. University World News. https://www.universityworldnews.com/post.php?story=20200422075107312 (Accessed 22 April 2020).

Nacke, L. & Deterding, S. (2016) The maturing of gamification research. *Computers in Human Behavior* 71 pp.450-454.

Nacke, L.E., Bateman, C. & Mandryk, R.L. (2011) Brainhex: Preliminary results from a neurobiological gamer typology survey. *International Conference on Entertainment Computing.* Vancouver, Canada: Springer.

Ngqakamba, S. (2020) *Lockdown: Universities prepare to switch to online learning from monday* [Online]. News24. https://www.news24.com/SouthAfrica/News/lockdown-universities-prepare-to-switch-to-online-learning-from-monday-20200416 (Accessed 4 May 2020).

O'Donovan, S., Gain, J. & Marais, P. (2013) A case study in the gamification of a university-level games development course. *Proceedings of the South African Institute for Computer Scientists and Information Technologists Conference.* East London, South Africa: Association for Computing Machinery.

OECD (2005) *E-learning in tertiary education*, Paris, France, OECD Publishing.

Patel, S. (2015) *The research paradigm – methodology, epistemology and ontology – explained in simple language* [Online]. http://salmapatel.co.uk/academia/the-research-paradigm-methodology-epistemology-and-ontology-explained-in-simple-language (Accessed 28 June 2017).

Ravitch, S.M. (2020) *The best laid plans… qualitative research design during covid-19* [Online]. https://www.socialsciencespace.com/2020/03/the-best-laid-plans-qualitative-research-design-during-covid-19/ (Accessed 20 October 2020).

Reich, J. & Ruipérez-Valiente, J.A. (2019) The mooc pivot. *Science* 363 p.130.

Ristiniemi, C. (2019) How do you feel?: *Designing for emotional self-awareness and perceived anonymity in an audience response system.* Dissertation. Department of Applied Physics and Electronics. Umea University, Umea.

Rudolph, J. (2018) A brief review of mentimeter – a student response system. *Journal of Applied Learning & Teaching* 1 pp.35-37.

Ryan, R.M. & Deci, E. L. 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist* 55 pp.68-78.

Sailer, M., Hense, J.U., Mandl, H. & Klevers, M. (2013) Psychological perspectives on motivation through gamification. *IxD&A* 19 pp.28-37.

Seaborn, K. & Fels, D.I. (2015) Gamification in theory and action: A survey. *International Journal of Human-Computer Studies* 74 pp.14-31.

Sekaran, U. & Bougie, R. (2016) *Research methods for business: A skill building approach.* John Wiley & Sons. West Sussex.

Selim, H.M. (2007) Critical success factors for e-learning acceptance: Confirmatory factor models. *Computers & Education* 49 pp.396-413.

Suh, A., Wagner, C. & Liu, L. (2016) Enhancing user engagement through gamification. *Journal of Computer Information Systems* pp.1-10.

Tagoe, M. (2012) Students' perceptions on incorporating e-learning into teaching and learning at the University of Ghana. *International Journal of Education and Development using ICT* 8 pp.91-103.

Urdan, T.A. & Weggen, C.C. (2000) *Corporate elearning: Exploring a new frontier.* WR Hambrecht + Co. Pennsylvania.

Vallely, K.S.A. & Gibson, P. (2018) Engaging students on their devices with mentimeter. *Compass: Journal of Learning and Teaching.* 11(2) https://journals.gre.ac.uk/index.php/compass/article/view/843 (Accessed 20 October 2020).

Van Roy, R. & Zaman, B. (2017) Why gamification fails in education - and how to make it successful. Introducing 9 gamification heuristics based on self-determination theory. In M. Ma & A. Oikonomou (Eds.) *Serious games and edutainment applications.* Cham: Springer, pp.485-509.

Vardi, M.Y. (2012) Will MOOCs destroy academia? *Communications of the ACM* 55 p.5.

Wong, P.M. & Yunus, M.M. (2020) Enhancing writing vocabulary using mentimeter. *International Journal of Learning, Teaching and Educational Research* 19(3) pp.106-122 .

Xi, L. & Chen, L. (2020) Communication theories applied in mentimeter to improve educational communication and teaching effectiveness. *4th International Conference on Culture, Education and Economic Development of Modern Society* (ICCESE 2020). Atlantis Press, pp.870-875.

Zhang, D., Zhao, J.L., Zhou, L. & Nunamaker Jr, J.F. (2004) Can e-learning replace classroom learning? *Communications of the ACM* 47 pp.75-79.

Zineveliu, D. (2019) *9 characteristics of authentic learning* [Online]. https://blog.neolms.com/9-characteristics-of-authentic-learning/ (Accessed 4 May 2020).