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How does gamification impact on medical students' academic motivation towards otolaryngology, and what demographics influence this: a mixed methods study.

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Abbreviations and acronyms

α	alpha
ACM	Association for Computing Machinery
AM	Amotivation
AMS	Academic Motivation Scale
APA	American Psychology Association
chp	Chapter
CUREC	University of Oxford's Central University research Ethics Committee
ENT	Ear, Nose and Throat
ER	External regulation
HTML5	Hypertext Markup Language 5
IM	Intrinsic motivation
IR	Identified regulation
k	number of clusters
n	number
p	probability value
pg	Page
SIMS	The Situational Motivation Scale
SDI	Self-Determination Index
SDT	Self-Determination Theory
t	Test Statistic
U.K.	United Kingdom

Abstract

Statement of purpose: This dissertation examines the impact of gamification on academic motivation in the context of medical training in otolaryngology. Gamification is the “use of game design elements in non-game contexts”, and has been proposed as a pedagogy which may enhance intrinsic academic motivation. Empirical studies have shown that student academic motivation influences learner’s enjoyment, engagement and academic achievement. However, educational academics argue that gamification impacts on academic motivation negatively and reduce engagement with learning in the long-term. Thus far, studies have shown that the impacts of gamification on academic motivation are person- and context-specific. There are a lack of studies investigating the impacts of gamification on academic motivation, and how student demographics may impact this. There are also no studies of this nature in the field of otolaryngology. This study addresses these research gaps by examining the association between gamification, academic motivation, age and gender in the context of otolaryngology learning.

Methods: Guided by Self-Determination Theory and the Hierarchical Model of Self-Determination, this study explores the impact of gamification on situational and contextual academic motivation using mixed methods within a post-positivist paradigm. I designed a short gamified and non-gamified otolaryngology module, and investigated for changes in situational academic motivation using The Situational Motivation Scale (SIMS) questionnaire. 195 undergraduate medical students across two universities enrolled for the study, and were randomised to the gamified or non-gamified module. 14 students completed the gamified, and 8 students completed the non-gamified, surveys and modules. Survey responses were used to analyse intra- and inter-personal situational academic motivation towards otolaryngology. 8 undergraduate medical students who completed the gamified module were also invited to semi-structured interviews. Survey responses were used to guide the semi-structured interview questions. Interview data was analysed deductively using template analysis to explore the impact of gamification on situational and contextual motivation.

Results: Gamification enhances intrinsic forms of situational academic motivation towards studying otolaryngology. Situational academic motivation towards studying otolaryngology does not appear to be influenced by age or gender. Template analysis identified gamification elements which promote student choice and enjoyable learning, thus enhancing situational and contextual autonomous academic motivation towards otolaryngology. Gamification elements were also identified which promoted high stakes competition or student frustration, leading to enhanced controlled or a-motivation in the context of otolaryngology education.

Conclusions: This investigation provides important insights on the impact of gamification on academic motivation towards studying otolaryngology. Whilst gamification may enhance situational and contextual autonomous motivation, irrespective of age and gender, this must be implemented in a needs-supporting manner. Understanding the specific gamification elements which support the basic psychological needs of medical students studying otolaryngology will allow clinical educators to adapt their course design and pedagogy to positively impact on academic motivation.

1. Introduction

Gamification is the “use of game design elements in non-game contexts” (Deterding et al., 2011). It has been claimed that gamification can create a fun learning experience, thereby enhancing academic motivation, or motivation to study (Lee & Hammer, 2011; Stott & Neustaedter 2013). Anecdotally, I have taken university courses which have incorporated gamification, and I found my motivation towards studying to be greatly increased. Increased academic motivation has been correlated with higher order thinking, student wellbeing and academic achievement (Nevin, 2014; Taylor et al., 2014; Ryan et al., 2019, chp 6). This was also my personal experience, as I achieved excellent marks in my examinations following the gamified courses. Gamification has also been shown to enhance knowledge, skills, attitudes and course satisfaction when compared with other forms of online or traditional learning (Gentry et al., 2019). Consequently, the incidence of gamification in education has risen dramatically over the past decade (van Gaalen et al., 2022; Zohari, 2023).

However, gamification has been criticised for it’s theoretical ability to enhance a specific type of motivation, known as extrinsic motivation (van Gaalen et al., 2020; Gentry et al., 2019). Extrinsic motivation is the desire to carry out a behaviour for the rewards it brings, without inherent interest in or enjoyment of the behaviour (Ryan & Deci, 2000). Whilst extrinsic academic motivation has beneficial short-term effects, it may have a negative impact on an individuals’ desire to learn in the long-term (Ryan & Deci, 2000).

However, the true impact of gamification on academic motivation remains unknown (Seaborn & Fels, 2015; Dahlstrøm, 2017). The limited studies carried out in this research area have suggested that the effects of gamification on academic motivation are person-specific and context-specific (van Roy & Zaman, 2018; Zahedi, 2021). In this way, studies suggest that the positive effects of gamification on my own personal motivation may not have been shared by my colleagues doing the same course. Equally, gamification may not

have had the same positive effect on my own motivation if it had been implemented during a different course.

The majority of studies investigating the impact of gamification on academic motivation are specifically focused on investigating contextual academic motivation (Vallerand, 1997; van Roy & Zaman, 2018; Rafii et al., 2019). Contextual academic motivation describes a student's general motivation towards education (Vallerand, 1997). There are very few studies investigating the impacts of gamification on academic motivation during short-term educational experiences, known as situational academic motivation (Vallerand, 1997; Stolk, 2021; Hulleman et al., 2016). Situational academic motivation impacts on a student's ability to engage with learning material in the short-term, which over a long period can impact on their contextual academic motivation (Vallerand, 1997). Therefore, it is essential that we understand the impacts of gamification on situational academic motivation, so that we can understand how gamification may impact on a students' long-term desire to learn.

Within medical education, previous studies have investigated the impact of gamification on motivation in the education of patients, genetic counselling students and nursing students (Yang et al., 2022; Dörflinger et al., 2021; Aigner et al., 2023; Smeddinck et al., 2015; Aufheimer et al., 2023; Cragun et al., 2024; Othman et al., 2024). However, there have been no studies investigating the impact of gamification on any types of motivation within medical education (see Appendix C). There have also been no studies investigating the impact of gamification on academic motivation within my own clinical specialty, otolaryngology, which is a surgical specialty focusing on the ears, nose and throat (Nogueira Júnior et al., 2007).

Due to the person- and context-specific impacts of gamification on academic motivation, it is important that we understand the impact of gamification on specific student populations before we adopt this pedagogy in these student groups. Therefore, this study aims to investigate the impact of gamification on medical students' situational and contextual motivation to learn about otolaryngology. This study also aims to explore how age and

gender may impact on medical students' motivation to study otolaryngology when learning through gamification compared with self-directed online learning. The results of this study will guide educators on the utility of gamification in specific medical student populations learning about otolaryngology.

2. Motivation and Gamification

2.1 Motivation

2.1.1 Motivation

Motivation is the energy to commence, continue or discontinue a behaviour (Ryan & Deci, 2000). Depending on the behaviour, individual's can have varying levels of motivation, from low to high, and different reasons for their motivation (Ryan & Deci, 2000). Behaviours carried out for their own inherent rewards, such as enjoyment, curiosity or fun, are considered intrinsically motivated (Ryan & Deci, 2000; Lepper, 2005). Behaviours carried out for other reasons, such as rewards or fear of reprisal, are considered extrinsically motivated (Ryan & Deci, 2000; Lepper, 2005).

Academic motivation has been defined as a students' desire to engage with learning and the educational experience (Hulleman et al., 2016). High intrinsic academic motivation has been correlated with advantageous outcomes for students. It has been associated with greater academic achievement, creativity, higher-order thinking and student wellbeing (Burton et al., 2006; Ryan & Deci, 2019; Lumsden, 1994; Eccles & Wigfield, 2002). Intrinsically motivated academic learners are also more likely to engage with lifelong learning and have a greater ability to retain information (Kohn, 1993; Dev, 1997). Lack of academic motivation has identified as the primary cause for academic underachievement, and may lead to students dropping out of educational courses (Scheel et al., 2009; Wigfield et al., 2005).

There are drawbacks associated with enhanced intrinsic academic motivation. Students may enter a 'flow' state when highly intrinsically motivated, losing track of time and focus (Lei, 2010). This may impact on their academic outputs and engagement with other essential learning activities, impacting on their academic performance overall (Ormrod, 2008). However, some educators would argue that encouraging 'flow' state in learner's is

the goal for educators, as it encourages lifelong engagement with that specific subject area (Czikszentmihalyi, 1982; Eccles & Wigfield, 2002).

Extrinsic academic motivation has also been correlated with learning benefits, but has considerably more learning drawbacks than intrinsic motivation (Lei, 2010). Highly extrinsically motivated students learn for recognition, external rewards and social status (Lei, 2010). The use of extrinsic motivators has been shown to enhance student engagement and performance in the short-term, and may be particularly valuable at the level of higher education (Lei, 2010). However, extrinsically motivated students are more likely to plagiarise to achieve these rewards (Brophy, 2004). They may also stop engaging with learning once rewards stop and seek out easy activities over challenging ones, affecting their higher-order learning and long-term academic achievement (Lepper, 2005; Czikszentmihalyi, 1982). Extrinsically motivated students are also more likely to suffer from anxiety and depression, and report low academic satisfaction, self-esteem and self-actualisation (Kasser & Ryan, 1996; Lei, 2010). Considering the significant advantages of promoting intrinsic academic motivation over extrinsic academic motivation, cultivating intrinsic academic motivation in students is a topic of interest to educators (Lei, 2010).

Studies show that pedagogy can impact academic motivation (Seaborn & Fels, 2015; van Roy & Zaman, 2018; Stolk, 2021), by encouraging autonomous over controlled motivation (Ryan & Deci, 2000). This matches my own experience of learning, as my intrinsic motivation was greatly heightened when learning about anatomy through a gamified pedagogy. However, the ability for gamification to encourage autonomous or controlled motivation remains a topic of debate (Seaborn & Fels, 2015; Gentry et al., 2019), and is therefore the focus of this study.

2.1.2 Self-Determination Theory: the Self-Determination Continuum

Self-determination theory (SDT) (Ryan & Deci, 2000) is a widely accepted, evidence-based psychological framework which describes the dynamic nature of motivation and the factors which influence it (van Roy & Zaman, 2019; Seaborn & Fels, 2015).

A sub-theory of SDT, called the self-determination continuum, proposes a detailed taxonomy of motivation (Ryan & Deci, 2000). At the far right of the continuum is amotivation, which describes a total lack of volition to carry out the behaviour (Ryan & Deci, 2000). As we progress left across the continuum, from extrinsic to intrinsic motivation, motivation becomes increasingly self-determined and driven by the 'self' (See Figure 1) (van Roy & Zaman, 2018).

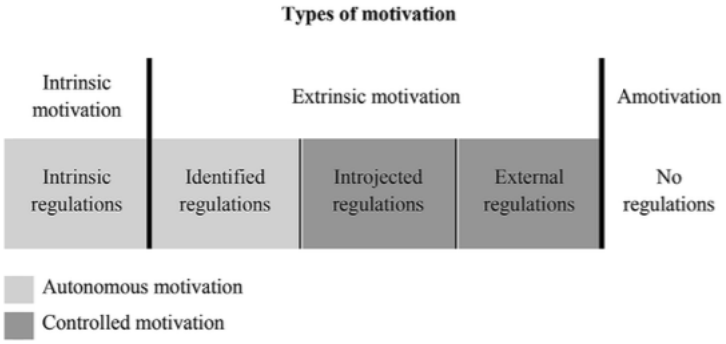


Figure 1: Self-determination continuum. Taken from van Roy & Zaman (2018).

According to the self-determination continuum, it is possible for students to 'internalise' extrinsic motivation, so that the student develops their own reasons for carrying out the originally extrinsically-motivated behaviour, thereby developing internalised motivation (Lepper, 2005; Ryan & Deci, 2000). Depending on how internalised the motivation has become, extrinsic motivation can be sub-categorised into 3 different types: external, introjected and identified regulations (Ryan & Deci, 2000).

External regulation describes extrinsic motivation where internalisation has not begun or failed (van Roy & Zaman, 2018). It is associated with compliance and reactance to extrinsic rewards or punishments, but the behaviour would not be carried out otherwise (Ryan & Deci, 2000). An example of this would be a pupil learning to play the piano for the reward from their parents, or fear of punishment, without any intrinsic desire to play the piano themselves. As such, it is considered a controlled form of motivation (Ryan & Deci, 2000).

Another form of extrinsic motivation is introjected regulation (Ryan & Deci, 2000). Introjected regulation describes extrinsic motivation that has been somewhat internalised (van Roy & Zaman, 2018). Introjected regulation is a form of extrinsic motivation where the behaviour is carried out to enhance self-esteem or avoid feelings of guilt and anxiety (Ryan & Deci, 2000). An example of this would be a pupil learning to play the piano because their parents would like them to learn, and they do not want to let their parents down.

Together, external and introjected regulation form controlled motivation. This form of motivation results in behaviours that are driven by externally referenced reasons, such as fear of punishment or desire for reward (Hagger, 2014). Introjected regulation has been correlated with persistence in engaging with learning tasks, even when considered uninteresting to the student (Levesque et al., 2004). However, controlled motivation in educational contexts has been correlated with rigid learning, cognitive anxiety and reduced creativity and vitality for learning (Guay et al., 2008). Therefore, any benefits of introjected regulation can be outweighed by the negative outcomes associated with controlled motivation.

Identified regulations describes extrinsic motivation that has been fully internalised, where the behaviour has become fully endorsed by the individual (Ryan & Deci, 2000). Identified regulations resemble intrinsic motivation, but it is not the same. Individuals driven by identified regulations desire the valuable outcomes of carrying out the behaviour, rather than carrying out the behaviour for the enjoyment it brings (Vallerand, 1997). Continuing

with the piano scenario, an example of identified regulations would be a pupil learning to play the piano as this has become a life goal for them.

Whilst identified regulations can be categorised as extrinsic motivation, they can also be categorised as autonomous motivation (see Figure 1) (Ryan & Deci, 2000). Autonomous motivation produces behaviours that are consistent with an individual's internal goals (Hagger, 2014). In contrast to controlled motivation, the locus of control comes from the self (van Roy & Zaman, 2018). Autonomous motivation therefore includes identified regulations and intrinsic regulations (Ryan & Deci, 2000).

Autonomously motivated individuals exhibit the same behaviours as intrinsically motivated individuals, resulting in the same advantageous outcomes (Vallerand, 1997). Autonomous motivation has been associated with persistence in learning tasks and schooling, greater academic achievement, enhanced depth and retention of learning, and enhanced wellbeing (Guay et al., 2008). Since many educational activities may not be intrinsically motivating to the learner, understanding how we can facilitate internalisation of extrinsic motivation to become identified regulations has become a key topic of educational research (Deci et al., 1994; van Roy & Zaman, 2018; Stolk et al., 2021).

At the far left of the continuum is amotivation, which is neither a controlled or autonomous form of motivation (Ryan & Deci, 2000). Amotivation describes the lack of internal or external drive to engage in a behaviour (Ryan & Deci, 2000). When an individual engages in an activity they do not value, they have low confidence in doing the activity or do not feel the activity will be useful to them, this can result in amotivation (Ryan & Deci, 2000; Ryan et al., 2019). This may result in an unwillingness to engage in the activity in future (Ryan & Deci, 2000). In the context of learning, amotivation is a form of motivation educators may wish to avoid.

Whilst the self-determination continuum helps us to understand the different types of motivation, learners' motivational responses are more complex than the continuum

suggests (Ryan & Deci, 2000; Stolk et al., 2021). Recent motivational studies have shown that intrinsic and extrinsic motivation can co-exist, and the presence of both may be essential to produce high-performing students, particularly in higher education (Harter, 1981; Lei, 2010; Stolk et al., 2021). However, due to the advantageous outcomes associated with autonomous motivation, the goal of educators should be to enhance autonomous motivation (Guay et al., 2008). Thus, it is important to establish the impact of gamification on autonomous and controlled motivation so that we can assess whether the benefits of gamification as a pedagogy are worth the trade-offs. The impact of gamification on autonomous motivation depends on whether it enhances or thwarts the three basic psychological needs, autonomy, competence and relatedness (Ryan & Deci, 2000).

2.1.3 Self-Determination Theory: Basic Psychological Needs Theory

Self-determination theory proposes that the internalisation of extrinsic motivation, and the degree to which this occurs, depends on the satisfaction of three basic psychological needs: autonomy, competence and relatedness (Ryan & Deci, 2000). Autonomy is the sense that one can choose between several courses of action without feeling pressure from others (Guay et al., 2000). Competence is the sense that one has the ability to do something effectively (Ryan & Deci, 2000). Relatedness describes a sense of belonging or connection with others (Ryan & Deci, 2000).

The learner's basic psychological needs can be satisfied or thwarted depending on the educational environment. For example, negative feedback can reduce the learner's feelings of competence, decreasing their autonomous motivation (Vallerand & Reid, 1988). However, these factors must be viewed holistically to ensure the promotion of one or two basic psychological needs does not thwart another. For example, Hanus and Fox (2015) used badges and leaderboards in an online educational course to enhance competence and relatedness. However, the use of a reward undermined the learner's feeling of autonomy, causing previously intrinsically motivated students to develop controlled motivation (Hanus & Fox, 2015). This resulted in reduced satisfaction, empowerment and performance in the long-term (Hanus & Fox, 2015). It is therefore essential that educators are cognisant of these basic psychological needs, and the delicate balance with which they relate to one another, when designing educational interventions. This study will therefore aim to utilise gamification elements which enhance basic psychological needs, and avoid elements which have been empirically proven to thwart these needs, such as leaderboards and badges (Hanus & Fox, 2015).

2.1.4 Hierarchical Model of Self-Determined Motivation

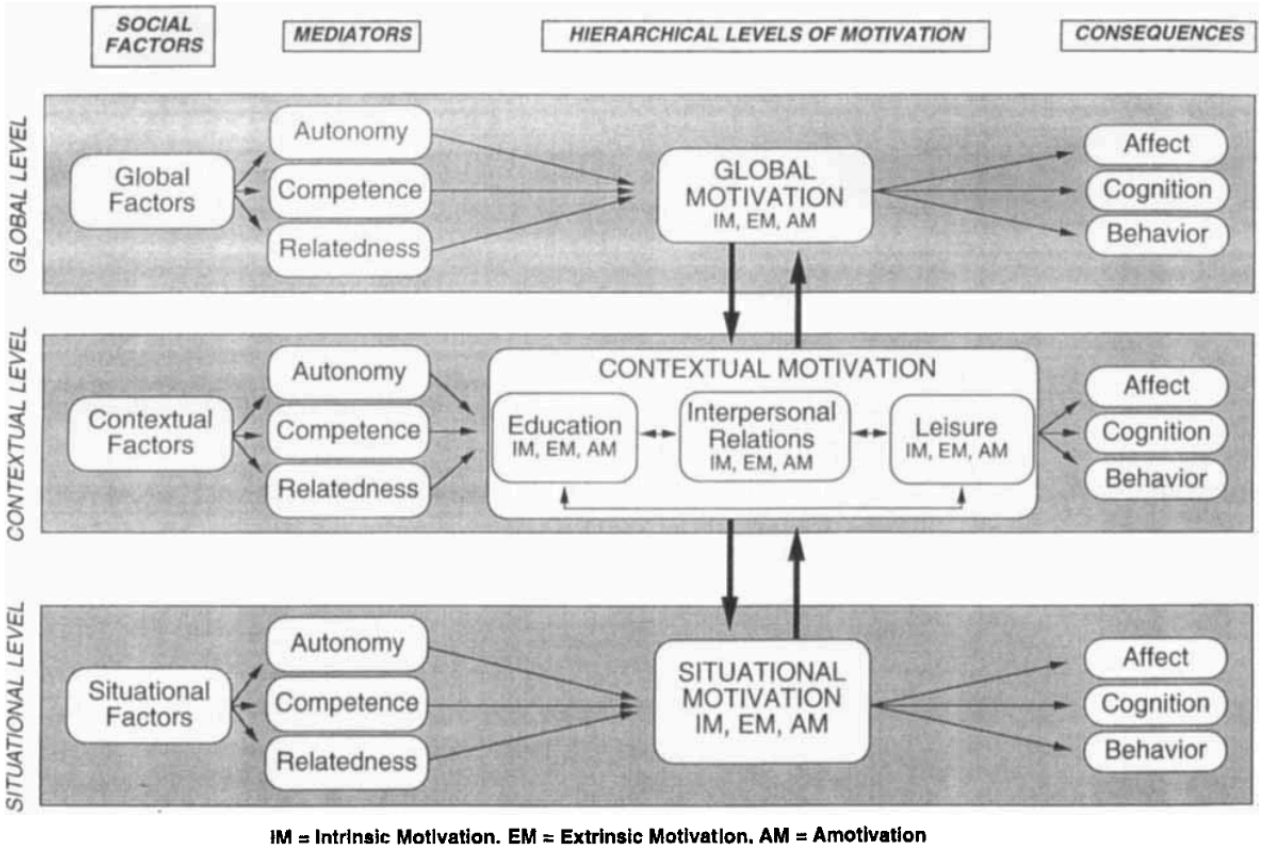


Figure 2: The Hierarchical Model of Self-Determined Motivation. Taken from Vallerand (1997).

Autonomous and controlled motivation are thwarted or enhanced by the three basic psychological needs (Ryan & Deci, 2000). These basic psychological needs are postulated to impact on different hierarchical levels of motivation (Vallerand, 1997). Vallerand (1997) proposed the Hierarchical Model of Self-Determined motivation, which describes the existence of motivation at three hierarchical levels: situational, contextual and global levels (Figure 2). At the bottom of the hierarchy, situational motivation describes the motivation to carry out a specific activity at a specific point in time, such as learning about a specific medical topic (Guay et al., 2000). The second level is contextual motivation, which describes motivation to carry out activity within a specific life contexts, such as education (Vallerand, 1997; Guay et al., 2000). The top level of the hierarchy is global motivation, which describes the motivational orientation of the individuals' personality, such as a predisposition to pursue intrinsically motivating activities (Vallerand, 1997). At each

motivational level, autonomous, controlled and a-motivation can co-exist (Vallerand, 1997; Stolk, 2021).

Motivation at each motivational level is influenced by Ryan & Deci's (2000) three basic psychological needs (Figure 2) (Vallerand, 1997). In turn, the three basic psychological needs are enhanced or thwarted by motivational determinants, known as social factors (Figure 2) (Vallerand, 1997). As such, situational factors, pertaining to experience in the 'here and now', can impact on situational motivation, and contextual factors, such as previous educational experience, can impact on contextual motivation (Blanchard et al., 2006).

The motivational levels are also impacted by the level of motivation above and below it, which are signified in the bi-directional arrows between each level in Figure 2 (Vallerand, 1997; Stolk, 2021). In this way, enhanced situational autonomous motivation in specific learning contexts can, over time, positively impact on contextual autonomous motivation towards education, thus promoting a global personality shift towards autonomous motivation to learn, and yielding the positive educational outcomes associated with intrinsic motivation over longer periods of time (Vallerand, 1997; Lepper, 2005). Conversely, global motivation to learn can impact on contextual motivation towards education, impacting on situational motivation in the present learning context (Vallerand, 1997). In this way, the motivational level above and below another motivational level can have promotional or deleterious effects on overall motivation in specific contexts and situations (Vallerand, 1997).

Motivation at each motivational level produces consequences (Figure 2) (Vallerand, 1997). These consequences are affect, cognition and behaviour. Affect is defined as the emotional response to an object or experience (Wight, 1972). The definition of cognition is contested, but can be defined as the ability to comprehend, know, apply, analyse and synthesise information (Wight, 1972; Bayne et al., 2019). The definition of behaviour is also contested,

but can be defined as co-ordinated responses emanating from an individual that can be externally perceived (Uher, 2016).

Consequences are specific to each motivational level (Vallerand, 1997). For example, enhanced autonomous situational motivation can cause enhanced attention levels in a specific educational setting at a specific point in time, whilst enhanced contextual autonomous motivation towards education can produce enhanced levels of satisfaction when learning (Vallerand, 1997). As such, we can use variations in consequences to infer motivation at each motivational level.

This model also matches my own experience of learning. During the semesters that I was studying anatomy through a gamified pedagogy, my intrinsic motivation to learn about anatomy, and other medical topics taught through traditional methods, increased. This resulted in me studying more than any other period in my education, and gave me excellent results in examinations that academic year. As my education progressed, and the gamified pedagogy was no longer utilised on my course, my intrinsic motivation decreased, and with it my desire to study and therefore my academic performance.

The Hierarchical model of Self-Determined Motivation can be harnessed to assess and enhance motivation at each motivation level within many contexts, including education (Ryan & Deci, 2000; Vallerand, 1997). Situational motivation towards a learning topic can be impacted by short-term learning experiences, such as studying a gamified online module. Therefore, studying the impact of a gamified online module on situational motivation will help us to infer the short-term impacts of gamification on a student's affect, cognition and behaviour, and therefore learning outcomes. As situational academic motivation can impact on one's desire to learn in general, we can also make inferences surrounding gamification's impact on contextual motivation to study in general. Ultimately, this will increase our understanding of the impacts of gamification on overall autonomous academic motivation.

2.2 Gamification

2.2.1 Gamification and Academic Motivation

Gamification has been hailed as a means of enhancing student engagement and intrinsic motivation (Lee & Hammer, 2011; Dichev & Dicheva, 2017; Seaborn & Fels, 2015). The definition of gamification is still contested, but the most commonly used one is “the use of gaming mechanics in non-gaming contexts” by Deterding et al. (2011) (Seaborn & Fels, 2015; Hellberg & Moll, 2023). Gaming mechanics include the use of points, badges, progress bars, storytelling narratives and challenging missions (Majuri et al., 2018). By adding gaming elements, learning activities should become more fun and immersive, promoting intrinsic academic motivation (Dichev & Dicheva, 2017).

Besides increased academic motivation and engagement, gamification has other reported benefits. Systematic reviews suggest that gamification may enhance healthcare professionals’ knowledge, skills, attitudes and course satisfaction (Gentry et al., 2019). This may be facilitated by the use of immediate and delayed feedback mechanisms and self-paced progression (Majuri et al., 2018). Gamification may also enhance enjoyment of online learning, allowing for medical knowledge to disseminate globally, upskilling healthcare workers in low income countries (Tuti et al., 2020). However, it has been criticised for the historical lack of social features, which deny students the opportunity to interact and enrich one another’s learning (Majuri et al., 2018). Gamification has also been criticised for it’s theoretical ability to enhance controlled motivation, through the use of rewards for otherwise unrewarded learning, leading to poor long-term engagement and learning outcomes (Kasser & Ryan, 1996; Lei, 2010).

However, the true impact of gamification on motivation remains a disputed topic. Empirical studies have shown mixed effects of gamification on academic motivation (van Gaalen, 2021; Dichev & Dicheva, 2017; Mekler et al., 2017; Herbert et al., 2014; Utomo & Santoso, 2015; Hanus & Fox, 2015). It is difficult to make firm conclusions from these studies

though, due to the lack of gamification definition consensus, heterogeneous gamification elements used and lack of qualitative studies (Majuri et al., 2018). Moreover, many studies appear to be based on poor understanding of motivational theory, as they conflate motivation with engagement, two related but distinct concepts, or utilise unsubstantiated motivational surveys to assess motivation levels (Loñez & Errabo, 2022; Mekler et al., 2013; Markland & Hardy, 1997). A negative relationship has been clearly established between the use of points, badges and leaderboards, termed 'pointsification', and motivation (Kapp, 2012; Hellberg & Moll, 2023). However, despite this, many gamification studies still incorporate 'pointsification' with other gamification elements, leading to mixed or inconclusive results (Hellberg & Moll, 2023). This impacts on the outcomes of systematic reviews evaluating the impact of gamification on motivation as, due to poor study quality, lack of theoretical knowledge, or mixed results, no conclusions can be made regarding the overall impact of gamification on academic motivation (Vélez et al., 2023; Zainuddin, et al., 2020). Consequently, very few educators utilise gamification as a pedagogy, particularly as it is expensive and resource-intensive (Gentry et al., 2019).

The limited quantitative or mixed methods studies carried out investigating the impact of gamification on motivation has also focused on assessing the impact on contextual academic motivation, rather than situational academic motivation (Stolk, 2021; van Roy & Zaman, 2018). As gamification can be used as a short-term study pedagogy, it is important to investigate the impact of gamification on situational motivation, which can have further implications on contextual and global motivation (Vallerand, 1997). Therefore, this study has decided to focus on quantitatively assessing the impact of gamification on situational academic motivation using a gamification module incorporating needs-supporting gamification elements by utilising a standardised situational motivational scale. It is outside the scope of this project to assess contextual academic motivation. However, situational and contextual academic motivation will be explored through the qualitative arm of this study.

2.2.2 Context is important

The effects of gamification on motivation appear to differ in different individuals: what may promote intrinsic motivation in one individual in one context may thwart intrinsic motivation in another individual or context (Stolk et al., 2021; van Roy & Zaman, 2018).

Studies have shown that gender can affect the impacts of gamification on motivation (McDaniel et al., 2012). Whilst both genders show enhanced intrinsic motivation in response to gamification, McDaniel et al. (2012) have shown mixed effects of gamification on intrinsic motivation in women compared with men. Females are more likely to have higher intrinsic motivation than males, regardless of pedagogy (Ratelle et al. 2007; Levesque et al., 2004). However, females are more likely to experience low self-esteem, and so may experience more negative outcomes than males in the context of enhanced extrinsic motivation in response to gamification (Lei, 2010; Levesque et al., 2004). Studies investigating academic motivational responses to gamification by gender in higher education students are particularly scarce, and are non-existent in medical education (Stolk et al., 2021) (See Appendix C).

Intrinsic motivation to learn can also vary with age (Harter, 1981; Jent & Janneck, 2018; Zahedi et al., 2021). Students become increasingly less intrinsically motivated as they progress from primary school to higher education (Harter, 1981; Lepper, 2005; Lei, 2010). This troubling data has been explained by a transition from task-focused and self-directed play in the younger years of primary school, to increasingly controlled and performance-focused learning in higher education (Lepper, 2005). This makes development of intrinsic motivation in older learner's increasingly difficult.

Increasing age has also been correlated with reduced intrinsic motivation in response to gamified learning (Seaborn & Fels, 2015; Jent & Janneck, 2018; Bagley & Levkowitz, 2011). This may be due to a lack of familiarity with digital technologies with increasing age. However, empirical studies have also shown that intrinsic motivation decreases with age,

regardless of pedagogy (Wigfield et al., 2019; van Roy, 2019). Nonetheless, there is a lack of studies investigating the impact of age on motivational responses to gamification in any educational setting, and has not been investigated at all in medical education or otolaryngology (see Appendix C).

Historically, gamification studies have investigated the impact of gamification on motivation at a group level without specifying population demographics and characteristics (van Roy & Zaman, 2018). However, motivational responses appears to be person-specific, and varies according to pedagogy and person-specific characteristics (Seaborn & Fels, 2015; Dichev & Dicheva, 2015). Identifying the impacts of gamification on different individuals may help us to untangle the somewhat contradictory results found in empirical studies and utilise gamification in student cohorts who would benefit best from this pedagogy.

2.3 Otolaryngology, gamification and academic motivation

Otolaryngology is the treatment of pathologies related to the ears, nose and throat (ENT) (Nogueira Júnior et al., 2007). Up to 25% of adult and 50% of paediatric presentations in general practice are related to ENT (Ferguson et al., 2021). Despite this, only 53% of medical school's in the United Kingdom (U.K.) mandate students to undertake an otolaryngology placement, the average length of which is 8 days (Yau et al., 2021). Consequently, U.K. medical graduates have expressed low confidence in dealing with common ENT presentations (Ferguson et al., 2021). Therefore, there have been calls to reform the medical curriculum to include more otolaryngology teaching.

How future otolaryngology teaching should be carried out at medical school remains a topic of debate (Yau et al., 2021). Gamification has been shown to enhance knowledge, skills and satisfaction compared with traditional and other forms of online learning, and could educate healthcare professionals worldwide in a scalable manner (Gentry et al., 2019). Due to short, or non-existent, otolaryngology placements for medical students in the U.K., gamification may offer an opportunity for medical schools to transfer knowledge and skills to medical students in a self-directed manner online, reducing direct teaching time. However, students must feel intrinsically motivated to study otolaryngology for them to engage with the gamified learning material.

There are a lack of studies investigating the effects of gamification on motivation in medical education, particularly in otolaryngology (Westenhaver et al., 2022; Gentry et al., 2019). Through this study, I hope to establish a clear correlation between the use of gamification on academic motivation in medical student's studying otolaryngology, therefore providing guidance to medical schools on how to best motivate students to study otolaryngology.

2.4 Research questions

Considering the promising effects of gamification and the lack of studies investigating the impact of gamification on motivation within otolaryngology, I have formulated the following research questions:

1. How does gamification impact on medical students' situational and contextual academic motivation to learn about otolaryngology?
2. How does the impact of gamification on medical students' situational motivation to learn about otolaryngology differ with age and gender?

As medical education transitions online (Alrumi, 2024), and direct exposure to otolaryngology in medical school decreases, it is important that medical student's are motivated to study otolaryngology in a self-directed manner. This study aims to enhance our understanding of the impact of gamification on student's academic motivation to study otolaryngology. Also, depending on the impacts of gamification on situational motivation in increasing ages or different genders, gamification may or may not be recommendable to specific medical courses, for example graduate entry medicine or unisex medical schools. Therefore, it is prudent to understand how gamification impacts situational motivation in different student demographics.

2.5 Research hypotheses

In conjunction with the post-positivism paradigm, my study will aim to falsify the following hypotheses:

1. Well-designed gamification enhances medical students' situational autonomous motivation and reduces situational controlled and a-motivation to learn about otolaryngology when compared with self-directed online learning.
2. Well-designed gamification enhances medical students' contextual autonomous motivation and reduces contextual controlled and a-motivation to learn about otolaryngology when compared with self-directed online learning.
3. Gamification and increasing age will be associated with a reduced level of situational autonomous motivation to learn about otolaryngology.
4. Gamification and female gender will be associated with a greater level of situational autonomous motivation to learn about otolaryngology than male gender.

3. Methodology

3.1 Personal/professional background

During medical school, I partook in an anatomy course which incorporated gamification elements. I found this course extremely enjoyable, and felt motivated to learn the content. I believe this helped me to achieve excellent marks in my anatomy examinations. My hypothesis when starting this project was that gamification would have a positive impact on medical students' intrinsic motivations based on my own experiences as a medical student. I decided to investigate this specifically in the specialty of otolaryngology as this is my clinical specialty.

3.2 Research paradigm

Prior to designing my study, I reflected on my philosophical viewpoints and my research questions. The effects of gamification on motivation in medical education is extremely complex, with many controllable and uncontrollable factors shaping the learners' response to the educational experience (Seaborn & Fels, 2015). I believe the response of a specific individual to a specific set of gamification elements within a specific context is impacted by an individual's past experience, ideas and beliefs, and so the motivational impact is impossible to fully define. However, we can broadly estimate the effects of gamification on medical students' motivation, "gain[ing] a closer approximation to the truth" (Clark, 1998; Bunniss & Kelly, 2010). This viewpoint most closely aligns with the post-positivism philosophical framework, and so I have designed my research project according to the principles of this research paradigm (Bergman et al. 2012). As such, I aim to falsify the research hypotheses I have created through the results of my study (Corry et al., 2019).

3.3 Research design

Post-positivist research embraces the use of mixed methods (Clark, 1998; Bunniss & Kelly, 2010). Mixed methods involves the collection and analysis of both quantitative and qualitative research (Almaki, 2016). Quantitative research involves the collection of numerical data and mathematical analysis of this data, producing 'objective' and deductive data (Almaki, 2016). Qualitative research involves exploring individuals' or groups perspective of a topic to produce rich, subjective and inductive data (Creswell, 2014). Therefore quantitative data helps to give an overall, rounded picture, whilst qualitative data produces deeper analysis of a topic (Cohen et al., 2007, pg 96). Due to the greater insights yield from mixed methods, there have been calls for more mixed methods studies, particularly in complex implementation research (Palinkas, et al. 2015; Almaki, 2016). The study will use holistic triangulation design, using two quantitative surveys to inform the semi-structured interview questions (Turner et al., 2017).

3.4 Reflexivity

The post-positivist research paradigm acknowledges that researchers' cannot be "wholly detached", and their perceptions will influence the research process (Clark, 1998). No research can be fully objective, and is always influenced by the researcher's past experience, culture and intentions (Clark, 1998). Therefore, it is impossible to avoid subjectivity in one's own research. Reflexivity involves reflecting on one's opinions and biases, acknowledging it's impact on the research processes and data (Olmos-Vega et al., 2023). Reflexivity is therefore a requirement when producing rigorous and high quality qualitative data (Johnson et al., 2020; Olmos-Vega et al., 2023). Whilst some researcher's would argue that reflexivity is not an appropriate practice in post-positivist research (Varpio et al., 2017), I would argue that the entire research context, including the relationship between researcher and participant, needs to be acknowledged to produce impactful research. Therefore, throughout the qualitative arm of this study, I wrote a personal reflexivity log (Appendix A). Reflecting on semi-structured interviews and their analysis

helped me to adapt my interview technique, allowing me to gather richer information from subsequent interviewees, thus producing more insightful research outcomes.

3.5 Methods

3.5.1 Scoping review

Prior to commencing the study, I performed a scoping review to outline existing gaps in the literature related to the impact of gamification on motivation within medical education (Arksey & O' Malley, 2005). Scopus, American Psychology Association (APA) PsycINFO, PubMed, Science Direct, Association for Computing Machinery (ACM) Digital Lab and grey literature were searched on 5th February 2024, and updated 2nd September 2024 (Appendix B). This identified 447 papers, which were categorised and sub-categorised according to the studies' context (Appendix C). Only 1 papers investigating the impact of gamification on motivation in the realm of medical education was identified through this scoping review, which was in the context of genetic counselling teaching (Appendix C). 5 other medical papers were identified which attempted to motivate healthcare professionals and patients with various digital platforms (Appendix C). No papers were identified which educated undergraduate or postgraduate medical students (Appendix C).

3.5.2 Eligible participants

Convenience sampling was used to recruit students at two medical schools, one in the North and one in the South of England (Cohen et al., 2007). These universities were chosen due to my personal connections with the medical teaching faculty at these universities. These universities recruit national and international students, so should provide a satisfactory spread of socioeconomic and demographic backgrounds representative of medical students across the U.K.

Students were required to be 18 years of age and over to provide full informed consent. At the Southern university, the recruited students were in their 3rd year, if studying graduate-entry medicine, and 5th year, if studying undergraduate medicine. At the Northern university, the recruited students were in their 4th year of undergraduate study. These student cohorts were selected as they have completed an otolaryngology placement and are sitting examinations in otolaryngology in their current academic year. Therefore, these students would have both intrinsic and extrinsic motivations to study the module. The knowledge in the modules would also be most useful for this cohort of students.

3.5.3 Gamified and non-gamified module design

To assess the impact of gamification on medical students' motivation within otolaryngology medical education, I designed two online modules, one with gamification elements and one without gamification elements. These modules were hosted on Canvas, an online course management system (Instructure, 2024). The modules took approximately 2 hours each to complete.

The gamification elements incorporated into the gamified module were limited by the technical scope of the Hypertext Markup Language 5 (HTML5) Content plug-in, H5P (Griff, 2024), but included drag-and-drop diagrams, fill-in-the-blanks, points for correctly answered questions, and immediate feedback (Figure 3-6). Thus, over 4 gamification elements were incorporated into the gamification module, which is the number needed to make a module "gamified" (Westenhaver et al., 2021). The focus of these tasks were to create meaningful activities that promoted learning and higher-order thinking, with an adequate amount of challenge, to promote intrinsic motivation (Wigfield, 2019). Gamification features which promoted direct comparison with peers were avoided, as this is thought to enhance extrinsic motivation (Wigfield, 2019).

Branching scenarios were also incorporated into the gamified module. Branching scenarios presented students with a clinical example and gave them differing options of how to

proceed, leading to different patient outcomes depending on their choices (Figure 6). In this way, the branching scenarios introduced story-telling, an important aspect of gamification (Enders, 2013). They were also designed to promote student choice, appealing to their sense of autonomy and theoretically enhancing their intrinsic motivation (Ryan & Deci, 2000; Wigfield, 2019).

The non-gamified module contained the same text, pictures and self-assessment questions as the gamified module, but in a non-interactive format. This has been exemplified in Figure 7. This allowed me to compare the gamified and non-gamified groups to assess whether there was a difference in motivational outcomes.

Both modules were designed in collaboration with Otolaryngology Clinical Leads at a world-leading university. The learning objectives were guided by the ENT UK Undergraduate curriculum guidelines to produce high quality and relevant undergraduate learning content (Lloyd, 2014).

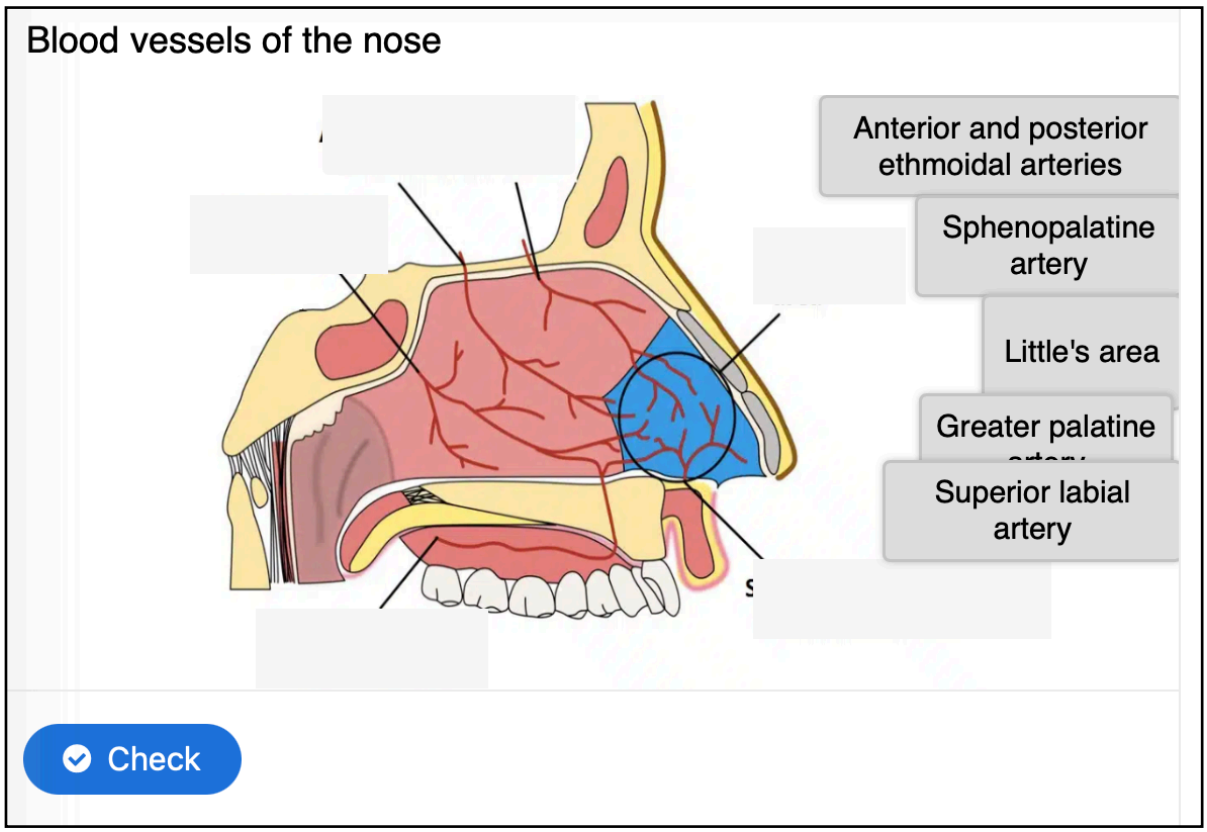


Figure 3: example of a 'drag-and-drop' exercise on the blood vessels of the nose in the gamified module.

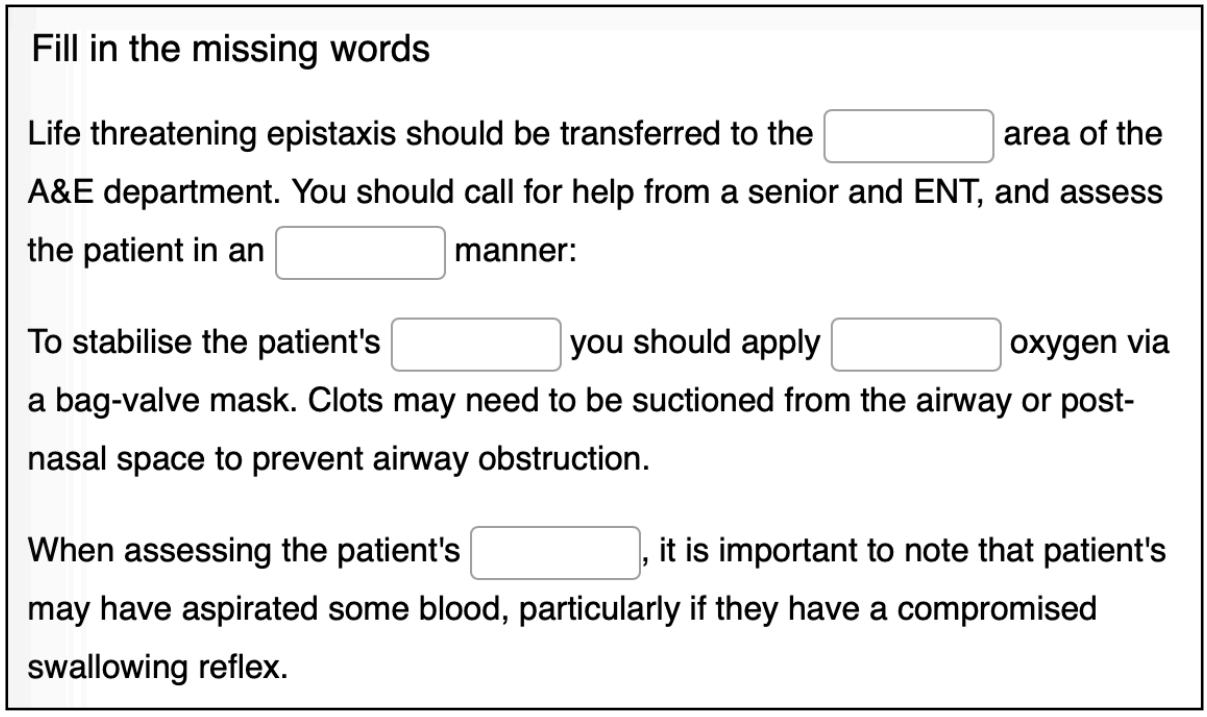


Figure 4: example of a 'fill-in-the-blank' exercise on the clinical management of life-threatening epistaxis in the gamified module.

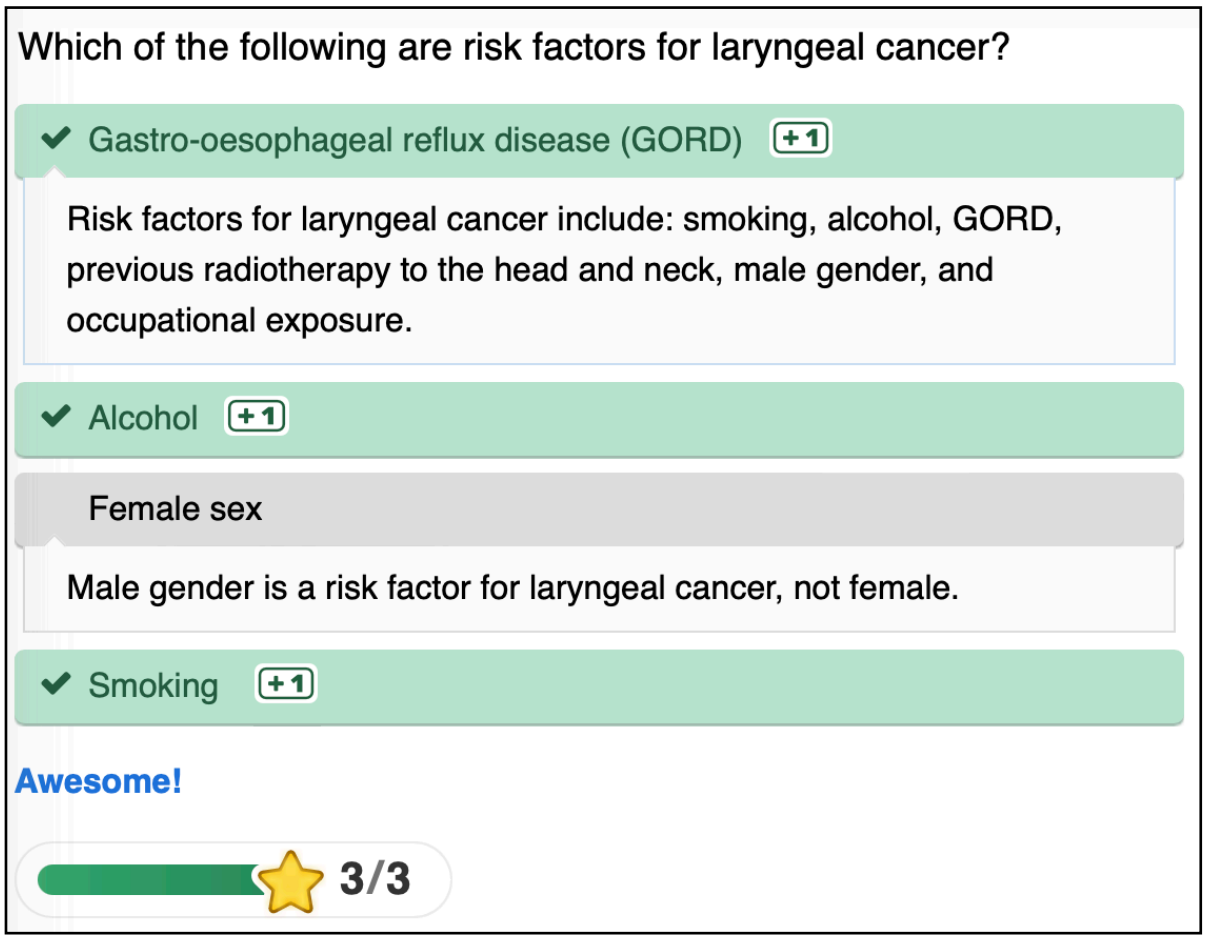


Figure 5: example of question, with points for correct answers and immediate feedback in the gamified module.

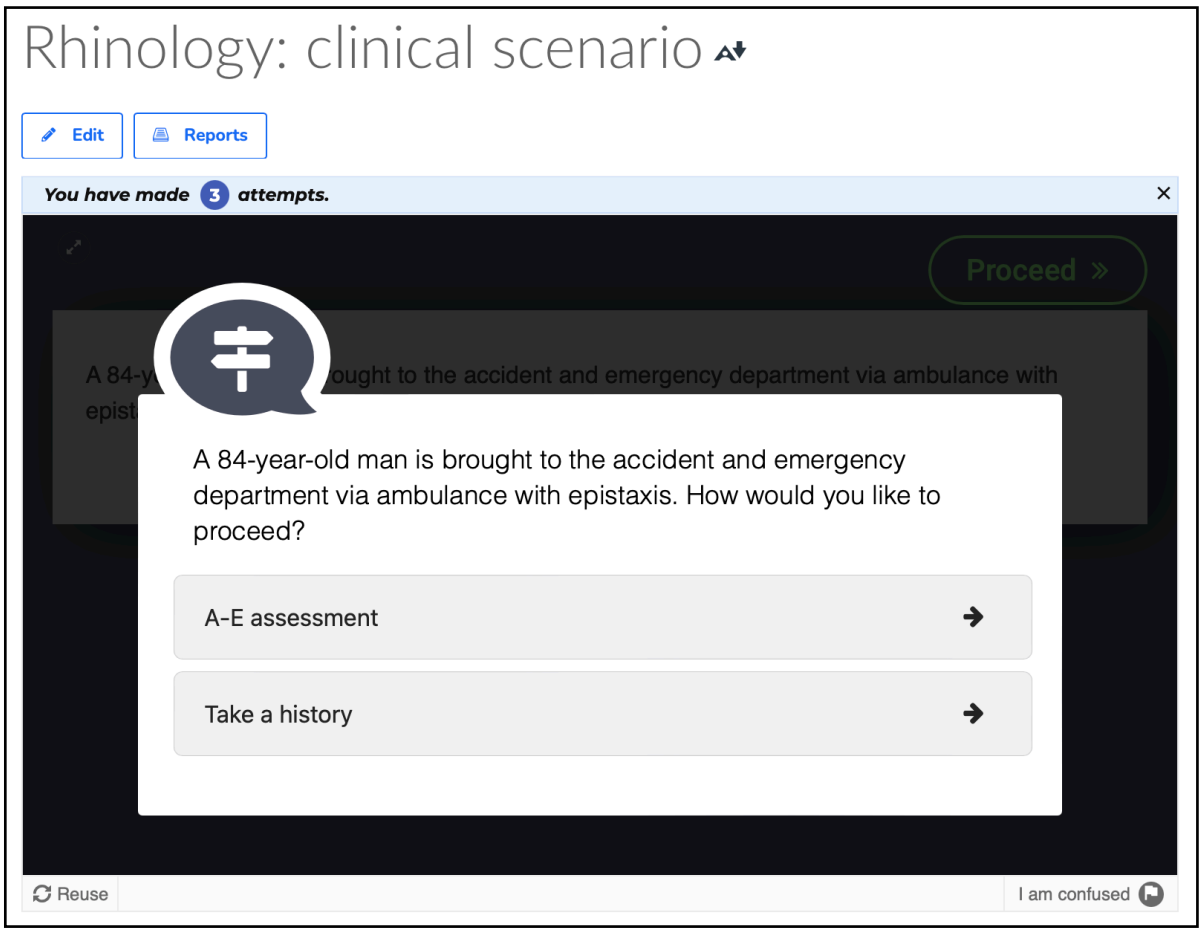


Figure 6: example of a branching scenario in the gamified module. Depending on the different options student's choose throughout the scenario, the patient will have a different outcome at the end.

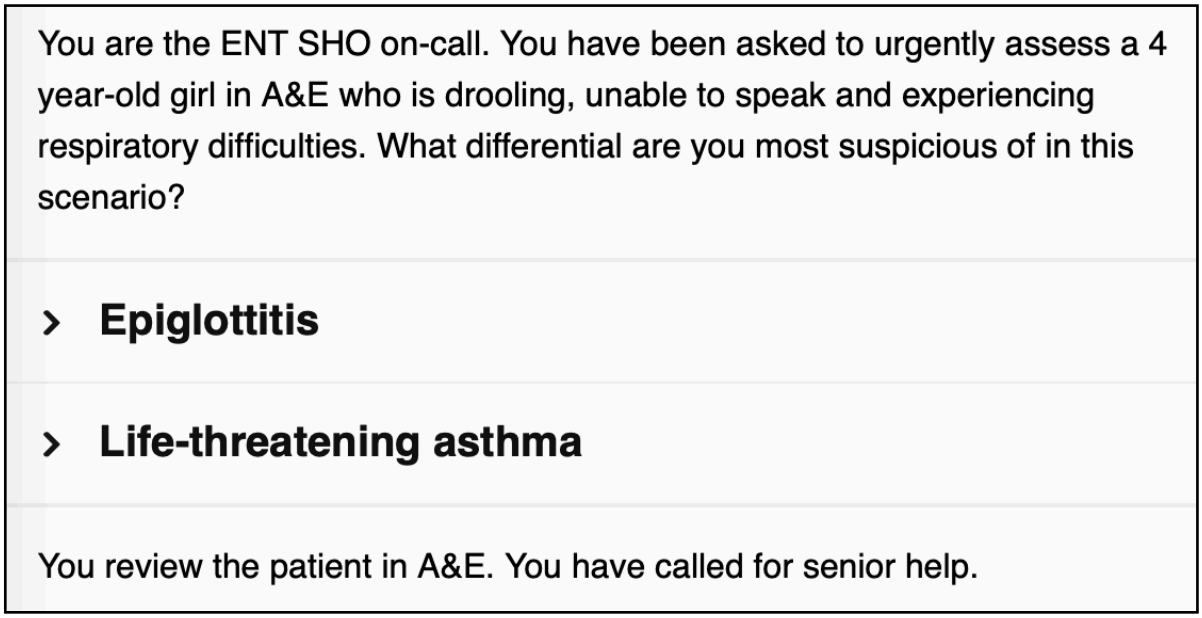


Figure 7: example of question and answer from non-gamified module. Students could select the answer to the question, which would drop down to reveal whether the answer was correct. In this way, content in the non-gamified module was identical to the gamified module, but without the interactive elements and personalised feedback.

3.6 Quantitative methods

3.6.1 Sample

My aim was to recruit 100 students to complete the pre- and post-module surveys to produce powerful quantitative data, as recommended by Cohen, Marion and Morrison (2007, pg 102). Comparable quantitative studies included a similar number of participants (Zahedi, et al., 2021; Hanus & Fox, 2015).

The Southern medical students were randomised and automatically enrolled onto the module as I had access to these students' details and email addresses. This was agreed by the Year 3 and Year 5 Clinical Leads and Otolaryngology clinical leads at the university. The module was entitled 'optional' so that it was clear to students that this was a non-compulsory module, and therefore consent was informed.

Students at the Northern medical school were advertised to online on the universities education portal (Appendix D) and recruited in-person as I did not have access to these students' details and email addresses. I attended otolaryngology inductions at all but one of the teaching hospitals at this university to advertise and recruit students. The students attending these inductions were all in their 4th year of medicine. I did not visit one of the teaching hospitals as it was geographically too far for me to travel. However, all students at the Northern University were advertised to through the medical school's online community website, and so students at the teaching hospital that I did not visit in-person could still sign up for the project if they wished to. Eligible students at the Northern university were invited to write their email on a sheet of paper at in-person inductions, or email me if recruited through the medical school's online website, if they would like to be enrolled. Students were informed at the point of recruitment that the module was non-compulsory.

Students from both universities were randomised prior to enrolment, reducing the impact of confounding variables (Pourhoseingholi et al., 2012). Students were unaware of which

module, gamified or non-gamified, they had been assigned to reduce bias. I, as the investigator, was aware which module the student had been assigned to, and so this was a single-blinded study (Day & Altman, 2000). Single blinded studies are more prone to false-positive, or type I, errors than double blinded studies, producing possibly inflated effect size in the intervention of interest (David & Khandhar, 2023). Unfortunately, this limitation could not be avoided, but is mitigated by the use of self-directed modules and surveys, and the use of quantitative analysis to analyse the results.

3.6.2 Module and surveys consent

Prior to commencing the module or surveys, students were directed to the module participant information sheet (Appendix E) and consent form (Appendix F). Student's could close the browser at the point of consent, thus not giving consent. Equally, student's could close the browser when completing the survey and module, thus not being included in the study. Student's were also given my personal email address so that they could withdraw their consent after completing the surveys and module, and therefore would not be included in the study. This helped to ensure student consent at all points in the research process.

3.6.3 Survey design

In this study, quantitative measurement of students' intrinsic and extrinsic situational motivation was assessed using a pre and post-module questionnaire adapted from The Situational Motivation Scale (SIMS) questionnaire (Guay et al., 2000). The SIMS questionnaire is a self-reported questionnaire which uses the Likert scale to assess "situational intrinsic motivation, identified regulation, external regulation, and amotivation" in accordance with Deci and Ryan's self-determination theory (Ryan & Deci, 2000; Guay et al., 2000; Stolk et al., 2021). This validated measure was chosen as it can be applied to adult learners and assesses situational motivation towards a specific topic at a specific point in time (Guay et al., 2000; Stolk et al., 2021). The Academic Motivation Scale (AMS) was not chosen for this study, despite being a popular measure to assess students' intrinsic and extrinsic motivation, as it measures contextual academic motivation (Vallerand et al., 1992; van Roy & Zaman, 2018). Contextual academic motivation is likely to change with a longer intervention, spanning weeks to months, as opposed to a short intervention spanning a few hours, as was the case for this studies intervention (Vallerand et al., 1992). Therefore, contextual motivation would not have changed with such a short intervention, and so the AMS could not be used (Vallerand, 1997).

Within the pre-module survey, student were asked about their demographics, including age and gender. These demographics were hypothesised to impact on the students' motivational response to the gamified or non-gamified module as seen in other studies (Seaborn & Fels, 2015; Dichev & Dicheva, 2015; Jent & Janneck, 2018; Stolk, 2021). As this data was sensitive, participants had the option to answer 'prefer not to say' (C.U.R.E.C, 2023). The pre- and post-module survey can be seen in Appendix G.

3.6.4 Survey analysis

The survey results were included in the analysis if there was both a pre- and post-module survey response available for the participant. This allowed me to compare motivation levels

in the same individual before and after the intervention, and therefore infer that differences in motivation were due to the intervention alone.

3.6.4.1 Internal consistency of SIMS questionnaire

The construct validity of the SIMS questionnaire was analysed using Cronbach's alpha (α) testing in IBM SPSS (version 29) (IBM Corporation, 2022). Cronbach's α values were calculated to assess the internal consistency of the four SIMS sub-scales to measure situational intrinsic motivation, identified regulation, external regulation, and amotivation, in accordance with Deci and Ryan's self-determination theory (2000). A Cronbach α value of 0.70 or more is thought to be indicative of instrument reliability and internal consistency (Taber, 2018).

3.6.4.2 Motivational response profiling

Once the scale was assessed for internal consistency, k-means quantitative clustering was used to analyse students' motivational response profiles to the module (Stolk et al., 2021). This was performed to assess whether students' overall motivational response to the gamified or non-gamified module was autonomous or controlled.

Quantitative clustering can incorporate many different continuous variables and analyse their interplay, producing numbers of groups from complex data (k) (Aldenderfer & Blashfield, 1985). K-means clustering has been shown to produce more consistent results than other clustering methods (Aldenderfer & Blashfield, 1985). One of the disadvantages of k-means clustering is the reliance on initial seed values for clustering (Aldenderfer & Blashfield, 1985; Stolk et al., 2021). However, Stolk et al. (2021) have previously defined 7 types of motivational responses, which vary depending on the intrinsic motivation, identified regulation, external regulation and amotivation levels shown. The descriptive statistics for each motivational response cluster from Stolk et al. (2021) was used to pre-

define the k-means centroid, and k-means cluster analysis was used to find the closest motivational response profile for each participant in the study.

3.6.4.3 SDI difference

The self-determination index (SDI) was also calculated from participants' pre- and post-module surveys (Guay et al., 2003). The self-determination index is a well established calculation in motivational research which represents the students overall intrinsic versus extrinsic motivation on the self-determination continuum (Guay et al. 2003; Stolk et al., 2021). It is calculated as follows: SDI = 2×(intrinsic motivation) + 1×(identified regulation) – 1×(external regulation) – 2×(amotivation) (Stolk et al., 2021). The SDI score can range from -18 to +18. The higher the SDI score, the higher the levels of intrinsic, or autonomous, situational motivation towards learning otolaryngology (Guay et al., 2003; Stolk et al., 2021). Participants' SDI score was calculated to compare students' motivation before and after the module for both gamified and non-gamified module participants to assess whether either intervention enhanced or decreased overall autonomous motivation.

The paired test statistic (t)-test is a parametric test that can be used to compare two dependent variables (Mishra et al., 2019a). The paired t-test was used to compare the pre- and post-module SDI scores for both the gamified and non-gamified modules to assess the difference in motivation levels before and after the interventions. The paired t-test was chosen over Wilcoxon-signed rank as the data was normally distributed (Mishra et al., 2019b; Dwivedi et al., 2017). Statistical significance was defined as a probability (p) value equal to or less than 0.05 that the null hypothesis can be accepted (Di Leo & Sardanelli, 2020).

3.6.4.4 Motivation, gamification and age or gender

The SDI difference for the gamified gamified cohort was also used to assess for associations between motivation, gamification and age or gender. The non-gamified study was not looked at as this was not the intervention of interest. The difference between the SDI score was calculated as follows: SDI difference = post-module SDI - pre-module SDI.

The Fisher's exact test can be used to test for associations between two independent, categorical variables in a single sample (Kim, 2017). It was used to test for an association between age and SDI difference, and gender and SDI difference, for participants in the gamified arm of the study. Fisher's exact test was chosen over chi square test of independence as Fisher's is an exact test, and so can be used on smaller sample sizes (Franke et al., 2012; Kim, 2017).

3.7 Qualitative methods

3.7.1 Sample

To complement the quantitative aspect of the study, semi-structured interviews were carried out to gain a richer understanding of the effect of the gamified module on students' motivations. Criterion-i sampling (Palinkas et al., 2015) was used to select medical students who had completed the gamified module.

14 of participants who completed the gamified module were invited to interview. It was predicted that only 50% of respondents would accept and proceed to interview (Cohen et al., 2007), producing 7 interview transcripts. This amount was deemed large enough to provide insightful data, producing overall data saturation, whilst also being an achievable number of interviews for me to carry out (Johnson et al., 2020). This number of interviews is similar to comparable studies (Maheu-Cadotte et al., 2023; Zahedi et al., 2021).

During qualitative data collection, 8 medical students signed-up for, and completed, the semi-structured interview. No further interviews were completed as data saturation had been reached (Saunders et al., 2017).

3.7.2 Semi-structured interview

Semi-structured interviews are a form of qualitative data collection, whereby topics and questions to be discussed are pre-planned, but the exact wording and order of questioning do not need to be followed (Cohen et al., 2017, pg 514). Semi-structured interviews were chosen for the qualitative arm of this study to ensure some standardisation between interviews, with flexibility to explore the medical students' individual perspectives (Cohen et al., 2017; DiCicco-Bloom & Crabtree, 2006). The semi-structured interview questions were adapted from Maheu-Cadotte, Dubé, & Lavoie (2023) (Appendix H), and incorporated questions based on students' pre- and post-module survey responses. This triangulation design helped to ensure interview questions incorporated general questions, asked of each participant, as well as personalised questions, generating holistic and robust interview data.

Participants were encouraged to discuss their experience of the gamified otolaryngology module, hence exploring their situational motivation towards studying otolaryngology in the module. Participants were also encouraged to discuss their experience of other gamified medical education platforms in the context of otolaryngology, impacting their contextual motivation to study otolaryngology. This enabled a deeper discussion around the impacts of gamification on situational and contextual motivation to be had.

Students were able to opt-in to be interviewed by ticking 'yes' in the post-module survey. Students who had volunteered for interview were sent the semi-structured interview participant information (Appendix I) and semi-structured interview questions prior to the interview to ensure informed consent and high quality interview responses. All semi-structured interviews were carried out on Microsoft Teams. At the beginning of the interview, the medical student was reminded that interview would be recorded before taking oral consent (Appendix J). Medical students were informed that they did not need to keep their cameras on if this made them uncomfortable, but also students chose to turn

their cameras on for the interview. This helped with rapport building and reading of non-verbal cues.

The interviews lasted between 15 to 20 minutes. Interviews were transcribed by the Microsoft Teams auto-transcription service, the accuracy of which was checked and edited manually by myself. Member checking was also used to ensure written transcripts reflected the students' meaning and intentions (Johnson et al., 2020). 5 out of 8 interviewees responded to inform me the transcript was accurate, and the remaining students did not respond. The transcripts were then subjected to rigorous thematic analysis.

3.7.3 Semi-structured interview analysis

Thematic analysis of the interview transcripts were carried out manually using template analysis as described by King (2012). This form of thematic analysis is in keeping with the post-positivism research paradigm (Braun & Clarke, 2022). Template analysis encourages the use of *a priori* themes to apply established theoretical models and accelerate thematic analysis (Brooks et al., 2015). Ryan & Deci's (2000) Self-Determination Theory, Ryan & Deci's (2000) three Basic Psychological Needs, and Vallerand's (1997) Hierarchical model of Self-Determination were used as a broad framework for the template analysis. This provided a logical starting point for analysis, with the flexibility to change themes according to what codes emerged throughout the interview data (Brooks et al., 2015).

All interview transcripts generated by Microsoft Teams were read through and checked for accuracy prior to coding and to enhance familiarisation with the data (Braun & Clarke, 2022). Four interview transcripts with varied demographics were coded into descriptive codes according to the *a priori* themes (Brooks et al., 2015). The descriptive codes were grouped deductively into situational and contextual social factors, and matched with the *a priori* themes, generating a hierarchical coding template (Braun & Clarke, 2022; Brooks, McCluskey, Hurley & King, 2015). As per Creswell (2014), I aimed to generate approximately 20 codes in the coding template (Brooks et al., 2015). The initial template was applied to the remaining four interviews, and modified if new data did not fit with the initial template codes and themes (Brooks et al., 2015). The interview data and template was read through and scrutinised three times to ensure template accuracy (Nowell et al., 2017). The template was considered complete when all interview data relevant to the research questions could be coded using the template, the codes were unique and definable, and the template provided an accurate summary of the data (Elliot, 2018; Braun & Clarke, 2022). The template underwent minor tweaks throughout the analysis process to better reflect the interview data and provide links with existing literature (Braun & Clarke, 2022).

3.8 Ethical considerations

This study received ethical approval from the University of Oxford's Central University research Ethics Committee (CUREC) on 5th December 2023 (Appendix K). The research was guided by the British Educational Research Association Ethical Guidelines for Educational Research (B.E.R.A, 2018), Central University Research Ethics Committee best practice guidelines (C.U.R.E.C,
2023), Association for Computing Machinery Code of Ethics and Professional Conduct (ACM, 2018), British Psychological Society: Ethics Guidelines for internet-mediated research (B.P.S, 2021) and the Association of Internet Researchers Ethical Guidelines 3.0 (Franzke et al., 2019).

Students who were recruited for the module in-person wrote their names and email addresses on paper, which was subsequently shredded for data protection. Student details were written manually to prevent third party storage of the respondent's details, outside of Canvas.

The home page on both the gamified and non-gamified online module contained the participant information sheet (Appendix E). If the student was happy to proceed, they would click through to the consent form (Appendix F), where participants were asked to confirm that they were 18 years of age and over, and that they were happy to proceed with the project.

Following this, the student would be directed to the pre-module survey. The pre-module survey also contained questions about the students' demographic, such as age and gender, as this has been shown to have an impact on a students' response to gamification (Seaborn & Fels, 2015; Dichev & Dicheva, 2015). As this data was sensitive, participants had the option to answer 'prefer not to say'.

In recognition of the students' time and effort, students were given a medical certificate for their portfolio for both completing the online module and surveys, and one for partaking in the interview. Medical student's are required to show engagement with extra-curricular activities, such as lectures and online modules, and so a certificate would be valuable for their learning portfolio's. The module was also designed to embed highly relevant otolaryngology knowledge that was pitched at the undergraduate level. Medical student's who had completed the surveys, module and semi-structured interviews were also offered a £25 Amazon gift voucher, as uptake to the semi-structured interview was initially poor. However, this may have enhanced students' extrinsic motivations to complete the module and the semi-structured interview, thus possibly impacting on the results of the study.

Individuals were informed at the point of recruitment and consent that they can withdraw themselves from the study by closing the internet tab. If they had submitted data which they wished to be deleted and not included in the study, they could do so until 12th September 2024, the date of dissertation submission. All students were disenrolled from the module on 1st May 2024 when the study ended. Students were automatically dis-enrolled from Canvas on 1st May 2024 if they had been enrolled for the purpose of this study only.

Consent, survey responses, interview recordings and transcripts were backed up onto Nexus 365 OneDrive for Business in a password-protected folder, which will be deleted on 1st October 2024. Survey responses and interviews were pseudo-anonymised to enhance participant anonymity and confidentiality. Interview recordings were deleted once transcribed and checked, apart from the oral consent, which was kept for audit purposes. This encouraged students to give their honest responses and opinions during the survey responses and semi-structured interviews, enhancing the validity of the data and producing insightful themes during template analysis.

4. Findings

This chapter will describe the findings of this study investigating the impacts of gamification on medical students' academic motivation. The results will be split into two sections, a quantitative and qualitative section. Both arms of this mixed method study will then be consolidated and analysed together in the discussion section to give a holistic overview of the research findings.

4.1 Sample and demographics

In total, 195 students enrolled for the study. 141 students were from the Southern University and in their 5th year of study, and 54 were from the Northern University and in their 4th year of study. The age and genders for the whole population was not known. Students were randomised into different intervention arms, with 103 students assigned the gamified module and 91 assigned the non-gamified module.

Out of 103 students assigned the gamified module, 21 students took the pre-module survey, and 14 students completed the module and pre- and post-module surveys (33% attrition). Out of these 14 students, 7 were male, 6 were female and 1 preferred not to disclose their gender. Their ages ranged from 21-29 years. 11 of the students were from the Southern university. 3 of these students were from the Northern University. The spread of data from the two universities is representative of the sample population.

Out of 91 students assigned the non-gamified module, 13 students took the pre-module survey, and 8 students completed the module and pre- and post-module surveys (38% attrition). Out of these 8 students, 1 was male and 7 were female. Their ages ranged from 23-26 years old. 6 students were from the Southern University, and 2 students were from the Northern University. The spread of data from the two universities is not representative of the sample population. None of the students who completed the non-gamified module were invited to semi-structured interview due to time and financial constraints.

All 14 participants who had completed the gamified module and pre- and post-module surveys were invited to semi-structured interview, with 8 accepting the invite to interview (57%). This exceeded the estimated number of interviews by 1 participant. Out of the 8 interview participants, 3 were male and 5 were female. 3 attended the Northern University and 5 attended the Southern University.

This detailed sample information helps to contextualise the data, informing analysis of the results and allows us to infer what these results may mean for other related student cohorts.

4.2 Quantitative data

My first research hypothesis will be investigated using quantitative and qualitative data. In this section, I will present the quantitative aspect of this investigation.

4.2.1 Cronbach's α for the SIMS survey

The pre- and post-module survey responses for the gamified and non-gamified participants were analysed for internal consistency using Cronbach's alpha. The sample size was 44. Table 1 describes the Cronbach's α for each of the motivational subscales assessed in the SIMS survey. Only one of the four SIMS sub-scales, IM, showed good internal consistency, with an α score of 0.87.

SIMS subscale	α	Item affecting α	α if affecting item deleted
Intrinsic motivation (IM)	0.87	-	-
Identified regulation (IR)	0.38	Question 2	0.44
External regulation (ER)	0.65	Question 15	0.69
Amotivation (AM)	0.64	Question 4	0.69

Table 1: SIMS subscale Cronbach α values

Two of the four SIMS sub-scales, ER and AM, showed less than satisfactory α scores of 0.65 and 0.64 respectively. This α score increased to 0.69 for both ER and AM if question 15 and question 4 of the SIMS questionnaire were deleted respectively, which is approaching an acceptable Cronbach's α score of 0.7 (Taber, 2018). Therefore question 15 and 4 were deleted (See Appendix G).

One of the from SIMS sub-scales, IR, showed low internal consistency, with an α score of 0.38. Question 2 was also deleted, increasing the α to 0.44, but not to an acceptable score (See Appendix G). It was not feasible to remove the IR subscale entirely from further analysis due to it's implications on motivational response profiling.

The implications of the IR subscale's low Cronbach's α score is discussed further in the section 4.4 of the results, and within the discussion section.

4.2.2 k means clustering of motivational response profiles

The k-means clustering centroids were pre-defined by Stolk et al. (2021) (Figure 6).

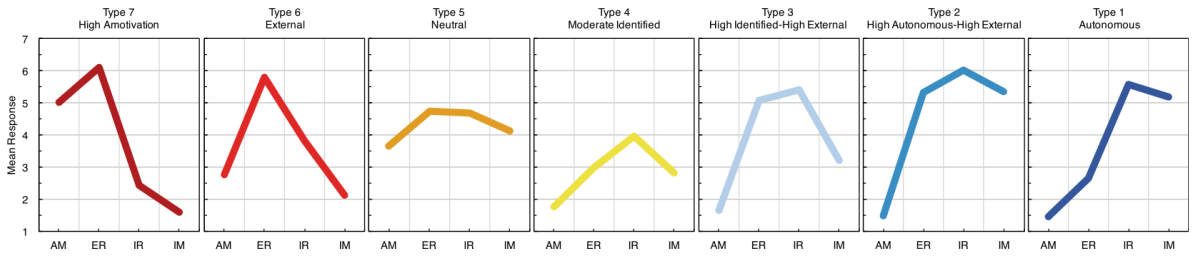


Figure 8: pre-defined k-means clustering centroids as defined by Stolk et al. (2021)

Non-gamified module participants showed autonomous (n=4), moderate identified (n=3), and neutral (n=1) motivational response profiles, as seen in Figure 7 (Stolk et al., 2021).

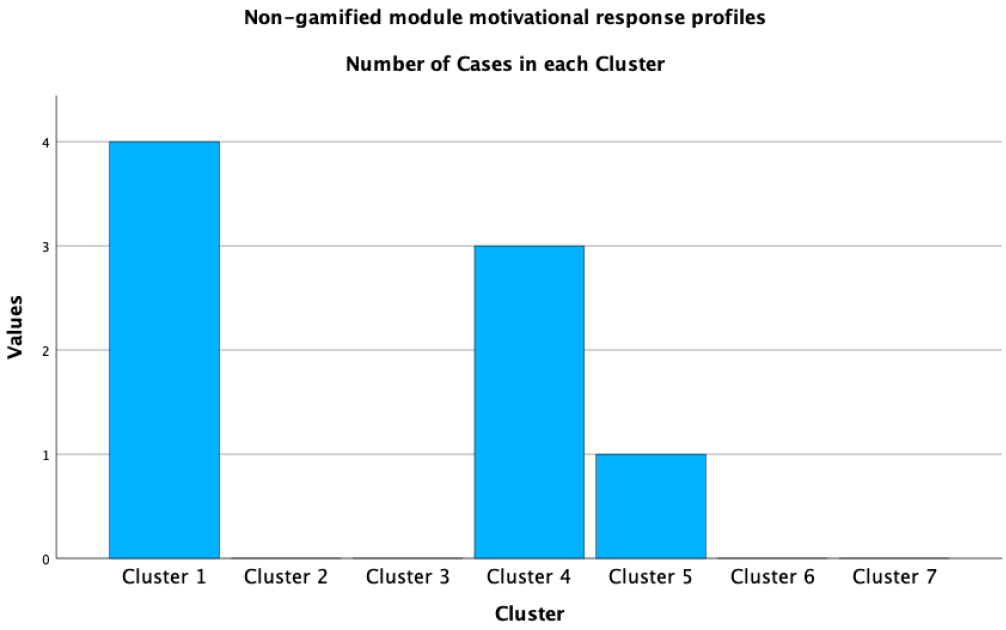


Figure 9: non-gamified module motivational response profiles.

Gamified module participants showed autonomous (n=7) and moderate identified (n=7) motivational response profiles (Stolk et al., 2021), as seen in Figure 8.

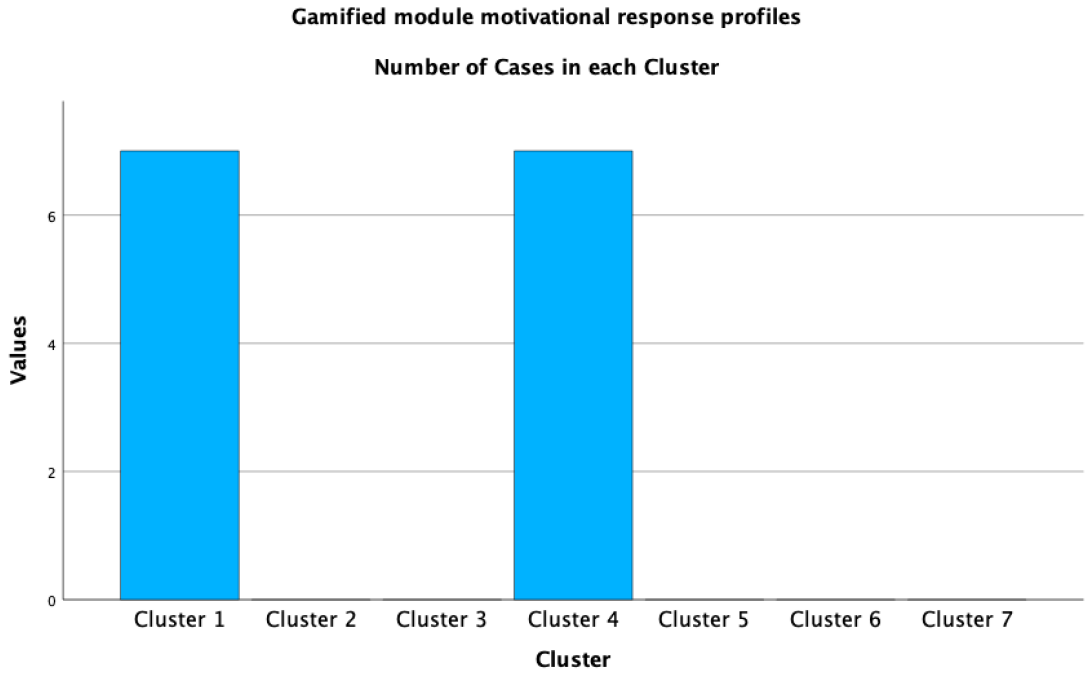


Figure 10: Gamified module motivational response profiles

Therefore, the majority of students showed autonomous situational motivation responses after completing the non-gamified module, with 1 student displaying neutral situational motivation. All students showed autonomous situational motivational responses after completing the gamified module.

4.2.3 SDI difference

The SDI was calculated for pre- and post-module survey scores for participants of the gamified and non-gamified modules.

The non-gamified module SDI difference had a mean of 1.57 and a median of 1.54, with a skewness of -0.086 and Kolmogorov Smirnov score of 0.187. Therefore, the data was deemed to have a normal distribution (Mishra et al., 2019b).

Participants of the non-gamified module had a higher mean mean post-module SDI of 6.91 (S.D. 3.77) than the pre-module SDI of 5.34 (S.D. 3.33), showing an overall increase in SDI after the non-gamified module. However, the difference in means (-1.57) was not statistically significant, $t(7) = -1.740$, $p = 0.125$. Moreover, the 95% confidence interval ranged from -3.71 to 0.56, and so the null hypothesis cannot be rejected. These results suggest that students experienced an increase in self-determined motivation after doing the non-gamified module, but this was not statistically significant.

The gamified module SDI difference had a mean of 1.40 and a median of 1.67, with a skewness of 0.132 and Kolmogorov Smirnov score of 0.116. Therefore, the data was deemed to have a normal distribution (Misha et al., 2019b).

Participants of the gamified module showed a higher mean post-module SDI of 8.26 (S.D. 4.51) than the pre-module SDI mean of 6.86 (S.D. 4.10), showing an overall increase in SDI after the gamified module. The difference in means (-1.40) was statistically significant, $t(13) = -2.105$, $p = 0.05$. These results suggest that students had a statistically significant increase in self-determined motivation after completing the gamified module. However the 95% confidence interval ranged from -2.83 to 0.04, and so the null hypothesis cannot be fully rejected.

4.2.4 Age and SDI difference for gamified module participants

Fisher's exact test was used to assess the association between participant age and SDI difference before and after the gamified module. Fisher's exact test produced a value of 55.14, with a p value of 1.00. Thus the null hypothesis was accepted, and no association between age and SDI difference was found for gamified module participants.

4.2.5 Gender and SDI difference for gamified module participants

Fisher's exact test was used to assess whether there was an association between gender and SDI difference for the gamified module participants. Fisher's exact test statistic for these variables was 26.60, with a p value of 0.885. Therefore the null hypothesis was accepted, showing no association between gender and SDI difference for gamified module participants.

4.2.6 Summary of quantitative findings

The quantitative arm of the study has shown that gamification promotes autonomous forms of situational motivation towards studying otolaryngology. Moreover, there was a statistically significant increase in situational motivation following participation in the gamified module. Participants of the non-gamified module also exhibited autonomous forms of situational motivation after doing the non-gamified module, but did not exhibit statistically significant increases in motivation following participation in the non-gamified module. Situational academic motivation towards studying otolaryngology does not appear to be influenced by age or gender.

The qualitative arm of this study aimed to investigate why students studying the gamified module experienced enhanced situational academic motivation, and what impacts gamification may have on contextual motivation. The participant's pre- and post-module

survey responses were also used to ask individual's personalised questions regarding motivational changes in the semi-structured interviews.

4.3 Qualitative data

Out of 14 participants invited to interview, 8 students accepted and completed the semi-structured interview (57%). Including verbal consent at the start of the interview, the interviews lasted between 20 and 30 minutes each. Each semi-structured interview was adapted to the individual being interviewed. Holistic triangulation design was utilised to create 2-3 personalised interview questions, which were based on the students' quantitative survey responses.

The interviews were transcribed, checked and coded as previously described. After coding of 4 interviews, an initial coding template was generated. I maintained an open attitude to the data when coding the remaining 4 interviews, amending research codes and themes until all interview data fit into the coding template. My aim was to create 20 lower level codes (Creswell, 2014). In the final coding template, I reached 19 lower level codes, which were placed within the *a priori* themes. The final coding template can be found in Table 2.

Self-determination theory	Basic psychological needs	Social factors	Lower level code
Autonomous motivation	Competence	Contextual	Preference for interactive forms of learning
			Previous emergency experiences shape motivation to study otolaryngology
		Situational	Clinical relevance of learning material impacts on it's perceived value
			Gamification can develop higher order thinking
			Direct feedback promotes engagement and learning
	Autonomy	Contextual	Previous limited or unsatisfactory otolaryngology exposure motivates students to study otolaryngology
			Opportunity for learner's to shape their learning experience
		Situational	Learning choices enhance autonomy
			Novelty keeps things interesting
	Relatedness	Situational	Simulating clinical scenarios is extremely valuable
			Competition without consequence is intrinsically motivating
Controlled motivation	Competence	Situational	Indirect and anonymised feedback can enhance or reduce motivation depending on the learner
	Autonomy	Contextual	Motivation through any means necessary
	Relatedness	Situational	Direct peer interactions in the learning environment are demotivating
Amotivation	Competence	Contextual	Otolaryngology is a complex subject area
		Situational	Technological limitations restricts the value of gamification
			Technical problems detract from the gamification experience
	Autonomy	Contextual	Gamification is a 'waste of time'
		Situational	Gamification without a focus on quality educational content is demotivating

Table 2: Final coding template

I will discuss the results of lower level codes below, relating them to the self-determination continuum and basic psychological needs proposed by Ryan & Deci (2000), and social factors, hierarchical levels of motivation and consequences, as proposed by Vallerand's (1997) Hierarchical Model of Self-Determined Motivation. I have categorised the presentation of results into autonomous, controlled and a-motivation so that I can directly relate the results to the study's research questions in the discussion.

4.3.1 Autonomous academic motivation

Autonomous motivation is a form of internalised motivation producing behaviours that are driven by the 'self' (Vallerand, 1997).

4.3.1.1 Competence and autonomous academic motivation

Competence is defined as one's sense of ability or effectiveness (Elliot & Dweck, 2005). Interview responses related to autonomous motivation and competence are summarised in Table 3.

Social factors	Lower level code
Contextual	Preference for interactive forms of learning
	Previous emergency experiences shape motivation to study otolaryngology
Situational	Clinical relevance of learning material impacts on it's perceived value
	Gamification can develop higher order thinking
	Direct feedback promotes engagement and learning

Table 3: contextual and situational social factors enhancing competence and autonomous academic motivation to study otolaryngology.

4.3.1.1.1 Contextual factors

4.3.1.1.1.1 Preference for interactive forms of learning

Contextual opinions on the use of gamification to teach otolaryngology were overall positive, as many medical students stated that they prefer interactive forms of learning.

Participant 4: “I'd definitely be a fan for like anything that's like gamified, applied, question based…”

Students also welcome gamification for it’s potential to replicate interactive clinical scenarios, promoting ‘active’ learning:

Participant 7: “I think the more the education can be like clinical practice… the more it's engaging and interactive and it makes you think like a the clinician, the better it is. Gamification, simulation… that's the direction that medical education has to go in.”

Gamification was perceived as a pedagogy which could replicate clinical scenarios, enhancing student’s contextual sense of competence. Enhanced competence has been correlated with higher self-efficacy and academic motivation (Schunk, 1991), therefore mirroring the results of other empirical studies. Studying otolaryngology through gamification appears to enhance contextual academic motivation, inducing positive affect towards studying through gamification.

4.3.1.1.1.2 Exposure to emergency scenarios

Exposure to emergency scenarios outside of otolaryngology, and possibly negative outcomes associated with this, led to one participant experiencing reduced levels of contextual competence.

Participant 7: “I've experienced that situation of needing to know something and not knowing it, and you wish you knew it from your degree.”

However, reflecting on their previous experience of emergency scenarios has led this student to seek opportunities to enhance his sense of contextual competence in emergency scenarios. The student reports finding the gamified otolaryngology module on ENT emergencies helpful:

> Participant 7: “I could see myself as an F1 looking back at it, and thinking ‘oh, I’m glad I did that because I now know… a bit more about how to manage epistaxis’.”

The student’s personal goal to enhance his competence in ENT emergency scenarios, combined with his experience of enhanced situational competence through the gamified module, has enhanced the students’ contextual autonomous motivation to study otolaryngology. It is, therefore, important to bear in mind that gamified education may not enhance academic motivation when utilised to teach student’s about topics which they are disinterested in or do not align with their personal goals and values (Assor et al., 2002).

4.3.1.1.2 Situational factors

4.3.1.1.2.1 Clinical relevance of learning material

The perceived clinical relevance of the module enhanced students' sense of situational competence towards otolaryngology emergencies, enhancing autonomous academic motivation and situational cognition.

> Participant 2: "it was quite easy to stay attention because you could see the relevance of it in clinical practice."

Some of this situational autonomous motivation may be intrinsic in nature, and some may be identified regulation:

> Participant 6: "So it's not really whether I enjoyed it or not, but I found it really useful to go over it in a kind of like, these are the emergency situations that you'll actually come across."

The above participant felt that enjoyment, a side effect of engaging in behaviour that is intrinsically motivating, was irrelevant. However, this student engaged with the module for the desirable outcome it brought, which was progression towards competence in otolaryngology emergencies. This aligned with their personal goals and values, thus promoting identified regulation, a form of autonomous motivation. In this way, needs-supporting gamification appears to enhance self-efficacy, enhancing autonomous academic motivation. The relationship between enhanced competence, self-efficacy and enhanced academic motivation observed in this study reflects the findings of other empirical studies (Assor et al., 2002).

4.3.1.1.2.2 Higher order thinking

Many students enjoyed gamification activities which challenged their knowledge, promoting lateral and higher-order thinking.

Participant 7: “It's going over a lot of the concepts we'd… we'd learned […], but particularly the way that it made you apply them in different… different forms […] I thought those were really, really helpful”

Gamification activities that student’s did not enjoy were those that did not challenge their knowledge.

Participant 4: “I guess the ones that felt the most useful […] were the ones that felt like I had to think a bit. And what I just read was useful rather than maybe the… the incorrect options were just there for the sake of it.’’

Gamified learning activities that challenged knowledge promoted higher-order thinking, enhancing students’ sense of situational competence and therefore situational autonomous motivation. Enhanced situational autonomous motivation enhanced learner’s sense of situational cognition. Activities which did not challenge knowledge did not enhance their sense of competence, and therefore did not promote situational autonomous motivation or cognition. This finding is reflected in other empirical studies investigating the impact of stimulating learning activities on academic motivation (Dev, 1997).

4.3.1.1.2.3 Direct feedback alongside learning

The knowledge provided in the module, alongside immediate feedback through the gamified activities, allowed student’s to learn, calibrate and re-test themselves until the knowledge was embedded.

Participant 1: "I thought it was really good that it, first of all, like, told you the knowledge, like, and recapped it for you and then it, like, tested you as you went on.”

Feedback has been shown to enhance knowledge and enhance academic motivation (Shukla & Singh, 2024). As gamification can deliver timely and low-stakes feedback, this pedagogy can help with enhancing situational otolaryngology competence and academic motivation.

4.3.1.2 Autonomy and autonomous academic motivation

Autonomy in the context of education is the sense that the learner can choose their own learning agenda, without teacher-led or other structures controlling this choice (Dickinson, 1995; Guay et al., 2000).

Interview responses concerning autonomous motivation and autonomy were noted in the interviews, which are detailed in Table 4.

Social factors	Lower level code
Contextual	Previous limited or unsatisfactory otolaryngology exposure motivates students to study otolaryngology
	Opportunity for learner's to shape their learning experience
Situational	Learning choices enhance autonomy
	Novelty keeps things interesting

Table 4: contextual and situational social factors enhancing autonomy and autonomous academic motivation to study otolaryngology.

4.3.1.2.1 Contextual factors

4.3.1.2.1.1 Previous unsatisfactory or limited otolaryngology exposure

Many students cited limited or unsatisfactory previous otolaryngology teaching as a motivating factor for them to learn more about the specialty.

Participant 6: “I think we don't really get any ENT teaching. […] So it's actually really useful for me to go over it.”

Participant 2: "But because we don't spend much time [in otolaryngology], I like, enjoy doing the module because I felt like it was furthering my learning or solidifying what I already knew.”

Participant 7: “I think there's not really enough teaching about [acute otolaryngology conditions] in medical school curriculums, and… it doesn't really focus on what to do when things go wrong.”

Previously limited or unsatisfactory otolaryngology exposure had lead to reduced sense of competence in these students. Student’s who were offered the opportunity to study otolaryngology through gamification experienced enhanced autonomy, therefore enhancing contextual autonomous academic motivation towards otolaryngology. In these students, the ability of learn about a topic they lacked confidence in promoted their development into a competent clinician, and thus aligned with their personal goals, enhancing autonomous motivation. This finding aligns with that found in other empirical studies (Assor et al., 2002). However, in this sense it is important that students are able to self-direct their learning to enhance their sense of contextual autonomy. Therefore, gamified teaching should not be enforced to enhance student autonomy, where possible.

4.3.1.2.1.2 Opportunity for learner’s to shape their learning experience

Participants spoke about the value of peer contributions in shaping their learning experience.

Participant 4: “other question bank resources, they often have, like, a comment section and that can be quite useful for explanations on memory techniques on things. And I've picked up lots of useful things on that.”

One participant cited that their primary reason for participating in the gamified module was their desire to contribute to medical education research:

Participant 7: "the reason that I did the module is probably because I think that research is very, very important, particularly education, is really important.”

Along with examples above, all participants offered ways in which the gamified module could be improved. Medical students want to be agents for change in their own education. A benefit to gamification is that it is a new and flexible pedagogy that is continually being developed and refined. There are also a multitude of ways gamification can be implemented, and it is not yet a common pedagogy in medical schools. Opening channels for medical student involvement in gamification design and content, student feedback on gamified modules and generating personalised gamified experiences in otolaryngology allows medical students the opportunity to exert influence on their learning, enhancing their contextual autonomy. This appears to enhance autonomous contextual academic motivation, promoting positive feelings towards the educational context. Enhanced academic motivation also enhances creativity (Guay et al., 2008). In this way, encouraging student participation in course design and context enhances student academic motivation, as well as potentially inviting creative feedback to enhance the utility of the course. Therefore, gamified teaching courses should encourage student participation in design and content.

4.3.1.2.2 Situational factors

4.3.1.2.2.1 Learning choices

The gamified otolaryngology module included ‘branching scenarios’. Students were presented with a clinical scenario, and they had to make choices about the diagnosis and management of the patient as the scenario progressed. All participants commented on this aspect of the gamified module, stating how much it enhanced their engagement and enjoyment of the module.

Participant 3: “Because I actually had to, like, click on the answers and then get it wrong. And then like, you know, like, get… do the actual game, which was why I engaged with it.”

Participant 5: “I liked the interactive nature of it basically. 'Cause, it felt like the time just passed.”

The interactive elements of the gamified module promoted a ‘flow state’, where students were fully engaged with the module. This enhanced academic situational autonomous motivation and their enjoyment of the module. The correlation between ‘flow state’ and enhanced autonomous motivation has been well established, and so the results of this study correlate with empirical literature (Czikszentmihalyi, 1982; Lei, 2010).

4.3.1.2.2.2 Novelty

A significant number of students referred to the amount of variation in the gamified module, citing this as a reason for their enhanced engagement.

Participant 6: "it was novel and obviously I’m more concentrated when something's novel so… I was in my element.”

All students reported that they would often use multiple resources in pursuit of variety and novelty. However, not all of these resources may be validated as clinically accurate.

Participant 2: "I'll often go, like, online and do like quizzes… And I do these to kind of like break up… The sort of work that when you want to do work but you don't want to have to put too much brain energy into doing work."

Gamification provides the variety that most, if not all, students seek in their own learning, enhancing their sense of situational autonomy and situational autonomous motivation to study otolaryngology. Novelty has been shown to enhance autonomous academic motivation in empirical studies, and may also encourage a 'flow' state of enjoyment (Oudeyer et al., 2016). This reflects what has been observed in this study, as gamification enhanced cognition, resulting in self-reported high concentration levels in students studying the gamified otolaryngology module. Therefore, gamification may enhance academic autonomous situational motivation through the novelty effect and promotion of a 'flow' state.

4.3.1.3 Relatedness and autonomous academic motivation

Relatedness is defined as the sense of belonging or attachment to others (Ryan & Deci, 2000).

Interview excerpts related to autonomous motivation and relatedness are summarised in Table 5.

Social factors	Lower level code
Situational	Simulating clinical scenarios is extremely valuable
	Competition without consequence is intrinsically motivating

Table 5: situational social factors enhancing relatedness and autonomous academic motivation to study otolaryngology.

4.3.1.3.1 Situational factors

4.3.1.3.1.1 Simulating clinical scenarios

The ability of gamification to simulate clinical scenarios was a significant theme in the interview transcripts.

> Participant 3: "I think my motivation was slightly higher, like for the clinical scenarios, but I was thinking it was more of a like, oh, this could be an actual clinical scenario. So I should actually like try and focus and think about like if I had the patient in front of me like what steps would I take?"

> Participant 8: “Stuff I see on the wards and patients I see in person are the patients I remember, and the presentations I remember. So, I feel like [branching scenarios are] a way of getting that […] and some stuff, you won't see on the wards just because it's… It's a bit rare.”

As graduated doctors, participants may encounter scenarios they have only ever read about in textbooks and have to apply their knowledge. However, the application of clinical knowledge to emergency scenarios may seem abstract, and the translation of this

knowledge to an emergency scenario in the moment may be overwhelming (Burridge et al., 2020). The use of clinical scenarios in the gamified module made the encounter seem ‘real’, and enhanced the students’ sense of relatedness, thus promoting situational autonomous motivation and situational cognition. Similarly, clinical simulation has been shown to enhance relatedness and enhanced autonomous motivation, and so this finding reflects the academic literature (Henrique-Sanches et al., 2024)

4.3.1.3.1.2 Competition without consequence

All participants discussed the element of competition that can be introduced in gamified learning. Students preferred low stakes competition.

Participant 1: "there wasn't, like, any, I guess, ramifications for getting things wrong or anything, and it was just more of, like, a fun, like, how much do I remember…”

Participant 6: “It was fun because […] it didn't feel overly stressful and it wasn't related to my exams.”

Low stakes competition in gamified learning experiences helps students to form bonds between colleagues, enhancing situational relatedness and situational academic autonomous motivation, and therefore situational engagement. This finding is supported by the literature, which suggests that high stakes competition reduces autonomous motivation, and low stakes competition enhances autonomous academic motivation and situational engagement (Ryan & Weinstein, 2009; Kusurkar et al., 2023).

4.3.2 Controlled academic motivation

Controlled motivation describes an external form of motivation, producing behaviours which are driven by external loci of control, such as fear of punishment or desire for reward (Hagger et al., 2014).

4.3.2.1 Competence and controlled academic motivation

Interview excerpts referencing competence in the context of controlled motivation are detailed in Table 6.

Social factors	Lower level code
Situational	Indirect and anonymised feedback can enhance or reduce motivation depending on the learner

Table 6: situational social factors decreasing competence and enhancing controlled academic motivation to study otolaryngology.

4.3.2.1.1 Situational factors

4.3.2.1.1.1 Indirect feedback

Indirect feedback, through comparison with peers in an anonymised format, was not seen in the gamified otolaryngology module generated for this study, but is common amongst other online medical education platforms that teach otolaryngology and incorporate gamification. This feature is what the following male student was referencing when they stated the below:

Participant 8: “It does, sort of, motivate you, but when you see maybe your percentages just dipped a little bit or your decile dipped a little bit, it motivates you to get back involved.“

In this particular participant, they are using fear of failure as an extrinsic motivator. This decreases their situational sense of competence, but enhances their controlled situational motivation. This controlled motivation has become internalised somewhat to introjected regulation, where the behaviour is enacted to enhance self-esteem (Ryan & Deci, 2000). This enhanced introjected regulation enhances their behaviour to study more, thus having a positive situational consequence.

However, some female participants reported that this indirect feedback has a negative impact on their motivation to study:

> Participant 6: “I actually hate that side of things because I find myself just being like, oh, great, like, 60% of people got it right. And I didn't. […] I don’t think I like the comparison, persay.”

In the above example, indirect feedback is encouraging comparison with peers and resulting in high stakes competition. In the context of low self-esteem, this has reduced this participants’ sense of situational competence. The fear of failure has enhanced her controlled academic motivation and reduced her autonomous academic motivation. As this motivation does not appear to have been internalised, it is likely external regulation (Ryan & Deci, 2000). The correlation of high stakes competition and reduced autonomous academic motivation is reflected in the empirical literature (Oudeyer et al., 2016).

It is interesting to note the difference in motivational response to indirect feedback experienced by the male and female participant. This finding matches empirical studies which suggest that enhanced controlled academic motivation can have a higher negative impact in females compared with males due to low self-esteem often found in females (Lei, 2010; Levesque et al., 2004). Controlled situational motivation may have a negative impact on autonomous situational motivation level, leading to contextual amotivation. As females are more likely to experience a more controlled form of controlled motivation than males, the impact of indirect feedback may result in worse outcomes for this demographic. The above results suggest that indirect feedback should be avoided in gamification, particularly for otolaryngology courses teaching predominantly female students.

4.3.2.2 Autonomy and controlled academic motivation

Interview excerpts referencing autonomy in the context of controlled academic motivation are detailed in Table 7.

Social factors	Lower level code
Contextual	Motivation through any means necessary

Table 7: contextual social factors decreasing autonomy and enhancing controlled academic motivation to study otolaryngology.

4.3.2.2.1 Contextual factors

4.3.2.2.1.1 Motivation through any means necessary

Medical students are required to learn about all aspects of medicine, even when they're disinterested in the topic. One participant referenced gamification as a means of enhancing motivation towards a topic, when motivation may otherwise be low:

> Participant 6: "I will motivate myself to learn it when I have to. […] if you know, you need to know something to make yourself comprehensive […] you will probably reward yourself naturally, so I don't think you should be expected to be interested in every aspect, because that would be bizarre."

This participant is arguing that it is unrealistic for medical students to be intrinsically motivated in all aspects of medicine, nor would it be desirable. If junior doctors were interested in all aspects of medicine, "we'd just all be doing general medicine all the time" (Participant 6), instead of producing specialists, such as otolaryngologists.

The participant also argues that gamification may be a better extrinsic motivator than other possible extrinsic motivators:

Participant 6: “I'll take anything that will motivate me to study […] I will... I can externally validate my own learning… In fact, even less validation right, because it's just a… it's just a score. So, you're kind of like, cool. And then you move on with your life.”

Gamification provides extrinsic motivation by rewarding engagement and learning progression. By choosing to enact a behaviour, and therefore receive the reward, students are enhancing their sense of contextual autonomy. In this way, gamification can provide enhanced contextual controlled motivation, particularly when leaderboards, badges and other indirect peer feedback is introduced (Hanus & Fox, 2015).

Whilst enhanced controlled motivation may be considered a negative income by some educational theorists, this student is arguing that gamification may provide ‘less validation’ (Participant 6) than other forms of extrinsic motivation, and so may have less of an impact on intrinsic motivation if results are negative. Moreover, incentives and rewards have been shown to prevent academic amotivation (Scheel et al., 2009), and so may be necessary for disengaged students to prevent educational drop-out. However, it is worth mentioning that student’s in this study volunteered to take the gamified module, and could drop out of the study at any point if they wished. Undertaking this gamified module also helped this participant to progress to be a competent clinician, which aligned with their personal goals and values, enhancing autonomous academic motivation (Assor et al., 2002).

Therefore, gamification may be an optimal mechanism for enhancing academic controlled motivation, therefore encouraging higher engagement. This may be necessary, particularly in students experiencing reduced academic motivation or amotivated students. However, care must be taken to ensure that autonomy is not thwarted, and that gamified teaching aligns with the participant’s personal goals and values, so that autonomous academic motivation is also enhanced in line with controlled academic motivation. Over time, this enhanced controlled motivation may become internalised in such a needs-supportive environment (Ryan & Deci, 2000).

4.3.2.3 Relatedness and controlled academic motivation

Interview responses concerning relatedness in the context of controlled motivation are detailed in Table 8.

Social factors	Lower level code
Situational	Direct peer interactions in the learning environment are demotivating

Table 8: situational social factors decreasing relatedness and enhancing controlled academic motivation to study otolaryngology.

4.3.2.3.1 Situational factors

4.3.2.3.1.1 Direct peer interactions

Many students highlighted that they do not enjoy direct or non-anonymised interactions with peers through gamified learning platforms, and so would avoid these interactions:

Participant 8: "You know, I don't want to get things wrong in front of other people, which is not ideal."

Participant 4: "I don't think I would like… I don't know, like, engage loads on live chat and stuff. I just… I kind of want to just like get the work done and move on."

Participant's expressed concern that direct peer interactions through the gamified learning environment would promote ridicule from colleagues, reducing their sense of situational relatedness and therefore reduce their autonomous situational motivation. Moreover, fear of punishment through social rejection, may enhance controlled motivation to not engage in the specific educational setting, changing behaviour and causing students to disengage. This finding reflects other empirical studies investigating the association between relatedness and academic motivation (Scheel et al., 2009; Wigfield et al., 2019).

Therefore, direct peer interactions on gamified otolaryngology medical education platforms are unnecessary and may have a negative impact on situational motivation levels.

4.3.3 Amotivation

Social factors affecting competence and autonomy leading to amotivation were uncovered in the interviews, but no social factors affecting relatedness were uncovered.

4.3.3.1 Competence and academic amotivation

Interview excerpts referring to competence and amotivation are detailed in Table 9 below.

Social factors	Low level coding
Contextual	Otolaryngology is a complex subject area
Situational	Technological and technical limitations restrict the value of gamification

Table 9: contextual and situational social factors decreasing competence and enhancing academic amotivation to study otolaryngology.

4.3.3.1.1 Contextual factors

4.3.3.1.1.1 Otolaryngology is a complex subject area

One student described her previous experience of learning otolaryngology, and found the experience overwhelming:

> Participant 1: "I think ENT is probably one of the like most anatomy heavy things […] So, it, like, impacts the motivation to want to study for it and, like, therefore it, like, impacts when we're on placements, how much we can engage with it and… How much we understand"

Otolaryngology is a highly complex subject area. Therefore, if gamified learning environments present learning information which is overwhelmingly challenging, this may lead to reduced sense of competence and amotivation towards studying otolaryngology. In the long-term, this may impact on contextual behaviour through avoidance of

otolaryngology learning or attendance to otolaryngology placement. The correlation between overwhelmingly challenging education activity and amotivation seen here correlates with the findings of other empirical motivational studies (Lowman, 1990; Vallerand & Reid, 1988).

4.3.3.1.2 Situational factors

4.3.3.1.2.1 Technological and technical limitations restrict the value of gamification

All students spoke about the limitations of otolaryngology gamification platforms and their desire for even more gamification.

> Participant 2: "obviously in real life, you're obviously not gonna have a list of A to D and then know what to do… […] Whereas in real life, you don't necessarily have those options to choose from."

> Participant 7: "I think, like, in an ideal situation, if you had unlimited resources for inter-technology… […] if you could gamify everything, that'll be brilliant."

Technical issues with course management systems or poor implementation by educators also impacted on medical students' experience of gamified otolaryngology learning materials.

> Participant 8: "some of the answers when you're dragging and dropping it like it sort of highlights the box where it's supposed to go. So […] it's not letting you think about it, you just drag it to where it's supposed to go."

Current online course management software does not have the gamification capabilities to match students' expectations of gamification and their learning needs. Moreover, they can also be complex to use, leading to technical error by educators creating online gamified courses. These technical and technological limitations can reduce participants' sense of situational competence, contributing to contextual amotivation over time. Educational contexts which do not challenge or stimulate can lead to reduced sense of competence

and enhanced amotivation, as seen in other empirical studies (Lowman, 1990; Vallerand & Reid, 1988).

4.3.3.2 Autonomy and academic amotivation

Themes related to autonomy and amotivation are detailed in Table 10 below.

Social factors	Low level coding
Contextual	Gamification is a ‘waste of time’
Situational	Gamification without a focus on quality educational content is demotivating

Table 10: contextual and situational social factors decreasing autonomy and enhancing academic amotivation to study otolaryngology.

4.3.3.2.1 Contextual factors

4.3.3.2.1.1 Gamification is a ‘waste of time’

Prior experience of gamified learning may impact on a student’s motivation to study otolaryngology through gamification. One student commented:

Participant 3: “Generally I think the efforts to gamify things normally just make me feel like it's wasted time…”

This student spoke about fill-in-the-blanks exercises and quizzes being fashionable in the world of education, but not useful. As the student felt this learning was not conducive to her personal goals but she was forced to engage with it, her learning autonomy was being limited, therefore contributing to contextual amotivation. This resulted in reduced engagement with gamification in the educational context. This finding correlates with other empirical findings (Assort al., 2002). It is important that gamification activities have a valuable contribution to the student’s learning and align with their learning goals, and are not used for the sake of educational fashion.

4.3.3.2.2 Situational factors

4.3.3.2.2.1 Gamification without focusing on quality educational content

Clinical educators may fall into the trap of creating technically impressive gamified learning platforms, without focusing on the quality of the educational content:

> Participant 1: "Sometimes when it comes to like the, the drag and drops and multiple choice […] [it doesn't] include everything, which isn't completely like holistic for the notes that we have to write. And that means you have to go away and do other things."

Students reported frustrations that gamified otolaryngology educational platforms were often not comprehensive enough, and so they had to use other resources to supplement their learning. Medicine is a very intensive subject, requiring many hours of studying. Where gamification produces inefficiency in learning, student's may become frustrated and feel their autonomy is restricted. This loss of autonomy contributes to situational amotivation towards studying otolaryngology through gamification. To enhance their sense of autonomy, medical student's may choose to use other otolaryngology learning materials, defeating the purpose of creating the gamified learning, or may choose to disengage altogether, having a negative impact on their overall learning. Therefore, gamified otolaryngology learning platforms should focus on the educational content first, and then use gamification to supplement and enhance the learning experience.

4.4 Limitations of the SIMS questionnaire

For each participant interview, 2-3 questions were based off the participants' SIMS survey responses. When asked about their responses, most participants stated that the survey responses, and how these were interpreted in accordance with the survey pro forma, did not reflect their true motivations for studying the otolaryngology gamified module:

Participant 8 "I don't know if there was a particular change at all, maybe just a slight discrepancy in the answers".

Participant 3: "I just, like, took the question differently in in the two times."

Along with the low Cronbach's alpha for the IR subscale, this highlights an inherent issue with the SIMS questionnaire, and therefore has implications on how these results can be interpreted. This will be discussed further in the limitations section (section 5.5).

4.5 Summary of qualitative findings

Through the semi-structured interviews, students were asked about their experience of the gamified otolaryngology module and other gamified otolaryngology educational experiences. This uncovered 20 lower level codes related to three overarching themes: 1) autonomous motivation, 2) controlled motivation and 3) amotivation. Exploration of these themes highlighted gamification elements which enhanced or thwarted medical students' three basic psychological needs, impacting on medical students' situational and contextual motivation to study otolaryngology.

During the discussion, the quantitative and qualitative findings of this study will be critically analysed and triangulated to form credible conclusions. I will relate these findings to the wider literature, and their implications on the field of otolaryngology education and gamification.

5. Discussion

5.1 Gamification enhances situational autonomous academic motivation for otolaryngology

Gamification, or the “use of game design elements in non-game contexts” (Deterding et al., 2011), can enhance healthcare professionals’ knowledge, skills, attitudes and learning satisfaction (Gentry et al., 2019). However, gamification has been theorised to enhance extrinsic motivation (Gentry et al., 2019). Empirical studies investigating the impact of gamification on academic motivation have shown mixed results (Gentry et al., 2019; van Gaalen, 2021; Dichev & Dicheva, 2017). These mixed results may be attributed to the use of gamification elements with proven negative impacts on motivation, such as ‘pointsification’ elements and direct peer comparison, alongside gamification elements with positive effects (Hellberg & Moll, 2023). However, these mixed results have limited the conclusions educators can make surrounding the impact of gamification on education (Dichev & Dicheva, 2017; Seaborn & Fels, 2015). The impacts of gamification on motivation also appear to be context-specific (Seaborn & Fels, 2015). Therefore, the impacts of gamification on motivation needs to be investigated within each educational context. Very few, if any studies, have investigated the impacts of gamification on motivation to study otolaryngology medical education specifically (see Appendix C).

Academic motivation can be autonomous or controlled in nature, or one can lack motivation (Ryan & Deci, 2000). These different types of motivations can co-exist alongside one another (Stolk, 2021). Academic motivation can also exist in multiple dimensions, in the immediate situation (situational motivation), in a specific life context (contextual motivation), and at a global personality level (global motivation) (Vallerand, 1997). Most empirical studies investigating the impact of gamification on motivation have assessed the impact on contextual academic motivation, with very few studies investigating the impact of gamification on situational academic motivation (Stolk, 2021).

As such, one of the study aims was to investigate the impact of gamification on medical student's situational motivation to study otolaryngology. I hypothesised that well-designed gamification of an otolaryngology online module would enhance medical students' situational autonomous motivation to study otolaryngology.

"*Hypothesis 1: Well-designed gamification enhances medical students' situational autonomous motivation and reduces situational controlled and a-motivation to learn about otolaryngology when compared with self-directed online learning."*

This study has shown that needs-supporting gamification can enhance autonomous situational motivation towards studying otolaryngology (Figure E). Gamification significantly enhanced overall situational motivation to study otolaryngology ($t(13) = -2.105$, $p = 0.05$) compared with non-gamified online learning, which showed enhanced motivation that was not statistically significant ($t(7) = -1.740$, $p = 0.125$). The results of this study are similar to other gamification and situational motivation studies in different educational contexts (Stolk, 2021; Leitão, Turner & Maguire, 2019; Schaper, Riedmann & Lurgin, 2021). However, for both the gamified and non-gamified arm, the 95% confidence interval crossed 0. Therefore, my hypothesis cannot be falsified or proven.

The semi-structured interviews provide insight into how gamification may enhance situational autonomous motivation. Gamification can enhance clinical knowledge (4.3.1.1.2.1) and promote higher order thinking (4.3.1.1.2.2) through the use of challenging and stimulating questions and clinical scenarios. This finding matches what we know about stimulating educational experiences and academic motivation (Dev, 1997). However, care must be taken to ensure these educational exercises are not too challenging and remain low stakes to avoid promoting academic amotivation (Lowman, 1990).

Gamification can also be used to give medical student's direct feedback (4.3.1.1.2.3) and simulate clinical scenarios (4.3.1.3.1.1). Many gamification elements, particularly branching scenarios, can provide timely and low stakes feedback (4.3.1.3.1.2), enhancing clinical knowledge and sense of situational competence and relatedness, and thus enhancing autonomous academic motivation (Shukla & Singh, 2024; Henrique-Sanches et al., 2024).

Gamification can also enhance situational autonomy through learner choice (4.3.1.2.2.1). Learner choice can be promoted by creating optional gamified modules, allowing students to contribute to gamification content and design, and through the gamification elements themselves. Some educators may be hesitant to introduce optional, low stakes learning (Kornhauser et al., 2014). However, if the gamified learning aligns with students' personal goals and values, students will choose to study the module whilst maintaining enhanced autonomous academic motivation (Assor et al., 2002).

Medical students appear to desire novelty (4.3.1.2.2) in their learning experiences. Novelty has been shown to promote a 'flow' state during learning, leading to enhanced autonomous academic motivation (Oudeyer et al., 2016). Gamification is an ideal pedagogy for providing the variety to keep learning interesting and fun.

Whilst the SIMS survey responses suggest that, overall, gamification reduces situational controlled motivation, the interview responses highlighted how gamification may promote controlled situational motivation in certain situations.

Indirect feedback through anonymised peer comparison (4.3.2.1.1.1) was not utilised in the gamified otolaryngology module, but is used by other medical education platforms teaching otolaryngology. Indirect feedback through anonymised peer comparison appears to enhance controlled motivation through fear of failure and reduced sense of situational competence. This can actually promote enhanced engagement with the learning material in the short-term. However, depending on the students' levels of self-esteem, this controlled motivation may or may not be internalised, possibly leading to negative long-term learning outcomes (Lei, 2010). This is discussed further in section 5.4.

Gamification may also promote controlled motivation in medical student's learning otolaryngology through direct peer interactions (4.3.2.3.1.1). Medical student's feared ridicule and social rejection from peers online, particularly in non-anonymised scenarios,

enhancing controlled motivation, promoting student disengagement (Ryan & Deci, 2000). The gamified online module did not feature direct peer interactions, and so this causation relationship could not be fully explored. However, a criticism of gamification is that it does not contain enough social features, therefore hampering students' ability to promote and enrich one another's learning (Majuri et al.; 2018). This study appears to suggest that social features in the form of direct peer interactions in the gamified environment are detrimental to students' academic situational motivation and engagement, as it promotes high stakes competition (Lowman, 1990). However, there are other ways social features may be utilised to promote autonomous contextual motivation, as discussed in section 5.2.

Gamification also has the ability to enhance situational amotivation if the technical problems hinder the learning experience or students' expectations are not met by the gamified technology (4.3.3.1.2.1). In this way, medical students' sense of situational competence can be limited, leading to amotivation and promoting disengagement with the learning material. These effects could be mitigated by developing gamification technology to better match medical students' expectations of gamification, through development of immersive gamified experiences that are easy for the non-technical medical educator to implement. As noted by Dichev & Dicheva (2015), course management systems offer a limited number of gamification elements that can be utilised by the non-technical educator. Therefore, course management systems should be developed to create the gamification elements that would promote the immersive gamification experience students want and can be easily used by clinical educators.

5.2 Gamification may enhance contextual autonomous academic motivation for otolaryngology

The second research hypothesis this study aimed to falsify was:

"*Hypothesis 2: Well-designed gamification enhances medical students' contextual autonomous motivation and reduces contextual controlled and a-motivation to learn about otolaryngology when compared with self-directed online learning."*

The SIMS survey assesses situational motivation only, and so there is no quantitative data from this study to suggest that gamification may enhance contextual motivation in medical student's studying otolaryngology. However, interview responses suggest that gamification may have a positive impact on contextual autonomous motivation, reflecting the results of similar contextual academic motivation studies (van Roy & Zaman, 2018) and upholding my hypothesis.

Gamification as a pedagogy appeals to medical student's learning otolaryngology as it facilitates their preferences for interactive learning (4.3.1.1.1.1), as seen in other higher education learners (Stolk et al., 2021). The perception that gamification can facilitate interactive learning and mirror clinical scenarios appeals to medical students with previous unsatisfactory or limited otolaryngology teaching (4.3.1.2.1.1), or exposure to emergency scenarios (4.3.1.1.1.2). Gamification is perceived as an optimal pedagogy to enhance student's competence, therefore enhancing academic contextual motivation (Schunk, 1991). Gamification may be a important pedagogy for otolaryngology teaching therefore, as otolaryngology is viewed as a complex subject area by medical students (4.3.3.1.1.1).

Gamification can also allow students the opportunity to shape their learning experience (4.3.1.2.1.2). Peer contributions were considered a constructive social feature, enhancing contextual autonomy and relatedness, and therefore contextual autonomous motivation to study otolaryngology. Moreover, the ability to influence gamification, a novel and undeveloped pedagogy, appealed to medical student's sense of contextual autonomy and

enhanced autonomous motivation. Not only will direct student contribution enhance the quality of gamified courses, but it appears to enhance student autonomy and therefore autonomous academic motivation. As gamification technology develops, it is possible that students may even be able to personalise their own gamified learning experience, which may enhance autonomous academic motivation even further (Ryan & Deci, 2000; Alamri et al., 2020).

It is important to recognise that enhanced situational and contextual autonomous motivation in student's studying gamified learning may be related to the learning content however, rather than the desire to participate in gamified learning experiences themselves. The gamified otolaryngology module was on otolaryngology red flags and emergencies, and supplied crucial information for any aspiring clinician (Yau et al., 2021). Medical student's studying the gamified otolaryngology module stated that their motivations for studying the module were related to limited or poor previous learning experiences in otolaryngology (4.3.1.2.1.1 and 4.3.1.2.1.2), and a desire to be clinically competent in emergency scenarios (4.3.1.1.1.2). Participating in the gamified module, therefore, appealed to their sense of contextual autonomy and competence in managing otolaryngology emergencies. This does have important implications for gamified otolaryngology module design, however. As seen in section 4.3.3.2.2.1, the learning content of gamified learning experiences are just as important, if not more, than how the learning material is presented. Medical student's desire learning experiences which are clinically relevant and high yield. If the gamified module does not align with the student's learning needs and personal goals, they may experience reduced contextual autonomy, promoting amotivation (Assor et al., 2002). Moreover, medical student's were able to volunteer to study the gamified otolaryngology module, thus enhancing their situational sense of autonomy (Vallerand, 1997). Medical school's utilising gamification in their online otolaryngology learning resources may wish to consider offering a non-gamified alternative, or offering the gamified module as a non-compulsory learning material, to enhance academic autonomy and therefore autonomous motivation.

Gamification has been theorised to enhance contextual controlled motivation by providing immediate rewards for otherwise unrewarded learning (van Gaalen et al., 2021). This can result in students no longer engaging with the learning when the rewards are retracted, a phenomenon called the 'over-justification effect', eventually leading to amotivation (van Gaalen et al., 2021; Hanus & Fox, 2015). One student described pursuing 'motivation by any means necessary', where they would provide their own rewards for their learning (4.3.2.2.1.1). They argued that medicine is such a broad topic, and one may not feel intrinsically motivated to study otolaryngology, particularly due to its complexity (4.3.3.1.1.1). However, to become a competent clinician, studying otolaryngology is necessary (Yau et al., 2021). In this way, enhancing controlled motivation in some students may be necessary to encourage otolaryngology learning. As stated by one of the participant's, gamification may be a more beneficial means of enhancing controlled motivation, as it would only provide low levels of validation and would not result in negative consequences if the student performs poorly in the gamified learning activity. Thus, the ability for gamification to enhance controlled motivation in otherwise amotivated individuals could be considered beneficial.

5.3 No association between age, gamification and situational academic motivation towards otolaryngology

The third research hypothesis this study aimed to falsify are as follows:

"Hypothesis 3: Gamification and increasing age will be associated with a reduced level of situational autonomous motivation to learn about otolaryngology."

This study investigated the association between age, gamification and situational motivation, and found no statistically significant association between these variables ($p = 1.00$), therefore falsifying this research hypothesis. The age of participants ranged from 21-29 years old, and so was quite limited. The impact of age on motivation does not seem to have been widely investigated in the broader literature, but the results of this study contrast the results of other papers investigating the impact of age and gamification on situational motivation in other contexts (Bagley, 2012). However, it agrees with other studies investigating the impact of age on other related psychological factors, such as the impact of age on intrinsic and extrinsic motivations and well-being (Kasser & Ryan, 1996).

Bagley (2012) found an association between increased age and decreased motivation from gamification elements in their study investigating the impact of points and rewards for using "search roadmaps" on online search engines (Bagley, 2012). Points and rewards, however, have been shown to have a negative impact on motivation, and so the negative impact of gamification on motivation in older participants may have impacted by this (Hellberg & Moll, 2023). Moreover, the research methods used to assess the association between age, gamification and motivation in this paper are questionable. Motivation was assessed using one non-standardised Likert-scale post-intervention question, "Getting points and awards […] motivated me to use it more" (Bagley, 2012). The question appears to be asking about intrinsic motivation, but there are no other questions asking about intrinsic motivation, and so a test of internal consistency could not be completed. Moreover, there is no consideration for motivational levels proposed by Vallerand's Hierarchical Model of Self-Determined Motivation (1997), and so it is unclear which type of

motivational level is assessed by Bagley's (2012) paper. Additionally, there were only 9 participants in this study, and was in the context of computer science, rather than education (Bagley, 2011). Therefore, as the author's freely admit in their paper, no wider conclusions can be drawn from Bailey (2011). Despite this, the results of this paper have been used in wider systematic reviews on gamification to suggest that gamification may decrease intrinsic motivation and engagement in participants with increasing age (Seaborn & Fels, 2015).

A similar paper, written by Jent and Janneck (2018), also reports an association between increasing age and decreasing motivational responses to gamification. This study included an adequate sample population of 300 participants (Jent & Janneck, 2018). However, no statistical analysis was performed on the data, so it is unclear whether the results of this study were statistically significant.

Although the gamified arm of this study only contained 14 participants, and therefore had a similarly small sample size as Bagley (2012), the results of this study are in contrast with the small body of existing studies in this area. However, the qualitative results of this study suggest that responses to certain gamification elements that were not utilised in the study intervention, such as indirect peer feedback, may enhance controlled academic motivation to differing effects in different genders. Enhanced controlled academic motivation has been shown to have a higher negative impact in females compared with males due to differing levels of self-esteem (Lei, 2010; Levesque et al., 2004). Therefore, it is very possible that certain gamification intevrentions, such as indirect peer feedback and badges, may cause differing motivational responses in different genders, therefore leading to the differing motivational responses seen in other studies. Whilst this may be an interesting topic for future empirical research, indirect feedback, badges and points appear to have a deleterious impact on autonomous academic motivation in both genders, and so otolaryngology educators should avoid such gamification elements in their teaching.

5.4 No association between gender, gamification and situational autonomous academic motivation

In the gamified arm of this study, 7 participants were male, 6 were female, and 1 preferred not to disclose their gender. I had hypothesised that females studying the gamified otolaryngology module would show higher levels of situational autonomous motivation than males (McDaniel et al., 2012; Stolk et al., 2021).

"Hypothesis 4: Gamification and female gender will be associated with a greater level of situational autonomous motivation to learn about otolaryngology than male gender."

This study suggests there is no statistically significant association between gender, gamification and situational autonomous motivation ($p = 0.885$), therefore falsifying this hypothesis.

The literature investigating the association between age, gender and motivation is limited to the McDaniel et al. (2012) study (see Appendix A), and has suggested that females experience enhanced motivation in response to gamification compared with men. Whilst my study contradicts this study investigating this topic, it matches the outcomes of other studies investigating the impact of gender on intrinsic and extrinsic aspirations and well-being (Kasser & Ryan, 1996). There are also limitations to the McDaniel et al. (2012) study and my own.

McDaniel et al. (2012) investigated the use of badges on motivation levels of digital media students, and analysed the results based on gender. The study found a borderline statistically significant increase in motivation in females compared with males ($p=0.059$) (McDaniel et al., 2012). However, these results were based off a non-standardised survey that the authors invented, and did not distinguish between autonomous, controlled and amotivation (McDaniel et al., 2012). Therefore, it is difficult to deduce what motivational type was increased (McDaniel et al., 2012). As the intervention incorporated badges and leaderboards, it is likely that controlled motivation was increased in females, which may

resulted in poor learning outcomes in the long-term (Lei, 2010; Kapp, 2012; McDaniel et al., 2012). Moreover, the McDaniel et al. (2012) study assessed students' motivation after partaking in a year-long course, therefore assessing contextual motivation. However, there were also limitations to my own study, which will be discussed in section 5.5.

5.5 Limitations and future work

To my knowledge, this study is the first to assess situational motivation in medical students studying otolaryngology. This holistic triangulation designed mixed methods study produced significant and rich data supporting the use of gamification in otolaryngology. However, the study has some limitations, which I have discussed below.

Firstly, the small sample size likely impacted on the significance of results and associations found in this study. Whilst gamification was shown to significantly increase autonomous situational motivation, no association was found between gender or age, motivation and gamification. However, a larger sample size may have teased out small but significant associations between demographics, gamification and motivation.

Additionally, all participants were aged between 21 and 29 years of age. Whilst no association was found between age, motivation and gamification, it is very possible that medical students studying otolaryngology will be older than 29 years of age, and that the situational motivation levels of these students would be significantly impacted by the use of gamification. As there were no participants in this study over the age of 29 years old, this study cannot comment on the effects of gamification on this age group.

Moreover, this study assessed situational motivation quantitatively before and after the gamified and non-gamified otolaryngology module to assess whether there was a change in situational motivation with either intervention. Therefore, I was only able to include students that completed both the pre- and post-module surveys. It was outside of the scope of this study to investigate why students did not complete the module and post-module survey. However, this student group may have experienced a different impact on their motivation from either the gamified or non-gamified module, which would have changed the results of the study.

As seen in this study, medical students feel extrinsic motivators are necessary to study aspects of medicine they may be less inherently interested in, including otolaryngology. However, the use of extrinsic motivators has been shown to lead to the 'over-justification effect' in general motivational studies, whereby the behaviour is no longer carried out after the reward has been removed, and is hypothesised to lead to situational and contextual amotivation (van Gaalen et al., 2021; Hanus & Fox, 2015). Whether or not gamification can cause this 'over-justification effect', and the impacts on situational and contextual motivation, has yet to be investigated.

However, the most significant limitation to this study is the unreliability of the SIMS survey questionnaire. As shown in section 4.2.1, the Cronbach's α for ER and AM was just below the acceptable limit of 0.7 (Taber, 2017), and the Cronbach's α for the IR subscale was far below at 0.44. Moreover, interview data revealed incongruence between participants SIMS survey responses and the participant's intended meaning. Interestingly, incongruence was found in questions correlating with all subscales, not simply the IR subscale. However, similar studies using the SIMS survey showed good internal consistency (Stolk, 2021). Therefore, the low Cronbach's α values found in this study may be due to the small sample size (Taber, 2017; Yurdugül, 2008). Moreover, the incongruence between SIMS responses and direct questioning during the semi-structured interview may be partly explained by student's not wishing to offend me by criticising the module. However, as all quantitative data was based on the SIMS survey responses, the quantitative results need to be read with some skepticism.

In terms of future work, repeating this study with a larger sample size, and introducing double-blinding and investigations for attrition rates, may produce differing results to this study. Students could also be followed up following the gamification intervention to investigate whether gamification causes the 'over-justification effect'.

Moreover, the semi-structured interviews allowed me to delve deeper into how gamification may impact both situational and contextual motivation. However, I was unable to also

assess contextual motivation quantitatively due to the length of the gamification intervention provided. A longitudinal study, involving recruitment of students to a gamified otolaryngology module over an academic semester or year, would have allowed for quantitative assessment of contextual motivation, and provided further insight into the medium-term impacts of gamification on contextual motivation when studying otolaryngology.

Extending this study even further to investigate global motivation would further develop our understanding of the effects of gamification in the long-term. Previous studies have suggested that enhanced extrinsic motivation may enhance extrinsic global motivation, negatively impacting well-being and learning vitality (Kasser & Ryan, 1996; Guay et al., 2008). Such a project was out of scope for this dissertation project, and would require vast time, technical skill and financial resources. However, the results of this study would have implications on whether gamification would be recommended as a pedagogy at all, despite the short- and medium-term advantages.

6. Conclusion

This is the first mixed methods study investigating the impact of gamification on situational motivation in medical students studying otolaryngology (See Appendix C).

Through the quantitative arm of this study, I have found that gamification enhances situational autonomous motivation compared with online non-gamified learning. Age and gender were not associated with changes in situational autonomous motivation in medical students studying otolaryngology through gamification. However, these results may have differed had the sample size been larger.

The qualitative arm revealed various ways that gamification can enhance or thwart situational and contextual motivation. Ultimately, gamification that was productive, fun, enabled student choice and helped student's progress to become competent clinicians had a positive impact on situational and contextual autonomous motivation. However, gamification can led to amotivation where it promotes student frustration, such as in scenarios where technical problems thwarted student autonomy, or poor quality learning content reduced their sense of competence.

Gamification can also enhance controlled situational academic motivation through the use of direct and indirect peer interactions, and the use of points. Depending on student self-esteem and the nature of the peer interactions, these can have a negative or positive impact on behaviour. Therefore, direct and indirect peer interactions should be avoided. However, the use of points in a gamified setting that is autonomy-supportive may be essential to motivate students with reduced academic motivation or amotivation towards otolaryngology (Lei, 2010).

The reliability of the study results are impacted by low internal consistency for the majority of SIMS sub scales, as well as the divergence between SIMS survey responses and student's responses to the same questions in the semi-structured interview. Future work

investigating the impact of gamification on situational academic motivation could utilise a different situational motivation survey to avoid these issues. Alternatively, future authors may decide to enlist a small sub-set of the overall sample population to carry out the SIMS survey, before testing the Cronbach's α and recruiting the remaining sample population once the SIMS survey has proven satisfactory internal consistency.

Ultimately, the body of research on the impacts of gamification on motivation within medicine is extremely limited. Unsurprisingly therefore, gamification is not routinely utilised in general medical education or otolaryngology education specifically. However, gamification has been shown to enhance knowledge, satisfaction and professionalism when utilised in health education (Gentry et al., 2019). It may also enhance overall intrinsic academic motivation to study otolaryngology. We should be endeavouring to enhance our knowledge of gamification's impact on academic motivation and, if positive, continue to develop gamification technologies to enhance this pedagogy. If beneficial, gamification has the potential to transform healthcare education as we know it, allowing medical student's to be effectively taught on a worldwide scale for the benefit of humanity (Tuti, 2020; Gentry et al., 2019).

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Appendices

Appendix A: Reflexivity log

29/4/24

Participant 1: This participant experienced enhanced intrinsic motivation following the gamified module. I felt very happy with how this interview went. We developed a good rapport early in the conversation and it was clear the participant had thought of their answers. I was aware that they had spoken to me about getting involved with future research, and I said I would keep her in mind for opportunities. There may have been a power-balance at play here though, as she wanted to please me so that I could provide some benefit to her in future.

Participant 2: this was a very short interview as the participant had done the module a few weeks ago and could not remember specifics about the module. Therefore it was difficult to discuss in detail any changes in motivations as participant could not remember and therefore did not expand on this. However, they did talk about practical ways the module could have been improved. I did feel that the conversation was quite stunted and concise, and not particularly rich in insights. In future, I would prefer to carry out the interviews as soon as possible after the participant has completed the module. If this is not possible, I will have more questions prepared so that the interview doesn't end very quickly and to enable rich discussions.

1/5/24.

Participant 3: for this interview, I had prepared more participant-specific questions. Whilst feeling more prepared, I was keen for this interview to produce more insightful data than the last interview, so felt nervous. I jumped straight into the interview without doing rapport building. I felt this tension in the interview, and found it difficult to gain rich responses. The interview ended after approximately 15 minutes. The lesson I have drawn from this interview was the need to do more rapport building in beginning.

Participant 4: this participant had an issue with setting the meeting up in teams, so there was a bit of a delay starting. This meant I felt I had to rush the interview a little as I was conscious of going over the allocated interview time. However, I do feel the interview went quite well, as the participant had recently done the module and I had prepared some personalised questions for her based on her survey results. I feel I got rich and meaningful data from this interview.

Participant 5: I found it difficult to direct this participant to give answers that directly spoke to my dissertation. When I asked a question about the gamified module, or other gamified learning, the participant answered referring to the educational content of the gamification (as opposed to the gamified elements themselves). Whilst I found this frustrating and difficult to overcome at the time, I have since realised that this is still helpful, as it highlights the importance of useful educational content, perhaps over and above gamification of that content.

During this interview, I found myself attempting to 'fit in' by expressing an appreciation of what being a medical student was like. Initially, I was concerned that this would skew my participants' responses, encouraging them to agree with my views rather than state their own opinions. On reflecting over the interview transcript, I feel the student was able to be honest with me and disagreed with me at points. Thus, perhaps this open dialogue assisted with honest conversation.

13/5/24

Participant 6: this participant was helping a friend move house, and so was outside an apartment block on his phone. I had not expected students to be carrying out their interviews in a loud environment, so this threw me a little. At the beginning of the interview, I was stumbling over my words. However, the participant did seem able to focus and gave lengthy and rich answers. In future though, I will ask participants to sit in a quiet environment for the interviews.

Participant 7: as this interview immediately followed Participant 6's interview, I had not been able to ask the participant to move locations. This interview was also carried out in a public space, and so may have influenced the students' responses. However, the volume was such that we were able to hear each other and it did not interfere with the interview. At the beginning of the interview, I developed good rapport with participant. I feel this helped with open dialogue, generating honest and insightful responses.

20/5/24

Participant 8: it had been several weeks since this participant had done module. Whilst I had tried to avoid this, it was not possible to due to timetabling issues. To learn from previous errors, I had prepared more survey-specific questions for this participant to ensure rich conversations. I also let the conversation digress somewhat to other gamified platforms, which I feel helped the participant feel comfortable and give their insights more freely.

Appendix B: Scoping review: search terms

Literature search performed of the following databases on 5th February 2024, and updated 2nd September 2024:

- SCOPUS
- PsycINFO
- PubMed
- Science Direct
- ACM Digital Library

Search terms for each database are presented below:

Scopus

Search terms: motivat gamification game-base

PsycINFO

Search terms: motivat*.ti. and (gamification or game-based).af. and ("higher education" or universit* or tertiary).af. and student*.af.

PubMed

Search terms: (((motivat*[Title]) AND (gamification[Title/Abstract] OR game-based[Title/Abstract])) AND ("higher education"[Title/Abstract] OR universit*[Title/Abstract] OR tertiary[Title/Abstract])) AND (student*[Title/Abstract])

ScienceDirect

Search terms:

Title, abstract, keywords: (gamification OR game-based) AND (higher education OR university OR tertiary) AND student

Title: motivation

ACM

Search terms: [Title: motivation] AND [[Abstract: gamification] OR [Abstract: game-based]] AND [[Abstract: higher education] OR [Abstract: university] OR [Abstract: tertiary]] AND [Abstract: student]

Appendix C: scoping review: results

Scoping review

Title	Authors	Database	Context: Category	Context: Sub-category
DataRPG: Improving student motivation in data science through gaming elements	Abdool, A.; Ringis, D.; Maharajh, A.; Sirju, L.; Abdool, H.	Scopus	Education	Engineering
Raising engagement and motivation through gamified e-portfolio in Kolej Profesional MARA (KPM), Malaysia: A preliminary survey	Abdul Wahab, M.; Joy, M.	Scopus	Education	Learning technologies
Effectiveness of web-based learning environment: role of intrinsic learning motivation, computer self-efficacy, and learner engagement	Aboobaker, N.; Muneer, K.H.	Scopus	Education	Learning technologies
Gamification with social and moral values: A motivate cross sectional proposition in physical education; [Gamificación y valores: Una propuesta transversal motivadora en Educación Física]	Acebes-Sánchez, J.; Bernal, I.R.	Scopus	Education	Sport Science
Gamification: A Motivation Metric Based in a Markov Model	Aguiar-Castillo, L.; Arce-Santana, E.; Guerra-Yanez, C.; Guerra-Yanez, V.; Perez-Jimenez, R.	Scopus	Education	Business
Gamification as a motivation strategy for higher education students in tourism face-to-face learning	Aguiar-Castillo, L.; Hernández-López, L.; De Saá-Pérez, P.; Pérez-Jiménez, R.	Scopus, ScienceDirect	Education	Hospitality
Implementing a gamification methodology to motivate reading and writing in young university students; [Implementando una metodología de gamificación para motivar la lectura y escritura en jóvenes universitarios]	Aguilar, A.F.G.; Ramos, A.F.A.	Scopus	Education	Spanish

Experimental Evidence of Performance Feedback vs. Mastery Feedback on Students' Academic Motivation	Aguilar, S. J.	Grey lit	Education	Higher Education
Nutrition Garden - A gamified mobile app for motivating people to eat specific food to prevent non-communicable diseases	**Aigner, C.; Hofmann, G.; Winkler, S.; Baranyi, R.; Grechenig, T.**	**ACM**	**Medical**	**Nutrition**
Participants' motivation factors and profile in crowdsourced law reform	Aitamurto, T.; Landemore, H.	ACM	Politics	Law reform
Game-based learning approach to improve self-learning motivated students	Akour, M.; Alsghaier, H.; Aldiabat, S.	Scopus	Education	Higher Education
The effect of mobile image recognition-based augmented reality application on students' acquisition of science processing skills and motivations to learn science	Al-Awidi, H.; Abumosa, M.; Al-Mughrabi, A.	PsychINFO	Education	Secondary education
Influence of teacher on student motivation: Opportunities to increase motivational factors during mobile learning	Al-Said, K.	PubMed, Scopus	Education	Science
Personality traits and the intention to continue to use the Smart Learning Technologies: The role played by internal and external motivations in the relationship between the Big Five Personality Traits and the Intention to Continue to Use MOOCs (ICM)	Alabdullatif, H.; Iturbide, Á. V.	Grey lit	Education	Higher Education
Gamification and discovery learning: Motivating and involving students in the learning process	Aldalur, I.; Perez, A.	PubMed, Scopus	Education	Software engineering

Enhancing students' learning achievements, self-efficacy, and motivation using mobile augmented reality.	Aldeeb, F.H.; Sallabi, O.M.; Elaish, M.M.; Hwang, G.-J.	PsychINFO	Education	Primary Education
Influence of gamification on student motivation in the educational process in courses of different fields	Aleksic-Maslac, K.; Rasic, M.; Vranesic, P.	Scopus	Education	Economics and Management
The Impact of E-Learning on the Learning Motivation of Jordanian University Students	Ali Krishan, E.A.; Almsaiden, A.H.I.; Al Njadat, E.N.; Abohelalah, A.A.	Scopus	Education	Higher Education
Socially-Motivated Discussion Forum Models for Learning Management Systems	Almukhaylid, M.; Suleman, H.	ACM	Education	Learning technologies
Using E-learning in Classroom Management for Improving the Students' Motivation in Vocational Schools	Amalia, F.; Brata, A. H.	ACM	Education	Learning technologies
Gamification in higher education: A study of the student's interest, motivation, and acceptance of gamification as a method of teaching welding technology	Amiruddin, M.H.; Sumarwati, S.; Ismail, M.E.; Salleh, M.R.M.; Mohammad, L.N.	Scopus	Education	Design & Technology
Intention to Redeem M-Coupons and Intention to Disclose Personal Information: based on Internet using motivation and m-coupons delivery approach	An, Y.; Chen, Y.; Li, S.	ACM	Business	e-Commerce
Impact of Educational Technology-Based Learning Environment on Students' Achievement Goals, Motivational Constructs, and Engagement	Anwar, S.	ACM	Education	Engineering
Creativity and intrinsic motivation in computer science education: experimenting with robots	Apiola, M.; Lattu, M.; Pasanen, T. A.	ACM	Education	Computer Science
CREANDO: Tool for creating pervasive games to increase the learning motivation in higher education students	Arango-López, J.; Cerón Valdivieso, C. C.; Collazos, C.A.; Gutiérrez Vela, F. L.; Moreira, F.	ScienceDirect	Education	Higher Education

Investigating the effectiveness of augmented reality technology in science education in terms of environmental literacy, self-regulation, and motivation to learn science.	Arici, F.	PsychINFO	Education	STEM
Exploring the motivating factors for using live-streaming and their influence on consumers' hedonic well-being: The mediating effect of psychological engagement.	Asante, I. O.; Jiang, Y.; Miao, M.	PsychINFO	Business	Marketing
Online collaborative tools for science education: Boosting learning outcomes, motivation, and engagement. [	Ates, H.; Koroglu, M.	PsychINFO	Education	Secondary education
An Examination of Motivation in Physical Therapy Through the Lens of Self-Determination Theory: Implications for Game Design	**Aufheimer, M.; Gerling, K.; Graham, T. C. N.; Naaris, M.; Konings, M. J.; Monbaliu, E.; et al.**	**Grey lit**	**Medical**	**Physiotherapy**
Using Online Critical Reflection to Enhance Students' Confidence, Motivation, and Engagement in Higher Education	Awidi, I.T.; Klutsey, J.Q	Scopus	Education	Media studies
Exploring the role of gamification in motivating students to learn	Baah C.; Govender I.; Rontala Subramaniam, P.	Scopus	Education	Higher Education
An analysis of software design understanding & motivation of engineering students	Bach, J.-C.; Beugnard, A.; Castaigne, J.-L.; Mallet, J.; Martínez, S.; Segarra, M.-T.	ACM	Education	Computer Science
SOFA: an online social network for engaging and motivating families to adopt a healthy lifestyle	Baghaei, N.; Freyne, J.; Kimani, S.; Smith, G.; Berkovsky, S.	ACM	Psychology	Behaviour
Tracking English language learners' progress through a gamified social visualisation tool to increase motivation and performance	Bagunaid, W.; Meccawy, M.; Meccawy, Z.; Allinjawi, A.A.	Scopus	Education	English as Second Language

The Effect of Gamification on Home Economics Students' Motivation and Engagement in Drawing Activities	Baiden, P.; Essel, H.B.; Vlachopoulos, D.; Tachie-Menson, A.; Essuman, M.A.	Scopus, PsychINFO	Education	Home Economics
Case study: Applying a motivation technique to improve student performance in higher education; [Esettanulmány: Hallgatói eredményesség javítását célzó módszer alkalmazása a felsőoktatásban]	Baksáné V.E.; Horánszky Z.	Scopus	Education	Computer Science
The Effectiveness of Gamification Tools in Enhancing Academic Performance and Motivation of Students in Fully vs. Partially Gamified Grading System of Online Classes	Balci, S.; Secaur, J. M.; Morris, B. J.	ACM	Education	Learning technologies
Doctoral Colloquium - The Potential of Mixed-Reality Technology for Motivating Dentistry Students in Higher Education	Banjar, A.; Campbell, A.G.	Scopus	Education	Dentistry
Worker's reward sensitivity predicting motivation in crowdsourcing: self-approach achievement goals perspective	Barashev, A.; Li, G.	ACM	Work	Management
Interactive Feedforward for Improving Performance and Maintaining Intrinsic Motivation in VR Exergaming	Barathi, S. C.; Finnegan, D. J.; Farrow, M.; Whaley, A.; Heath, P.; Buckley, J.; et al.	ACM	Sport Science	Movement
Game2Learn: improving the motivation of CS1 students	Barnes, T.; Powell, E.; Chaffin, A.; Lipford, H.	ACM	Education	Computer Science
The effect of digital game-based learning interventions on cognitive, metacognitive, and affective-motivational learning outcomes in school: A meta-analysis.	Barz, N.; Benick, M.; Dorrenbacher-Ulrich, L.; Perels, F.	PsychINFO	Education	General
Motivation is a game: Massively multiplayer online games as agents of motivation in higher education	Bawa, P.; Watson, S.L.; Watson, W.	PsychINFO, ScienceDirect	Education	English and Business

Physics XP: Integration of ChatGPT and Gamificatioto Improve Academic Performance and Motivation in Physics 1 Course	Beltozar-Clemente, S., Díaz-Vega, E.	Scopus	Education	STEM
Increase motivation in learning Java Programming Fundamentals using Gamified Moodle: Case: Central University of Ecuador; [Incrementar la motivación en el aprendizaje de Fundamentos de Programación Java usando Moodle Gamificado: Caso: Universidad Central del Ecuador]	Beltran, J.; Sanchez, H.; Rico, M.	Scopus	Education	Computer Science
Gamification to motivate the development of autonomous tasks in the university : Case study: Central University of Ecuador; [Gamificacion para motivar el desarrollo de tareas autonomas en la universidad Caso de estudio: Universidad Central del Ecuador]	Beltran, J.; Sanchez, H.; Rico, M.	Scopus	Education	Software engineering
GreaTest: a card game to motivate the software testing learning	Beppe, T. A.; Linhares de Araújo, I.; Aragão, B. S.; de Sousa Santos, I.; Ximenes, D.; Castro Andrade, R. M.	ACM	Education	Computer Science
Motivation, students' needs and learning outcomes: a hybrid game-based app for enhanced language learning	Berns, A.; Isla-Montes, J.-L.; Palomo-Duarte, M.; Dodero, J.-M.	PubMed, Scopus	Education	Modern Languages
High school students' motivation to learn climate change science through educational computer games.	Besalti, M.; Smith, G. G.	PsychINFO	Education	Secondary education
Measuring learning motivation of students in supply chain management games setting: A case study of Innov8.0 game	Bhuiyan T.; Peng W.W.; Mahmud I.	Scopus	Education	Higher Education

Control your game-self: effects of controller type on enjoyment, motivation, and personality in game	Birk, M.; Mandryk, R. L.	ACM	Computer Science	Gaming
Improving Learning Motivation for Out-of-Favour Subjects	Böck, F.; Landes, D.; Sedelmaier, Y.	Scopus	Education	Engineering
A hybrid escape room to foster motivation and programming education for pre-service teachers.	Borras-Gene, O.; Hijon-Neira, R.; Paredes-Barragan, P.; Serrano-Lujan, L.	PsychINFO	Education	STEM
New Challenges for the motivation and learning in engineering education using gamification in MOOC	Borras-Gene, O.; Martiñez-nunez, M.; Fidalgo-Blanco, A.	Scopus	Education	Engineering
Room escape at class: Escape games activities to facilitate the motivation and learning in computer science	Borrego, C.; Fernández, C.; Blanes, I.; Robles, S.	Scopus	Education	Computer Science
BeadLoom Game: adding competitive, user generated, and social features to increase motivation	Boyce, A.; Doran, K.; Campbell, A.; Pickford, S.; Culler, D.; Barnes, T.	ACM	Education	Computer science
Design Features of a Career Guidance Platform to Promote Intrinsically Motivated Use	Brandenburger, J.; Mötsch, I.; Janneck, M.	ACM	Careers	Planning
Proceedings of the 6th International ICSE Workshop on Games and Software Engineering: Engineering Fun, Inspiration, and Motivation	Bucchiarone, A.; Cooper, K.M.L; Lin, D.; Melcer, E.F.; Sung, K.	ACM	Computer Science	Serious games
Mobile augmented reality and adaptive art: a game-based motivation for energy saving	Bühling, R.; Obaid, M.; Hammer, S.; André, E.	ACM	Environment	Energy consumption
Drag and Drop Programming Experiences and Equity: Analysis of a Large Scale Middle School Student Motivation Survey	Bush, J.B.; Gilmore,M.R.; Miller, S.B.	ACM	Education	Computer Science
Enhancing motivation and academic performance through gamified digital game-based learning methodology using the ARCS model	Camacho-Sánchez R.; Serna Bardavío J.; Rillo-Albert A.; Lavega-Burgués P.	Scopus, PsychINFO	Education	Sport Science

Gamified Digital Game-Based Learning as a Pedagogical Strategy: Student Academic Performance and Motivation	Camacho-Sánchez, R.; Rillo-Albert, A.; Lavega-Burgués, P.	Scopus	Education	Higher Education
The Students' Intrinsic and Extrinsic Motivations to Engage with Digital Learning Games	Camilleri, A. C.; Camilleri, M. A.	ACM	Education	Teaching
Gamification in higher education: Impact on student motivation and the acquisition of social and civic key competencies	Campillo-Ferrer, J.-M.; Miralles-Martínez, P.; Sánchez-Ibáñez, R.	Scopus	Education	Social science
Give me a reason to dig: qualitative associations between player behavior in Minecraft and life motives	Canossa, A.	ACM	Psychology	Behaviour
Enhancing Chinese International Students' Motivation and Engagement in a STEM Subject in UK Higher Education: A Case of Gamification in Programming	Cao C.; Zhao X.; Hopfgartner F.	Scopus	Education	STEM
Application of Motivation and Transcendence 4-stage Learning Pedagogy on Online Teaching: Case of Pharmacology in 91suke Class	Cao, Y.; He, Y.; Wang, T.	ACM	Education	Pharmacology
Increased Learning Perceptions and Intrinsic Motivation to Learn with Educational Apps.: A South African Experience	Carenys, J.; Davies, M.; Carter, M.	Scopus	Education	Accounting
Is it worth it to consider videogames in accounting education? A comparison of a simulation and a videogame in attributes, motivation and learning outcomes; [¿Merece la pena considerar los videojuegos en la enseñanza de contabilidad? Comparación de una simulación y un videojuego respecto a atributos, motivación y resultados de aprendizaje]	Carenys, J.; Moya, S.; Perramon, J.	Scopus, ScienceDirect	Education	Accounting

Gamification and mobile learning: innovative experiences to motivate and optimise music content within university contexts	Carrión Candel, E.; Colmenero, M.J.R.	Scopus	Education	Music education (Primary education)
Perceptually motivated guidelines for voice synchronization in film	Carter, E.J.; Sharan, S.; Trutoiu, L.; Matthews, I.; Hodgins, J.K.	ACM	Computer Science	Computing methodologies
Student Motivation and Engagement in STEM Courses: Exploring the Potential Impact of Gamification	Cassel, L.; Dicheva, D.; Dichev, C.; Guy, B.; Irwin, K.	ACM	Education	STEM
The use of an educational digital game in higher education: Design and application to increase the motivation in calculus learning	Cezar, V.L.; Botelho, V.R.; Garcia, P.V.; Miletto, E.M.	Scopus	Education	Mathematics
Using ontology and gamification to improve students' participation and motivation in CSCL	Challco, G.C.; Mizoguchi, R.; Isotani, S.	Scopus	Education	Computer Science
Increasing reading motivation and vocabulary of south asian children in hong kong: A home-based intervention.	Chan, Y. Y.; Rao, N.	PsychINFO	Education	Foreign language
Elevating EFL learners' professional English achievements and positive learning behaviours: A motivation model-based digital gaming approach.	Chang, C.C.; Hwang, G.-J.	PsychINFO	Education	EFL
Gamification as a strategy to increase motivation and engagement in higher education chemistry students	Chans, G.M.; Portuguez Castro, M.	Scopus	Education	Chemistry
Does educational gamification improve students' motivation? If so, which game elements work best?	Chapman, J.R.; Rich, P.J.	Scopus	Education	Learning technologies
Integrating a Game-Based App to Enhance Translation Learners' Engagement, Motivation, and Performance	Chen, Y.	Scopus	Education	English as Second Language

Empirical study on the effect of digital game-based instruction on students' learning motivation and achievement	Chen, Y.-C.	Scopus	Education	Higher Education
Gamification in classroom, effect of categorization of extrinsic reward to motivate student learning performance	Chernbumroong, S.; Sureephong, P.	ACM	Education	Secondary education
The Unexpected Downside of Paying or Sending Messages to People to Make Them Walk: Comparing Tangible Rewards and Motivational Messages to Improve Physical Activity	Cherubini, M.; Villalobos-Zuñiga, G.; Boldi, M.-O.; Bonazzi, R.	PsychINFO	Computer Science	Applied computing
Exploring Motivational Differences in Competitive and Cooperative Game-Based Learning through Educational Board Games	Chiang, Y.-Y.; Hsu, T.-C.	Scopus	Education	Higher Education
A game-theoretic model motivated by the darpa network challenge	Chitnis, R.; Taghi Hajiaghayi, M.; Katz, J.; Koyel, M.	ACM	Computer Science	Algorithm theory
Motivational and affective engagement in learning Spanish with a mobile application	Cho, M.-H.; Castañeda, D.A.	Scopus, ScienceDirect	Education	Modern Languages
Exploring the Impact of code.org's Block-Based Coding Curriculum on Student Motivation in K-12 Education	Choi, W.C., Choi, I.C	Scopus	Education	STEM
A survey of students' motivations for playing computer games: A comparative analysis	Connolly, T.; Boyle, L.; Hainey, T.	Scopus	Education	Higher Education
Motivating People to Move More with Personalized Activity and Tip Recommendations: a Randomized Controlled Trial	Coppens, I.; Martens, L.; De Pessemier, T.	ACM	Sport Science	Movement
Gamification in the Social Environment: a tool for Motivation and Engagement	Cordero-Brito, S.; Mena, J.	ACM	Psychology	Behaviour
Motivational influences for higher education (HE) students	Costello, R.; Lambert, M.	Scopus	Education	Higher Education

Creation and beta testing of a "choose your own adventure" digital simulation to reinforce motivational interviewing skills in genetic counseling.	**Cragun, D. L; Phillips Hunt, P.; Dean, M.; Zierhut, H.; Kaphingst, K.; Resnicow, K.**	**PsychINFO**	**Education**	**Medical**
Increasing Student Motivation in College Physics with Gamified Instruction	Cruz, M. K. B. d.; Tolentino, A. N.; Roleda, L. S.	ACM	Education	Physics
Leaderboards – A Motivational Tool in the Process of Business Education	Ćwil, M.	Scopus	Education	Business
Gamification for Education: Using LexiPal to Foster Intrinsic and Extrinsic Learning Motivation of Students with Dyslexia	D. Cahyono	ACM	Education	Supportin g students with disability
Student motivation assessment using and learning virtual and gamified urban environments	D. Fonseca, S.; Villagrasa, I.; Navarro, E.; Redondo, F.; Valls, J.; et al.	Grey lit	Education	Architectur e
The Role of Game-Based Learning in Experiential Education: Tool Validation, Motivation Assessment, and Outcomes Evaluation among a Sample of Pharmacy Students	Dabbous, M.; Kawtharani, A.; Fahs, I.; Hallal, Z.; Shouman, D.; Akel, M.; Rahal, M.; Sakr, F.	Scopus, PsychINFO	Education	Pharmacy
Reaching Across the Institutional Aisle: Student Motivation to Navigate Higher Education	Dallas, F. I.; Howard, L.; Wilson, S.; Williams, R.	ACM	Education	Learning technologi es
A mobile game-based C programming language learning: Results of university students' achievement and motivations	Daungcharone, K.; Panjaburee, P.; Thongkoo, K.	Scopus	Education	Computer Science
Using technology to make learning fun: Technology use is best made fun and challenging to optimize intrinsic motivation and engagement.	David, L.; Weinstein, N.	PsychINFO	Education	General

A Survey and Analysis of TLS Interception Mechanisms and Motivations: Exploring how end-to-end TLS is made “end-to-me” for web traffic	de Carné de Carnavalet, X.; van Oorschot, P. C.	ACM	Computer Science	Cyber security
Gamifying education: Motivation and the implementation of digital badges for use in higher education	Delello, J.A.; Hawley, H.; McWhorter, R.R.; Gipson, C.S.; Deal, B.	Scopus, PsychINFO	Education	Higher Education
Motivation-driven educational game design: applying best practices to music education	Denis, G.; Jouvelot, P.	ACM	Education	Music
Gamification: designing for motivation	Deterding, S.	Grey lit	Gamification	Theory
Do Badges Increase Student Engagement and Motivation?	Dicheva, D.; Caldwell, R.; Guy, B.	ACM	Education	Computer Science
Using Gamification Strategies to Motivate and Engage Students in Computer Science Courses: (Abstract Only)	Dicheva, D.; Dichev, C.; Jones, E. J.; Clarke, P. J.; Cassel, L. N.	ACM	Education	Computer Science
Motivating students taking CS1 by using image manipulation in C and C++	Dickson, P. E.	ACM	Education	Computer Science
All we crave is pleasure! The motivation behind millennial men's clothing store choices when purchasing semi-formal/ smart workwear for themselves.	Diedericks, L.; Erasmus, A. C.; Donoghue, S.	PsychINFO	Business	Retail
How Downward Social Comparison Motivates Workers: A Structural Equation Model on Personality, Social Comparison Orientation, Motivation and Performance	Dong, Y.; Zhu, Q.	ACM	Work	Employee motivation
Social robots and gamification for technology supported learning: An empirical study on engagement and motivation	Donnermann, M.; Lein, M.; Messingschlager, T.; Riedmann, A.; Schaper, P.; Steinhaeusser, S.; Lugrin, B.	Scopus, PsychINFO, ScienceDirect	Education	Higher Education

Digital Maternity Records: Motivation, Acceptance, Requirements, Usability and Prototype Evaluation of an Interface for Physicians and Midwives	**Dörflinger, L.; Nissen, M.; Jäger, K.; Wirth, M.; Titzmann, A.; Pontones, C.; Fasching, P.; Beckmann, M.W.; Gradl, S.; Eskofier, B.M.**	**ACM**	**Medical**	**Electronic health records**
Enrollment Motivations in an Online Graduate CS Program: Trends & Gender- and Age-Based Differences	Duncan, A.; Bobbie, E.; Joyner, D. A.	ACM	Education	Computer Science
Toward usability testing of motivational affordances through gamification.	Durmaz, T. B.; Fuertes, J. L.; Imbert, R.	PsychINFO	Psychology	Well-being
Towards Applying ARCS Model for a Blended Teaching Methodologies: A Quantitative Research on Students' Motivation Amid the COVID-19	Durrani, U.; Kamal, M.M.	Scopus	Education	Business
Gamification, intrinsic motivation, and task performance of employees: The moderating role of goal difficulty.	Ebina Justin, M.A.; Joy, M. M.	PsychINFO	Work	Employee motivation
Game Engines Construction to Motivate Computing Concepts: Build from Scratch or Leverage Existing Systems	Egert, C. A.	ACM	Education	Computer Science
A QUALITATIVE STUDY ON THE EFFECT OF GAMIFICATION IN HIGHER EDUCATION TO PROMOTE MOTIVATION IN STUDENTS; [ESTUDIO CUALITATIVO SOBRE EL USO DE LA GAMIFICACIÓN EN EDUCACIÓN SUPERIOR PARA PROMOVER LA MOTIVACIÓN EN EL ALUMNADO]	Elena, M.F.; Rosa, M P.M.; José, H.N.	Scopus	Education	Teaching (primary school)
The impact of game-based learning (GBL) on students' motivation, engagement and academic performance on an Arabic language grammar course in higher education	Eltahir, M.E.; Alsalhi, N.R.; Al-Qatawneh, S.; AlQudah, H.A.; Jaradat, M.	Scopus	Education	Foreign language

Effect of gamified flipped classroom on improving nursing students' skills competency and learning motivation: a randomized controlled trial	Elzeky, M.E.H.; Elhabashy, H.M.M.; Ali, W.G.M.; Allam, S.M.E.	PubMed, Scopus	Education	Nursing
Gamification as a driver of motivation in the organizations: A Bibliometric Literature Review	Encarnação, R.; Reuter, J.; Dias, M. F.; Amorim, M.	Grey lit	Business	Human Resources
Digital Badges for Motivating Introductory Programmers: Qualitative Findings from Focus Groups	Facey-Shaw, L.; Specht, M.; Bartley-Bryan, J.	Scopus	Education	Computer Science
Do Badges Affect Intrinsic Motivation in Introductory Programming Students?	Facey-Shaw, L.; Specht, M.; van Rosmalen, P.; Bartley-Bryan, J.	Scopus, PsychINFO	Education	Computer Science
Applying the self determination theory of motivation in Games Based Learning	Farrell D.; Moffat D.	Scopus	Education	Gaming
Yes, I comply!': Motivations and Practices around Research Data Management and Reuse across Scientific Fields	Feger, S. S.; Wozniak, P. W.; Lischke, L.; Schmidt, A.	ACM	Science	Data management
How Can LMS Affect Student's Motivation and Engagement?	Ferreira, R.; Cardoso, E.; Oliveira, J.	Scopus	Education	Learning technologies
Gamification in Physical Education: Evaluation of Impact on Motivation and Academic Performance within Higher Education	Ferriz-Valero, A.; Østerlie, O.; García Martínez, S.; García-Jaén, M.	PubMed, Scopus	Education	Sport Science
Motivating learners by dynamic score and personalized activity stream	Filipcik, R.; Bielikova, M.	Scopus	Education	Higher Education
Improving study habits using a behaviour change framework incorporating social motivation and gamification	Filippou, J.; Cheong, C.; Cheong, F.	Scopus	Education	Learning technologies
Beyond Motivation and Engagement: Students' Voices on the Use of Game-based Learning in a Bachelor Computer Science Online Degree	Fiorucci, A.; Yee-King, M.; Gillies, M.	ACM	Education	Computer Science

An exploratory study of undergraduate nursing students' perceptions of digital badges.	Foli, K. J.; Karagory, P.; Kirby, K.	Grey lit	Education	Nursing
The Reverse Exam: A Gamified Exam Structure to Motivate Studying and Reduce Anxiety	Frank-Bolton, P.; Simha, R.	ACM	Education	Learning technologies
Motivation to Learn in Open, Distance, and Digital Education	Fryer, L.K.; Shum, A.; Nakao, K.	Scopus	Education	Learning technologies
Research on Information Security Behavior of Smart Agriculture Internet of Things Based on Protection Motivation Theory	Fu, J.	ACM	Business	Agriculture
A study of motivation for playing computer games at tertiary education level in China	Fu, K.; Yuan, Y.; Mai, E.L.-C.; He, J.	Scopus	Education	Learning technologies
Motivation centered learning	Fuhrmann, T.	Scopus	Education	Higher Education
A gamification strategy in engineering education—A case study on motivation and engagement	Gamarra, M.; Dominguez, A.; Velazquez, J.; Páez, H.	Scopus	Education	Engineering
Investigating the Impact of Gamification on Student Motivation, Engagement, and Performance	García-López, I.M.; Acosta-Gonzaga, E.; Ruiz-Ledesma, E.F.	Scopus	Education	Mathematics
Gamification in the online university environment to promote student motivation: an experience in the degree of pedagogy	García, Á.P.; García, L.C.F.; Rodríguez, I.S	Scopus	Education	Information technology
What motivates children to become creators of digital enriched artifacts?	Giannakos, M. N.; Jaccheri, L.	ACM	Education	Computer Science
Effects of Augmented Reality Gamification on Students' Intrinsic Motivation and Performance	Gill, A.; Irwin, D.; Towey, D.; Zhang, R.; Zheng, Y.	Scopus	Education	STEM
Enhancing learning in design for manufacturing and assembly: the effects of augmented reality and game-based learning on student's intrinsic motivation	Gill, A.S.; Irwin, D.; Long, P.; Zhang, Y.; Zheng, Y.	Scopus	Education	STEM

On motivational tools of gamification in higher education: Theoretical aspect	Gilyazova, O.S.; Zamoshchanskii, I.I.	Scopus	Education	Higher Education
Gamification pedagogy: A motivational approach to student-centric course design in higher education	Gironella, F.	Scopus	Education	Social science
Effects of a gamification and flipped-classroom program for teachers in training on motivation and learning perception	Gómez-Carrasco, C.-J.; Monteagudo-Fernández, J.; Sainz-Gómez, M.; Moreno-Vera, J.-R.	Scopus	Education	Primary Education
The impact on nursing students' opinions and motivation of using a "Nursing Escape Room" as a teaching game: A descriptive study	Gómez-Urquiza, J.L.; Gómez-Salgado, J.; Albendín-García, L.; Correa-Rodríguez, M.; González-Jiménez, E.; Cañadas-De la Fuente, G.A.	PubMed, Scopus, ScienceDirect	Education	Nursing
Learning through Challenges and Enigmas: Educational Escape Room as a Predictive Experience of Motivation in University Students	González-Yubero, S.; Mauri, M.; Cardoso, M.J.; Palomera, R.	Scopus	Education	Higher Education
Motivation and Virtual Education in Computer Science: Case Universidad de Medellín-Colombia	Gonzalez, L.; Gomez, M.C.; Echeverri, J.A.	Scopus	Education	Computer Science
Using gamification to motivate students with dyslexia	Gooch, D.; Vasalou, A.; Benton, L.; Khaled, R.	ACM	Education	Supporting students with disability
Using Gamification to Motivate Students with Dyslexia	Gooch, D.; Vasalou, A.; Benton, L.; Khaled, R.	Grey lit	Education	Supporting students with disability
A Flexible Approach to Introductory Programming: Engaging and motivating students	Gordon, N.; Brayshaw, M.; Grey, S.	ACM	Education	Computer Science
Methods of student motivation by means of E-learning system	Govorov A.; Govorova M.; Bulakova A.	Scopus	Education	Science and technology

Personalized Motivation-supportive Messages for Increasing Participation in Crowd-civic Systems	Grau, P.; Naderi, B.; Kim, J.	ACM	Work	Social participation
A field experiment on gamification of physical activity-Effects on motivation and steps.	Grech, E. M.; Briguglio, M.; Said, E.	PsychINFO	Psychology	Well-being
Motivating Students to Learn How to Write Code Using a Gamified Programming Tutor	Grey, S.; Gordon, N.A.	Scopus	Education	Computer Science
Motivating High School Girls to Study Computer Science	Gutica, M.	ACM	Education	Computer Science
The differences in motivations of online game players and offline game players: A combined analysis of two studies at higher education level	Hainey T.; Connolly T.; Boyle L.	Scopus	Education	Higher Education
Gender differences in motivations for playing computer games: A combined analysis of three studies	Hainey, T.; Boyle, E.; Connolly, T.M.; Stansfield, M.	Scopus	Education	Higher Education
A survey of students' motivations for playing computer games: A comparative analysis of three studies in higher education	Hainey, T.; Connolly, T.; Boyle, L.	Scopus	Education	Higher Education
Motivations for playing computer games at tertiary education level: A comparison of further education and higher education computing students	Hainey, T.; Connolly, T.; Boyle, L.; Stansfield, M.	Scopus	Education	Computer Science
The differences in motivations of online game players and offline game players: A combined analysis of three studies at higher education level	Hainey, T.; Connolly, T.; Stansfield, M.; Boyle, E.	Scopus, PsychINFO, ScienceDirect	Education	Higher Education
The use of games as an educational web2.0 technology a survey of motivations for playing computer games at HE level	Hainey, T.; Connolly, T.M.	Scopus	Education	Higher Education
The effects of computer games on primary school students' achievement and motivation in geography learning	Hakan, T.; Yılmaz-Soylu, M.; Karakuş, T.; İnal, Y.; Kızılkaya, G.	PsychINFO, ScienceDirect	Education	Primary Education

Effects of a successful mathematics classroom framework on students' mathematics self-efficacy, motivation, and achievement: a case study with freshmen students at a university foundation programme in Kuwait	Hammad, S.; Graham, T.; Dimitriadis, C.; Taylor, A.	Scopus	Education	Mathematics
Stressed yet motivated: web-based peer assessed competition as an instructional approach in higher education	Hammer, R.; Ronen, M.; Kohen-Vacs, D.	ACM	Education	Science
Contest based learning with blending software engineering and business management: for students' high motivation and high practice ability	Hanakawa, N.	ACM	Education	Engineering
Gamifying sustainability with self-efficacy: Motivating green behaviours in large industrial firms.	Haque, S.; Panda, D.; Ghosh, A.	PsychINFO	Business	Environment
Gaming social work history – increasing motivation in an unloved field of students' professional development	Harrer-Amersdorffer, J.; Lehmann, R.	Scopus	Education	Social services
Gamification and motivation: Impact on delay discounting performance.	Harvey, S.; Jensen, G.; Anderson, K. G.	PsychINFO	Psychology	Delay discounting
StudyGotchi: Tamagotchi-Like Game-Mechanics to Motivate Students During a Programming Course	Hellings, J.; Leek, P.; Bredeweg, B.	Scopus	Education	Computer Science
Motivation in project-based classrooms: new measures better coupled to students' experiences	Herman, P.; Gomez, L.	ACM	Education	Science
Improving Student Motivation in Higher Education Through Nearpod	Hernandez-Mena, C.; Amado-Moranchel, N.; Avalos, M.O.; Álvarez, J.; Faccinetto-Beltrán, P.	Scopus	Education	STEM

Revitalising learning in three university contexts: Unleashing the power of the Quizizz app to increase self-efficacy, intrinsic motivation, satisfaction and performance	Hernanz, V.; Latorre-Cosculluela, C.; Suárez, C.; Lanchares-Sancho, E.	Scopus	Education	Higher Education
Gamifying the flipped classroom: how to motivate Chinese ESL learners?	Ho, J.	Scopus	Education	English as Second Language
Unplugged Versus Plugged Gamification – A Comparative Study in Higher Education on Engagement, Motivation and Teachers' Perception	Ho, P.H.; Barrios-Fleitas, Y.; González-González; C.	Scopus	Education	Higher Education
Evaluating the Expectations and Motivational Drivers in an Undergraduate Geology Classroom Using the Magma Pop Serious Game	Hoermann, S.; Saha, S.; Harris, N.; Bah, C.; Davidson, J.; Nichols, A.; Kennedy, B.; Brogt, E.	Scopus	Education	Geology
Exploring the Effects of Browsing Motivations on Planned Impulse Buying in Facebook Transaction Groups	Hsiu-Chia Ko,Ci-Syuan Yan	ACM	Business	e-Commerce
Assessing the impacts of gamification on students' motivation, learning and participation	Huang B.; Hew, K.F.	Scopus	Education	Higher Education
Mobile game-based learning with a mobile app: Motivational effects and learning performance	Huang Y.-L.; Chang D.-F.; Wu B.	Scopus	Education	English as Second Language
The Influence of Self-Efficacy, Perceived Usefulness, Perceived Ease of Use, and Cognitive Load on Students' Learning Motivation, Learning Attitude, and Learning Satisfaction in Blended Learning Methods	Huang, C.-H.	ACM	Education	STEM
Impact of online instructional game features on college students' perceived motivational support and cognitive investment: A structural equation modeling study	Huang, W.D.; Johnson, T.E.; Han, S.-H.C.	Scopus, PsychINFO, ScienceDirect	Education	Higher Education

Motivational support from digital game-based learning environments (DGBLEs) for scientific topics designed by novice end users	Huang, W.D.; Oh, E.G.	Scopus, PsychINFO	Education	Teaching
Understanding Newcomers to 3D Printing: Motivations, Workflows, and Barriers of Casual Makers	Hudson, N.; Alcock, C.; Chilana, P. K.	ACM	Computer Science	3D printing
Collaborative game-based learning with motion-sensing technology: Analyzing students⇔ motivation, attention, and relaxation levels	Hung, C.-Y.; Lin, Y.-R.; Huang, K.-Y.; Yu, P.-T.; Sun, J.C.-Y.	Scopus	Education	Higher Education
EFFECTS OF DIGITAL GAME-BASED LEARNING IN STEM EDUCATION ON STUDENTS' MOTIVATION: A SYSTEMATIC LITERATURE REVIEW	Ilić, J.; Ivanović, M.; Klašnja-Milićević, A.	Scopus	Education	STEM
Gamification Influences on Students' Motivation in the EFL Classroom	Infante-Paredes, R.; Mayorga-Gaona, C.; Guerrero-Velástegui, C.-A.; Morocho-Lara, D.	Scopus	Education	EFL
Systematic Review on the Effect of the Gamification of Teaching on the Motivation of Higher Education Students; [Revisión Sistemática acerca del Efecto de la Ludificación de la Enseñanza en la Motivación de Estudiantes de Educación Superior]	Infante-Villagrán, V.A.; Maluenda-Albornoz, J.I.; López-Angulo, Y.; Díaz-Mujica, A.	Scopus	Education	Higher Education
The role of gamification in activating primary school students' intrinsic and extrinsic motivation at a museum	Ioannou, I.; Kyza, E. A.	ACM	Education	Teaching
Nonformal Test-Based Gamification Model to Improve Student Motivation	Iskandar, A.P.S.; Sudarma, M.; Saputra, K.O.	Scopus	Education	Learning technologies
Characterizing High School Participants' Motivations and Outcomes in a Service-Oriented Summer Internship	Isvik, A.; Lytle, N.; Catete, V.; Barnes, T.	ACM	Education	Computer Science

Augmented reality and gamification in higher education: Designing mobile interaction to enhance students' motivation and learning	Ivarson, E.; Erlandsson, V.; Faraon, M.; Khatib, S.	Scopus	Education	Information technology
Game-based learning and students' motivation in project management education	Jääskä, E.; Lehtinen, J.; Kujala, J.; Kauppila, O.	Scopus, ScienceDirect	Education	Business
A Mixed-Methods Study of Marketing Students' Game-Playing Motivations and Gamification Elements	Jaskari, M.-M.; Syrjälä, H.	Scopus	Education	Business
The effect of virtual reality learning on students' motivation: A scoping review.	Jiang, J.; Fryer, L. K.	PsychINFO	Education	General
Learning to Represent Human Motives for Goal-directed Web Browsing	Jiang, J.Y.; Lee, C-J; Yang, L.; Sarrafzadeh, B.	ACM	Computer Science	Web
Are Children More Motivated with Plugged or Unplugged Approach to Computational Thinking?: (Abstract Only)	Jiang, S.; Wong, G.K.W.	ACM	Education	Computer Science
Improving college student engagement and motivation in a gamified learning environment: The pilot study in China.	Jing, L.V.	PsychINFO	Education	Higher Education
Motivational Factors Affecting Computer Science Enrollment	Jones, L.K.; Gottlieb, J.J.	ACM	Education	Computer Science
Fostering autonomous motivation: A deeper evaluation of gamified learning. [References].	Kam, A. H. T; Umar, I. N.	PsychINFO	Education	Secondary education
Motivations of game jam organizers: case of finnish game jam community	Kankainen, V.; Kultima, A.; and Meriläinen, M.	ACM	Computer Science	Gaming
Gamification through the Application of Motivational Affordances for Physical Activity Technology	Kappen, D. L.; Mirza-Babaei, P.; Nacke, L. E.	Grey lit	Computer Science	Applied computing
Applying Gamification to Motivate Students to Write High-Quality Code in Programming Assignments	Kasahara, R.; Sakamoto, K.; Washizaki, H.; Fukazawa, Y.	ACM	Education	Computer Science

The impact of applying challenge-based gamification program on students' learning outcomes: Academic achievement, motivation and flow	Kaya, O.S.; Ercag, E.	PubMed, Scopus	Education	Higher Education
Engaging and Motivating Students Through Programming Competitions and GIS Applied Research Projects	Khmelevsky, Y.; Chidlow, K.; Sugihara, K.; Zhang, K.	ACM	Education	Computer Science
Feasibility of utilizing gamified learning as a motivational strategy for promoting physical activity participation and healthy eating among college students.	Kim, J.; Lindqvist, A. K.; Castelli, D. M.	PsychINFO	Psychology	Well-being
Developing an e-learning System which enhances students' academic motivation	Koike, H.; Ishikawa, T.; Akama, K.; Chiba, M.; Miura, K.	ACM	Education	Teaching
Increasing assignment motivation using a game AI tournament	Kolås, Ø.; Farup, I.	Grey lit	Education	Computer Science
Tailoring gamification to requirements elicitation: a stakeholder centric motivation concept	Kolpondinos, M. Z. H.; Glinz, M.	ACM	Engineering	Software engineering
The Race to Nuclear Supremacy: Classroom Games as Motivation for Student Learning	Kraff, A.R.V.; Castellanos, E.C.O.; Moroyoqui, D.A.D.	Scopus	Education	Physics and Social science
Motivating Adult Learners by Introducing Programming Concepts with Scratch	Krafft, M.; Fraser, G.; Walkinshaw, N.	ACM	Education	Computer Science
Impact of online instructional game features on students' perceived motivational support and cognitive investment	Kumar, A.; Soundirapandian, K.; Jaraime, N.H.; Krishnan, M.; Alzah Juno, N.S.; Samsudin, N.A.	Scopus	Education	Higher Education
Beyond pleasure, desire for meaningful consumption and peacefulness from digital entertainment platforms; extending utaut2 model with eudemonic motivation and tranquility.	Kuriakose, M.; Nagasubramaniyan, G.	PsychINFO	Psychology	Entertainment

To gamify or not to gamify? An experimental field study of the influence of badges on motivation, activity, and performance in an online learning course	Kyewski, E.; Krämer, N.C.	Scopus, PsychINFO, ScienceDirect	Education	Higher Education
Assessing the effects of data compression in simulations using physically motivated metrics	Laney, D.; Langer, S.; Weber, C.; Lindstrom, P.; Wegener, A.	ACM	Computer Science	Modelling
The influence of students' cognitive and motivational characteristics on students' use of a 4C/ID-based online learning environment and their learning gain	Larmuseau, C.; Elen, J.; Depaepe, F.	ACM	Education	Languages
Improving Learning Motivation and Academic Achievement by Flipped Learning	Lee, H. S.; Kim, C. S.	ACM	Education	Learning technologies
A Study of Factors Affecting Foreign Language Learning Motivation in Chinese Higher Education	Lee, H.-I.; Qin, Q.; Li, R.; Xiong, H.; Lin, T.-Y.	ACM	Education	Languages
Field guide to gamification: Game components and motivation in higher education	Lenz, L.; Stehling, V.; Haberstroh, M.; Isenhardt, I.	Scopus	Education	Engineering
Investigating the Relationships among Students' Motivational Beliefs, Behavioural Engagement and Problem-solving Ability in STEM Education	Lewis, C.; Wardrip-Fruin, N.; Whitehead, J.	ACM	Education	STEM
Turning Your Book into a Game: Improving Motivation through Tangible Interaction and Diegetic Feedback in an AR Mathematics Game for Children	Li, J.; D. van der Spek, E.; Hu, J.; Feijs, L.	ACM	Education	Mathematics
The incorporation of peer learning into MosoTeach-supported flipped language class: Effects on student motivation, participation, feedback and test performance.	Li, L.; Huang, C.-Q.	PsychINFO	Education	Higher Education

The impact of digital educational games on student's motivation for learning: The mediating effect of learning engagement and the moderating effect of the digital environment.	Li, Y.; Chen, D.; Deng, X.	PsychINFO	Education	Higher Education
Effects of vocabulary games on lexical growth and retention of low-motivated EFL learners in Taiwan	Liao H.-C.; Chen M.	Scopus	Education	English as Second Language
When Does Kahoot! Provide Most Value for Classroom Dynamics, Engagement, and Motivation?: IS Students' and Lecturers' Perceptions	Licorish S.A.; Lötter A.L.J.	Scopus	Education	Higher Education
"Go kahoot!" Enriching classroom engagement, motivation and learning experience with games	Licorish, S.A.; George, J.L.; Owen, H.E.; Daniel, B.	Scopus	Education	Higher Education
Evaluation of the user experience and intrinsic motivation with educational and mainstream digital games	Lima, L. G. R. d.; Salgado, A. d. L.; Freire, A. P.	ACM	Education	Learning technologies
Motivating Learning by Playing Animal Crossing New Horizons: A trending game during the COVID-19 pandemic	Lin, X.; Su, S.	ACM	Computer Science	Gaming
The evaluation of a scaffolding-based augmented reality educational board game with competition-oriented and collaboration-oriented mechanisms: differences analysis of learning effectiveness, motivation, flow, and anxiety	Lin, Y.-C.; Hou, H.-T.	Scopus, PsychINFO	Education	Higher Education
A Study of the Relationship between Achievement Goal Orientation on Online Academic Procrastination among Junior High School Students: Multiple mediation analysis of task value and motivational regulation	Lin, Y.; Chen, Y.; Zhang, Y.	ACM	Education	Secondary education

Motivating and evaluating game development capstone projects	Linhoff, J.; Settle, A.	ACM	Education	Gaming
Application Data Mining Technology in Monitoring Strategies of College Students' English Learning Motivation	Liu, S.	ACM	Education	English
Sports Gamification: Evaluation of Its Impact on Learning Motivation and Performance in Higher Education	Liu, T.; Lipowski, M.	PubMed, Scopus	Education	Sport Science
ENHANCING COOPERATIVE LEARNING AND STUDENT MOTIVATION WITH GAMIFICATION STRATEGIES: A CASE STUDY IN	Lluch-Molins L.; Balbontin-Escorza F.Y.; Sullivan-Campillay N.	Scopus	Education	Engineering
Is Difficulty Overrated?: The Effects of Choice, Novelty and Suspense on Intrinsic Motivation in Educational Games	Lomas, J.D.; Koedinger, K.; Patel, N.; Shodhan, S.	ACM	Education	Learning technologies
Students' Self-Motivation, Self-Efficacy, Self-Regulation in Virtual Laboratory in Human Anatomy Subject	Loñez, H. E.; Errabo, D. D.	Grey lit	Education	Psychology
Proposal of a system architecture based on emerging technologies to motivate and engage STEM undergraduate students	López Zapata, E.; Cajaleón Flores, E.	Scopus	Education	STEM
Using Gamified Strategies in Higher Education: Relationship between Intrinsic Motivation and Contextual Variables	López-Martínez, A.; Meroño, L.; Cánovas-López, M.; García-de-Alcaraz, A.; Martínez-Aranda, L.M.	Scopus	Education	Higher Education
Gamification improves extrinsic but not intrinsic motivation to learning in undergraduate students: a counterbalanced study; [La gamificación mejora la motivación extrínseca pero no la intrínseca hacia el aprendizaje en estudiantes universitarios: un estudio reequilibrado]	López-Navarro, E.; Giorgetti, D.; Isern-Mas, C.; Barone, P.	Scopus	Education	Psychology

Perceived usefulness of english (l2) learning apps and language mindset mediated by flow and motivation intensity: A serial mediation model and a network analysis.	Lu, A.; Liu, S.; Chen, W.	PsychINFO	Education	Foreign language
Development of a Questionnaire on Self-concept, Motivational Beliefs, and Attitude Towards Programming	Luzia, L.; Tsarava, K.; Moeller, K.; Ostermann, K.	ACM	Education	Computer Science
Exploring the structural relationships of microinteractions in perception and behavior by the hedonic motivation system adoption model.	Ma, J. Y.; Xie, J. F.; Chen, C. C.	PsychINFO	Computer Science	Microinteractions
Elaboration of a biophysical teaching game as a learning tool and motivation for medicine courses; [Elaboração de um jogo didático de biofísica como ferramenta de aprendizado e motivação para acadêmicos do curso de medicina]	Machado, M.; Alves, I.S.; Maia, E.R.R.M.; Magalhães, A.A.D.S.; Cordeiro, I.B.	Scopus	Education	Biophysics
Educational hall escape: Increasing motivation and raising emotions in higher education students	Macías-Guillén, A.; Díez, R.M.; Serrano-Luján, L.; Borrás-Gené, O.	Scopus, PsychINFO	Education	Business
Motivating students with practical problems	Malasri, K.; Sherrell, L.	ACM	Education	Computer Science
A Meta-Analysis on the Impact of Gamification over Students' Motivation	Mamekova A.T.; Toxanbayeva N.K.; Naubaeva K.T.; Ongarbayeva S.S.; Akhmediyeva K.N.	Scopus	Education	Learning technologies
Development and Validation of a Questionnaire on Motivation for Cooperative Playful Learning Strategies	Manzano-León, A.; Camacho-Lazarraga, P.; Guerrero-Puerta, M.A.; Guerrero-Puerta, L.; Alias, A.; Aguilar-Parra, J.M.; Trigueros, R.	PubMed, Scopus	Education	Higher Education

Games: The Motivation in Engineering Education	Marques, B. P.; Reis, R.; Cardoso, M.	ACM	Education	Engineering
The Spheres of Player Motivation: Understanding Players of Digital Games	Martin, C. T.	Grey lit	Computer Science	Gaming
ESCAPING THE LAB: INCREASING MOTIVATION IN THE PHYSICS CLASSROOM THROUGH EDUCATIONAL ESCAPE ROOMS	Martinez, E.; Alvarez, J.; Carbonell, V.; Florez, M.; Montoya, E.	Scopus	Education	Physics
A Methodology to Motivate Students to Develop Transversal Competencies in Academic Courses Based on the Theory of Planned Behavior by using Gamification and ANNs	Mata, O.; Mendez, I.; Aguilar, M.; Ponce, P.; Molina, A.	Scopus	Education	Mathematics
Electronic Feedback in Large University Statistics Courses: The Longitudinal Effects of Quizzes on Motivation, Emotion, and Cognition	Maur, A.	Scopus, PsychINFO	Education	Mathematics
Investigating Potential Gender Differences in First-Year Engineering Students' Academic Motivation and Homework Submission Behavior	Mawson, M.C.; Bodnar, C.A.	Scopus	Education	Engineering
Game-Based entrepreneurship education: Identifying enterprising personality, motivation and intentions amongst engineering students	Mayer, I.; Kortmann, R.; Wenzler, I.; Wetters, Á.; Spaans, J.	Scopus	Education	Business
Motivations and informing frameworks of game degree programs in the United Kingdom and the United States	McGill, M. M.	ACM	Education	Gaming
Evaluating Motivation for the Use of an Electronic Health Record Simulation Game	McLeod, A.; Hewitt, B.; Gibbs, D.; Kristof, C.	PubMed, Scopus	Education	Health Information

Physiopucks: Increasing User Motivation by Combining Tangible and Implicit Physiological Interaction	Mealla Cincuegrani, S.; Jordà, S.; Väljamäe, A.	ACM	Education	Music
Understanding Chinese teachers' informal online learning continuance in a mobile learning community: An intrinsic-extrinsic motivation perspective.	Meng, Z.; Li, R.	PsychINFO	Education	Teaching
Motivated reinforcement learning for adaptive characters in open-ended simulation games	Merrick, K.E., & Maher, M.L.	ACM	Computer Science	Gaming
What motivates university students to engage in learning computer skills?	Micheletti, A.; Orio, N.; Zilio, D.	Scopus	Education	Information technology
Meaningful learning in mathematics: A study on motivation for learning and development of computational thinking using educational robotics. [References].	Miguens, B.; Lucia A.; Piedade, N.; Manuel, J.; dos Santos, R.J.B.; Tiago Lopes, O.	PsychINFO	Education	Primary Education
Motivation and manipulation: A gamification approach to influencing undergraduate attitudes in computing	Mitchell, N.; Danino, N.; May, L.	Scopus	Education	Computer Science
Effects of gamification on motivations of elementary school students: An action research field experiment. [References].	Mohammed, M.; Fatemah, A.; Hassan, L.	PsychINFO	Education	Primary Education
A REVIEW OF GAMIFICATION TOOLS TO BOOST STUDENTS' MOTIVATION AND ENGAGEMENT	Mohd, C.K.N.C.K.; Mohamad, S.N.M.; Sulaiman, H.A.; Shahbodin, F.; Rahim, N.R.; Aizudin, A.	Scopus	Education	Learning technologies
Awarding bonus points as a motivator for increased engagement in course activities in a theoretical system development course	Moll, J.; Gao, S.	Scopus	Education	Higher Education

Wooclap for improving student achievement and motivation in the Chemical Engineering Degree	Moreno-Medina, I.; Peñas-Garzón, M.; Belver, C.; Bedia, J.	Scopus, ScienceDirect	Education	Chemical Engineering
"I just stopped using one and started using the other": Motivations, Techniques, and Challenges When Switching Password Managers	Munyendo, C.W.; Mayer, P.; Aviv, A.J.	ACM	Computer Science	Data management
Serious game and students' learning motivation: Effect of context using Prog&Play	Muratet, M.; Delozanne, E.; Torguet, P.; Viallet, F.	Scopus	Education	Higher Education
The case of literacy motivation: Playful 3d immersive learning environments and problem-focused education for blended digital storytelling	Mystakidis, S.; Berki, E.	Scopus, PsychINFO	Education	Learning technologies
Playful Blended Digital Storytelling in 3D Immersive eLearning Environments: a Cost Effective Early Literacy Motivation Method	Mystakidis, S.; Lambropoulos, N.; Fardoun, H. M.; Alghazzawi, D. M.	ACM	Education	Teaching
Development and Validation of Extrinsic Motivation Scale for Crowdsourcing Micro-task Platforms	Naderi, B.; Wechsung, I.; Polzehl, T.; Möller, S.	ACM	Work	Employee motivation
Supporting motivation and effort persistence in an online financial literacy course through game-based learning	Nadolny, L.; Nation, J.; Fox, J.	Scopus, PsychINFO	Education	Financial literacy
Pathfinder: The Behavioural and Motivational Effects of Collectibles in Gamified Software Training	Naglé, T.; Bateman, S.; Birk, M. V.	ACM	Education	Learning technologies
Speak Up: A Multi-Year Deployment of Games to Motivate Speech Therapy in India	Nanavati, A.; Dias, M. B.; Steinfeld, A.	ACM	Education	Supporting students with disability

Gamification as a Promoting Tool of Motivation for Creating Sustainable Higher Education Institutions	Navarro-Espinosa, J.A.; Vaquero-Abellán, M.; Perea-Moreno, A.-J.; Pedrós-Pérez, G.; Martínez-Jiménez, M.P.; Aparicio-Martínez, P.	PubMed, Scopus	Education	Higher Education
Mathematics and technological integration in the Brazilian basic education as motivation to STEM	Nicolete, P. C.; Cristiano, M. A. d. S.; Silva, J. B. d.; Bilessimo, S. M. S.; Simão, J. P. S.; Benavides, K. D. R.; et al.	Scopus	Education	STEM
Why do people tag?: motivations for photo tagging	Nov, O.; Ye, C.	ACM	Psychology	Behaviour
Assessing motivation and capacity to argue in a gamified seminar setting	Ohira,S.; Kawanishi, K.; Nagao, K.	ACM, Scopus	Education	Learning technologies
A discussion on introducing half-anonymity and gamification to improve students' motivation and engagement in classroom lectures	Ohno, A.; Yamasaki, T.; Tokiwa, K.-I.	Scopus	Education	Engineering
Teacher motivational scaffolding and preschoolers' motivational triggers in the context of playful learning of multiliteracy and digital skills.	Ollonen, B.; Kangas, M.	PsychINFO	Education	Pre-school
Investigating students' attitude, motivation & achievement: The impact of Kahoot! engagement in MUET classroom	Omar, S.S.; Ismail, M.E.; Hasbullah, M.S.; Amiruddin, M.H.; Hashim, S.; Ismail, I.M.; Sa'Adan, N.	Scopus	Education	English as Second Language
IoT-Poly: An IoT Security Game Practice Tool for Learners Motivation and Skills Acquisition	Omiya, T.; Fall, D.; Kadobayashi, Y.	ACM	Education	Computer Science

The power of a human bridge: Motivating older adults to long-term engagement with touchscreen devices in a sdt-based learning session.	Oppl, S.; Kronberger, N.; Stary, C.; Oppl, S.	PsychINFO	Education	Information literacy
Towards understanding the mechanism through which reward and punishment motivate or demotivate behaviours.	Orji, R.; Alslaity, A.; Chan, G.	PsychINFO	Psychology	Motivation
Gamification in computer programming: Effects on learning, engagement, self-efficacy and intrinsic motivation	Ortiz-Rojas, M.; Chiluiza, K.; Valcke, M.	Scopus	Education	Computer Science
Effect of using gamification and augmented reality in mechanical ventilation unit of critical care nursing on nurse students' knowledge, motivation, and self-efficacy: A randomized controlled trial	Othman, S.Y.; Ghallab, E.; Mohamed, A.M.	ScienceDirect	Education	Nursing
Using an Escape Room Activity to Enhance the Motivation of Undergraduate Life Science Students in Mathematics Classes: A Case Study	Pais S.; Sousa A.; Pires A.	Scopus	Education	Mathematics
Using kahoot! To enhance the motivation of undergraduate students of tourism in mathematics classes - A case study	Pais, S.; Hall, A.	Scopus	Education	Mathematics
Differences in learning motivation among bartle's player types and measures for the delivery of sustainable gameful experiences	Park, S.; Min, K.; Kim, S.	Scopus	Education	Learning technologies
Gamification in Engineering Education: The Use of Classcraft Platform to Improve Motivation and Academic Performance	Parody, L.; Santos, J.; Trujillo-Cayado, L.A.; Ceballos, M.	Scopus	Education	Engineering
Multilingualism & motivation in language classrooms in england.	Parrish, A.; Bailey, E. G.	PsychINFO	Education	Languages

Increasing students' motivation by using virtual learning environments based on gamification mechanics: Implementation and evaluation of gamified assignments for students	Pastushenko, O.; Hruška, T.; Zendulka, J.	ACM	Education	Learning technologies
Motivation and Strategies for Effective Inclusion of Cloud Solution Provider Certifications in Computing Curricula	Paterson, J.H.; Adams, J.; Foster, D.; Baghban Karimi, O.	ACM	Education	Computer Science
Personality, motivations, and information quality: a comparative study across games for human computation	Pe-Than, E. P. P.; Goh, D. H.-L.; Lee, C. S.	ACM	Computer Science	Gaming
The benefits of agent-based motivation models in policy formulation and implementation	Pedell, S.; Sterling, L.	ACM	Politics	Policy-making
Exploring the coaction of motivation and learning styles in educational gamification: A preliminary study for understanding 'motivational learning modes'	Pereira J.; Morton J.; Gomes L.	Scopus	Education	Higher Education
A Project-Based Learning Approach for Enhancing Learning Skills and Motivation in Software Engineering	Pérez, B.; Rubio, Á. L.	ACM	Education	Computer Science
Developing and validating a scale for motivation in participating in time-bounded collaborative events.	Perin, M. G.; de Almeida Melo, L.; de Souza, C. R. B.; de Almeida, A. C. D. B.; Figueira Filho, F.	PsychINFO	Education	STEM
Learning and motivational effects of digital game-based learning (DGBL) for manufacturing education – The Life Cycle Assessment (LCA) game	Perini, S.; Luglietti, R.; Margoudi, M.; Oliveira, M.; Taisch, M.	Scopus, ScienceDirect	Education	Manufacturing
Project Based Learning or the Rethinking of an Engineering Subject: Measuring Motivation	Petchamé, J.; Iriondo, I.; Riu, D.; Masi, T.; Almajano, A.; Fonseca, D.	ACM	Education	Engineering

Motivational Readiness of Future Teachers-Philologists to Use the Gamification with Elements of Augmented Reality in Education	Petrovych, O.; Zavalniuk, I.; Bohatko, V.; Poliarush, N.; Petrovych, S.	Scopus	Education	Journalism
How Gamification Enhances Student Motivation in Online Courses	Pham, A. T. V.; Kieu, N. V.; Vu, T. T. T.	ACM	Education	Learning technologies
Automated generation of adaptive perturbed images based on GAN for motivated adversaries on deep learning models: Automated generation of adaptive perturbed images based on GAN	Pham, D.T.; Nguyen, C. T.; Truong, P.H.; Nguyen, N.H.	ACM	Computer Science	AI
Leaderboards in an EFL course: Student performance and motivation	Philpott, A.; Son, J.-B.	Scopus, PsychINFO, ScienceDirect	Education	English as Second Language
Quest-based learning and motivation in an EFL context	Philpott, A.; Son, J.-B.	Scopus, PsychINFO	Education	English as Second Language
Virtual Escape Rooms: a gamification tool to enhance motivation in distance education; [Escape Rooms virtuales: una herramienta de gamificación para potenciar la motivación en la educación a distancia]	Piernas, J.M.P.; Meroño, M.C.P.; Asenjo, M.P.F.	Scopus	Education	Higher Education
Motivational active learning for computer science education (abstract only)	Pirker, J.; Gütl, C.	ACM	Education	Computer Science
Motivational active learning - Engaging university students in computer science education	Pirker, J.; Riffnaller-Schiefer, M.; Gütl, C.	Scopus	Education	Computer Science
Seek What You Need: Affiliation and Power Motives Drive Need Satisfaction, Intrinsic Motivation, and Flow in League of Legends	Poeller, S.; Seel, S.; Baumann, N.; Mandryk, R. L.	ACM	Computer Science	Gaming
Development of Motivation for Learning in the Remote form of Organization of the Educational Process	Pogodaeva,M. V.; Moiseeva, L. V.; Pushkareva, I. N.; Gazizova, F. S.; Galich, T. N.	ACM	Education	Learning technologies

Appendix D: Online advert for quantitative arm of study

How to get a badge? Unlock your mind: Motivation through student empowerment	Pombo, N.; Garcia, N.; Alves, P.	Scopus	cation	Higher Education
A New and Interactive Teaching Approach with Gamification for Motivating Students in Computer Science Classrooms	Portela, F.	Scopus	Education	Computer Science
"Secure settings are quick and easy!" – Motivating End-Users to Choose Secure Smart Home Configurations	Prange, S.; Thiem, N.; Fröhlich, M.; Alt, F.	ACM	Computer Science	Cyber security
The Effect of Gaming Habits on Achievement Motivation, Social Support, and Personal Achievements: A Structural Equation Modeling Approach	Prasetyo, Y. T.; Miquiera, F.; Pudadera, C. M.; Sobremonte, M.	ACM	Computer Science	Gaming
The Use of Games as Extrinsic Motivation in Education	Preist, C.; Jones, R.	ACM	Education	Mathematics
Engagement factors and motivation in e-Learning and blended-learning projects	Priego, R. G.; Peralta, A. G.	ACM	Education	Learning technologies
A systematic review about gamification, motivation and learning in high school, [Una revisiÓn sistemÁtica sobre gamificaciÓn, motivaciÓn y aprendizaje en universitarios]	Prieto Andreu, J.M.	Scopus	Education	Secondary education
Gamification, Motivation, and Performance in Education: A Systematic Review; [Gamificação, motivação e desempenho na educação: Uma revisão sistemática]; [Gamificación, motivación y rendimiento en educación: Una revisión sistemática]	Prieto-Andreu, J.M.; Gómez-Escalonilla-Torrijos, J.D.; Said-Hung, E.	Scopus	Education	Learning technologies
"Why would Someone Hack Me out of Thousands of Students": Video Presenter's Impact on Motivating Users to Adopt 2FA	Qahtani, E. A.; Sahoo, L.; Javed, Y.; Shehab, M.	ACM	Computer Science	Cyber security
How to improve students' intrinsic motivation and 4C skills in the virtual e-learning community and evaluate its results	Qin, B.; Zhao, D. D.	ACM	Education	Philosophy

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How does gamification impact medical students 'academic motivation towards otolaryngology, and what demographics influence this: a mixed methods study

Ethics Approval Reference: [**EDUC_C1A_23_343**]

VOLUNTEERS NEEDED FOR GAMIFICATION PROJECT

The aim of this study is to investigate the impact of gamification on medical students 'academic motivation, compared with traditional self-directed learning, when learning about otolaryngology (ear, nose and throat). This study also aims to explore whether age or gender may impact on students 'academic motivation when learning through gamification.

We are looking for volunteers to complete a survey and online learning module on *otolaryngology red flags*.

You must be a medical student studying otolaryngology in your current academic year enrolled at the University of Oxford or the University of Manchester.

You will be asked to complete a short survey about your university, year of birth and gender, followed by a survey about your motivation levels. Following this, you will be invited to complete either a module with game elements, or a module without game elements on red flags in otolaryngology. This module has been created in association with the Clinical Leads for otolaryngology at the University of Oxford. Your progression through the module will be monitored and collected as data, however, you will need to complete the module if you would not like to opt out. After the module, you will be asked to complete another short survey about your motivation levels. The module will take up to 120 minutes to complete, and the surveys will take up to 10 minutes each.

As a form of motivation and developing knowledge of otolaryngology, you will be issued with a certificate for your medical portfolio.

Following the module and online surveys, you may opt in to be invited for an interview about your experience of the module. This is entirely voluntary. You would receive a separate certificate recognising your contribution to qualitative research if you participate in the interview.

If you are interested and would like more information please contact Dr Catherine Burr at the Department of Education, 15 Norham Gardens, Oxford on catherine.burr@gtc.ox.ac.uk. There is no obligation to take part.

Thank you!

Appendix E: Information sheet for quantitative arm of study

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How does gamification impact medical students' academic motivation towards otolaryngology, and what demographics influence this: a mixed methods study

CUREC Approval Reference: EDUC_C1A_23_343

General Information

The aim of this research is to investigate the impact of gamification on medical students' academic motivation, compared with traditional self-directed learning, when learning about otolaryngology (also known as Ear, Nose, and Throat (ENT)). This study also aims to explore how age and gender may impact on students' academic motivation when learning through gamification.

We appreciate your interest in participating in this survey and online task. You have been invited to participate as you are a medical student at either the University of Manchester or the University of Oxford, and are studying otolaryngology in your current academic year. Please read through this information before agreeing to participate (if you wish to) by following the instructions at the end of this information sheet.

You may ask any questions before deciding to take part by contacting the researcher (details below).

The Principal Researcher is Dr Catherine Burr, who is attached to the Department of Education at the University of Oxford. This research is being completed under the supervision of Dr Jeremy Knox.

What will the study involve?

If you are studying at the University of Manchester: If you choose to take part, you will be enrolled as a student on Canvas, the virtual learning environment used by the University of Oxford. You will also be enrolled onto H5P, a plug-in service which allows us to gamify the module.

If you are studying at the University of Oxford: You will be auto-enrolled onto the module. However, the module is entirely option.

You will be randomised to complete either an online otolaryngology learning module with game elements (gamification), or one without game elements (traditional learning). These modules will differ in how the learning content is delivered, but the written content will be the same. Both modules have been created in association with the Clinical Leads for Otolaryngology at the University of Oxford, and will be on otolaryngology (ENT) red flags.

Prior to the module, you will be asked to complete a survey, asking you about your age, gender, university and academic year, and about your motivations for completing the module. If you have any questions about the survey, you can contact me prior to completing the survey. If you would prefer not to answer questions about gender or age, you can put "prefer not to say" as your answer in the survey. After the module, you will be invited to repeat the same survey asking about your motivations for completing the module.

The surveys should take 10 minutes each, and the module should take up to 120 minutes. No background knowledge is required. As recognition of your time and developing otolaryngology knowledge, you will receive a certificate for your medical portfolio.

The information you provide will help us to understand whether gamification impacts on medical student motivation when learning about otolaryngology, and whether student demographics impacts

intention.

An artificial intelligence case based approach to motivational students assessment in (e)-learning environments	Ribeiro, J.; Dias, A.; Marques, J.; Ávidos, L.; Araújo, I.; Araújo, N., et al.	ACM	Education	Learning technologies
Beyond designing for motivation: the importance of context in gamification	Richards, C.; Thompson, C. W.; Graham, N.	ACM	Education	Computer Science
Gamification as a Teaching Method to Improve Performance and Motivation in Tertiary Education during COVID-19: A Research Study from Mexico	Rincon-Flores, E.G.; Mena, J.; López-Camacho, E.	Scopus, PsychINFO	Education	Engineering, Economics and Social Sciences
Gamification during Covid-19: Promoting active learning and motivation in higher education	Rincon-Flores, E.G.; Santos-Guevara, B.N.	Scopus	Education	Mathematics
Motivating Professional Student Behavior Through a Gamified Personal Branding Assignment	Robson, K.	Scopus, PsychINFO	Education	Learning technologies
A methodology exploration to motivate teachers to place mathematics at the center of a transdisciplinary experience using videogames and big data combined with the 21st century skills	Rocuts, S.; Alier, M.	ACM	Education	Mathematics
How personalization affects motivation in gamified review assessments.	Rodrigues, L.; Palomino, P. T.; Toda, A. M. ; Klock, A. C. T; Pessoa, M.; Pereira, F. D.; Oliveira, E. H. T; Oliveira, D. F.; Cristea, A. I.; Gasparini, I.; Isotani, S.	PsychINFO	Education	Gamification design
Gamified Strategies to Increase Motivation in Middle School Programming Learning: A Systematic Mapping	Rodríguez González, A.F.; Gómez Álvarez, M.C.; Ramírez, G.M.; Manrique Losada, B.	Scopus	Education	Computer Science
Motivational active learning: An integrated approach to teaching and learning process control	Rodríguez, M.; Díaz, I.; Gonzalez, E.J.; González-Miquel, M.	Scopus, ScienceDirect	Education	Chemical Engineering
Motivational Active Learning in Chemical Engineering	Rodríguez, M.; González, E.J.; González-Miquel, M.; Díaz, I.	Scopus, ScienceDirect	Education	Chemical Engineering

Using Nearpod for Reviewing Lessons to Increase Motivation and Academic Performance: A Case Study with Engineering Students	Romero Rodríguez, L.	Scopus	Education	Engineering
Scratch vs. Karel: impact on learning outcomes and motivation	Ruf, A.; Mühling, A.; Hubwieser, P.	ACM	Education	Teaching
Intrinsic motivation, psychological needs, and competition: a self-determination theory analysis.	Ryan, R. M.; Reeve, J.	PsychINFO	Psychology	Competition
Use of storytelling to increase engagement and motivation in computing in lower primary schools	S. Rizvi, S. Sentance, K. Childs, H. Leonard, O. Quinlan and J. Waite	ACM	Education	Computer Science
Continued involvement in software development: motivational factors	Sach,R.; Sharp, H.; Petre, M.	ACM	Computer Science	Software engineering
Factors That Influence Students' Motivation and Perception of Studying Computer Science	Säde, M.; Suviste, R.; Luik, P.; Tõnisson, E.; Lepp, M.	ACM	Education	Computer Science
The effects of implementing gamified instruction on vocabulary gain and motivation among language learners	Sadeghi, K.; Sağlık, E.; Mede, E.; Samur, Y.; Comert, Z.	PubMed, Scopus, ScienceDirect	Education	English as Second Language
Gamification Based Collaborative Learning: The Impact of Rewards on Student Motivation	Sahli, S.; Spriet, T.	Scopus	Education	General
How an open learning environment affects the motivation of secondary and higher education students	Samarakou, M.; Fylladitakis, E. D.; Karolidis, D.; Papadakis, A.; Prentakis, P.; Tsaganou, G.	ACM	Education	Engineering
A gamification experience to improve engineering students' performance through motivation	Sánchez-Carmona, A.; Robles, S.; Pons, J.	Scopus	Education	Engineering
Using digital educational escape rooms as a motivational review tool for Economics	Sánchez, A.M.	Scopus, ScienceDirect	Education	Economics
Do multi-user virtual environments really enhance student's motivation in engineering education?	Sancho, P.; Torrente, J.; Fernández-Manjón, B.	Scopus	Education	Engineering

The effectiveness of the gamified LMS platform to increase students' motivation in online courses	Saputro, R.E.; Salam, S.; Zakaria, M.H.; Baihaqi, W.M.	Scopus	Education	Higher Education
A review of intrinsic motivation elements in gamified online learning	Saputro, R.E.; Salam, S.B.; Zakaria, M.H.	Scopus	Education	Learning technologies
Investigating teachers motivation to use ICT tools in higher education	Schulz, R.; Isabwe, G.M.; Reichert, F.	Scopus	Education	Teaching
Studying the impact of gamification on motivation in remote programming education	Scott, L.; Dalton, N.	Scopus	Education	Computer Science
Un espace de conception pour explorer la continuité des affordances motivationnelles dans un contexte scolaire hybride.: A design space for the exploration of motivational affordances continuity in hybrid learning environments	Serna, A.; Pereira, A.; Lavoue, E.	ACM	Education	Teaching
Impact of gamification on green consumption behavior integrating technological awareness, motivation, enjoyment and virtual CSR	Shahzad, M.F.; Xu, S.; Rehman, O.; Javed, I.	PubMed, Scopus	Environment	Behaviour
Techniques for Increasing Educational Motivation and the Need to Assess Students' Knowledge: The Effectiveness of Educational Digital Games in Learning English Grammatical Material	Shakhmalova, I.; Zotova, N.	PubMed, Scopus, PsychINFO	Education	English
Weekly Open-Ended Exercises and Student Motivation in CS1	Sharmin, S.; Zingaro, D.; Brett, C.	ACM	Education	Computer Science
Academic Motivation and Learning Strategies of Students at Lectures	Shlenskaya, N.; Lavrinovich, D.; Khorokhorina, G. and Zamel, D.	Scopus	Education	Learning strategies
An Interdependent Model of Personality, Motivation, Emotion, and Mood for Intelligent Virtual Agents	Shvo, M.; Buhmann, J.; Kapadia, M.	ACM	Computer Science	Human-computer interaction
Gamification in Engineering Education: Exploring Students' Performance, Motivation, and Engagement	Silva, I.; Wong, A.; Auria, B.; Zambrano, D.; Echeverria, V.	Scopus	Education	Engineering

Exploring the Impact of Gender Stereotypes on Motivation, Flow State, and Learning Performance in a Gamified Tutoring System	Silva, K.; Santos, J.; Chalco, G.; (...), Bittencourt, I.I.; Isotani, S.	Scopus	Education	General
Engaging and Motivating Developers by Adopting Scrum Utilizing Gamification	Sisomboon, W.; Phakdee, N.; Denwattana, N.	Scopus	Education	Software engineering
The significance of game, as a practice, for education: Students' motivation for gaming and tendency to games	Slijepcevic, D.; Crnogorac, B.; Sijakovic, I.; Kovacevic, B.; Kosarac, B.; Hadzic, A.; Dabrowska-Prokopowska, E.	Scopus	Education	Social science
Exergames for Physiotherapy and Rehabilitation: A Medium-term Situated Study of Motivational Aspects and Impact on Functional Reach	**Smeddinck, J.D.; Herrlich, M.; Malaka, R.**	**ACM**	**Medical**	**Physiotherapy**
Video games challenge and motivate data structure students	Smith, R. F.	ACM	Education	Computer Science
"Gamifying" a library orientation tutorial for improved motivation and learning	Spence, M.; Foster, J.A.; Irish, R.; Sheridan, P.K.; Frost, G.S.	Scopus	Education	Engineering
Fostering Self-Regulation, Motivation, and Creativity Through Gamification Software iWrite	Stein C.; Zhang Z.S.	Scopus	Education	Higher Education
Game-Based Learning of the Structure and Functioning of Body Cells in a Foreign Language: Effects on Motivation, Cognitive Load, and Performance	Stiller, K.D.; Schworm, S.	Scopus	Education	English as Second Language
Gamification in thermal engineering: Does it encourage motivation and learning?	Suárez-López, M.J.; Blanco-Marigorta, A.M.; Gutiérrez-Trashorras, A.J.	Scopus, ScienceDirect	Education	Engineering
Influence of Course Design on Student Engagement and Motivation in an Online Course	Subramanian, K.; Budhrani, K.	ACM	Education	Computer Science
Gamification in classroom, effect of categorization of extrinsic reward to motivate student learning performance	Suepphong, C.; Sureephong, P.	Grey lit	Education	Engineering

motivation. Pre- and post-module surveys will be collected and analysed to identify whether your motivation changed after the gamification module (if in the gamification group), or used as a comparison to the gamification group (if in the traditional learning group). Surveys will also be analysed to assess whether age and gender has any impact on motivation in response to gamification. Your progression through the module on Canvas will also be collected as data and included in study analysis. The data will not be shared with anyone outside the research team.

At the end of the post-module survey, you will be asked whether you would like to opt-in for interview. If you do opt in, I will send you an email containing an information sheet and the questions I would like to ask you at interview. If you have any questions at this stage, or are no longer interested in being interviewed, please let me know. Following the interview, as recognition of your contribution to qualitative research, I will send you a certificate for your medical portfolio.

Do I have to take part?

No. Please note that participation is voluntary. If you do decide to take part, you may withdraw at any point for any reason before submitting your answers by pressing the 'Exit' button/ closing the browser. We have included a 'Prefer not to say' option for age and gender questions in the survey should you prefer not to answer a particular question.

How will my data be used?

The data we will collect that could identify you will be age, gender, year group and university.

Your IP address will not be stored[1]. We will take all reasonable measures to ensure that data remain confidential. If you are studying at the University of Manchester, you will be disenroled from Canvas and H5P on 1st May 2024 and all data deleted from this software.

The survey responses you provide will be stored in a password-protected electronic file on my personal laptop and University of Oxford secure servers. They may be used in academic publications and conference presentations. Identifiable information will be anonymised and deleted as soon as it is no longer required for the research. Research data will be stored for at least 3 years after publication or public release of the work of the research to answer queries from fellow researchers.

You may withdraw your data from the study up until the data has been anonymised, or until 1st September 2024 (whichever is sooner).

Who will have access to my data[2]?

The University of Oxford is the data controller with respect to your personal data and, as such, will determine how your personal data is used in the research. The University will process your personal data for the purpose of the research outlined above. Research is a task that we perform in the public interest. Further information about your rights with respect to your personal data is available from https://compliance.admin.ox.ac.uk/individual-rights.

The results will be written up for an MSc degree.

Who has reviewed this research?

This research has been reviewed by, and received ethics clearance through, a subcommittee of the University of Oxford Central University Research Ethics Committee EDUC_C1A_23_343.

Who do I contact if I have a concern or I wish to complain?

[1] Guidance is available within CUREC's Best Practice Guidance (09) on Data collection, protection and management

[2] Guidance is available within CUREC's Best Practice Guidance (09) on Data collection, protection and management

Techniques for Motivating Users	Nacke, L. E.		Science	n design

Gamified learning: A role-playing approach to increase student in-class motivation	Topîrceanu, A.	Scopus, ScienceDirect	Education	Learning technologies
The use of hedonic-motivation system adoption model in evaluating aviation technology students' behavioral intention and immersion toward using flight simulator.	Toring, H.; Benatiro, R.; Legaspi, N.; Cahayagan, M. L.; Felix, R.; Adaptar, A.; Cortes, S.; Licen, C. R.	PsychINFO	Education	Aviation
Gamification, Online Learning and Motivation: A Quantitative and Qualitative Analysis in Higher Education	Torrado Cespón, M.; Díaz Lage, J.M.	Scopus	Education	Higher Education
Developing software for motivating individuals with intellectual disabilities to do outdoor physical activity	Torrado, J.C.; Wold, I.; Jaccheri, L.; Pelagatti, S.; Chessa, S.; Gomez, J.; Hartvigsen, G. Michalsen, H.	ACM	Sport Science	Disability
Structure of disaster preparedness motivation and its relationship with disaster preparedness behaviors.	Toyosawa, J.; Takehashi, H.; Shimai, S.	PsychINFO	Environment	Disaster preparedness
Teachers' Motivations to Learn about ML and AI	Tshukudu, E.; Waite, J.; Rizvi, S.; Sentance, S.	ACM	Education	Teaching
Understanding online collectible card game players' motivations: a survey study with two games	Turkay, S.; Adinolf, S.	ACM	Computer Science	Gaming
Integrating the arcs motivational elements into an on-line game-based learning application: Does the application enhance students' motivation in learning programming?	Ubaidullah, N.H.; Hamid, J.; Mohamed, Z.	Scopus	Education	Computer Science
Understanding ESL Students' Motivations to Increase MOOC Accessibility	Uchidiuno, J.; Ogan, A.; Yarzebinski, E.; Hammer, J.	ACM	Education	English as Second Language

Use of a gamified website to increase pain neurophysiology knowledge and improve satisfaction and motivation among students studying for a degree in physiotherapy: a quasi-experimental study	Valenzuela-Pascual, F.; Pàmies-Fabra, J.; García-Martínez, E.; Martínez-Navarro, O.; Climent-Sanz, C.; Gea-Sánchez ,M.; Virgili-Gomà, J.; Rubí-Carnacea, F.; Garcia-Escudero, M.; Blanco-Blanco, J.	PubMed, Scopus	Education	Physiotherapy
Need-supporting gamification in education: An assessment of motivational effects over time	van Roy, R.; Zaman, B.	Scopus, PsychINFO, ScienceDirect	Education	Higher Education
Unravelling the ambivalent motivational power of gamification: A basic psychological needs perspective	van Roy, R.; Zaman, B.	Scopus, PsychINFO, ScienceDirect	Education	Higher Education
Business Simulation Games for the Development of Intrinsic Motivation-Boosting Sustainability: Systematic Review	Vélez, A.; Alonso, R.K.; Rico-González, M.	Scopus	Education	Business
Stakeholder dissonance: disagreements on project outcome and its impact on team motivation across three countries	Verner, J.; Beecham, S.; Cerpa, N.	ACM	Computer Science	Software engineering
Motivational Principles and Personalisation Needs for Geo-Crowdsourced Intangible Cultural Heritage Mobile Applications	Vinella, F.L.; Lykourentzou, I.; Papangelis, K.	ACM	Computer Science	Social computing
The impact of self-organization course on the cognitive motivation of first-year students in Online Learning Environments	Vokhmintseva, E. P.; Chipenko, T. G.; Kalimullina, A. V.; Danilchenko, I. V.	ACM	Education	Higher Education
Player Types and Achievements -- Using Adaptive Game Design to Foster Intrinsic Motivation	Volkmar, G.; Pfau, J.; Teise, R.; Malaka, R.	Grey lit	Computer Science	Gaming
Motivating skill-based promotion with badges	Wallis, P.; Martinez, M. S.	ACM	Work	Employee evaluation
Understanding Motivational Factors in Social Media News Sharing Decisions	Wang, L.; Rzeszotarski, J. M.	ACM	Psychology	Behaviour
A Conceptual System Architecture for Motivation-enhanced Learning for Students with Dyslexia	Wang, R.; Chen, L.; Solheim, I.	Grey lit	Education	Supporting students with disability

Modeling Dyslexic Students' Motivation for Enhanced Learning in E-learning Systems	Wang, R.; Chen, L.; Solheim, I.	ACM	Education	Supporting students with disability
Signaling feedback mechanisms to promoting self-regulated learning and motivation in virtual reality transferred to real-world hands-on tasks.	Wang, W.-S.; Pedaste, M.; Lin, C.-J.; Lee, H.-Y.; Huang, Y.-M.; Wu, T.-T.	PsychINFO	Education	Gamification
Using narrative as a motivating device to teach binary arithmetic and logic gates	Waraich, A.	ACM	Education	Computer Science
Motivating Students Beyond Course Requirements with a Serious Game	Watson, S.; Lipford, H. R.	Grey lit	Education	Computer Science
Motivating Students Beyond Course Requirements with a Serious Game	Watson, S.; Richter Lipford, H.	ACM	Education	Computer Science
Towards Self-motivated Learning in Computer Science Education: Results of a Questionnaire Study	Werner, C.; Girnat, B.	Grey lit	Education	Computer Science
Motivation and computer game based learning	Whitton, N.	Scopus	Education	Higher Education
Jomgames: Creating a motivating learning environment	WilliamCheng, W.L.; JosephNg, P.S.; Eaw, H.C.; Phan, K.Y.	Scopus	Education	Higher Education
The Role of Gear Grind Games in Creating a Motivating Learning Environment	WilliamCheng, W.L.; JosephNg, P.S.; Eaw, H.C.; Phan, K.Y.	Scopus	Education	Learning technologies
A Framework for Motivating Sketching Practice with Sketch-based Gameplay	Williford, B.; Runyon, M.; Cherian, J.; Li, W.; Linsey, J.; Hammond, T.	ACM	Education	Art
Improving e-learning motivation using social software	Wirtky, T.	Grey lit	Business	Human Resources
Using social software for enhancing IS talents' e-learning motivation	Wirtky, T.; Laumer, S.; Eckhardt, A.; Weitzel, T.	ACM	Work	Management

Digital game-based learning supports student motivation, cognitive success, and performance outcomes	Woo, J.-C.	Scopus, PsychINFO	Education	Art & Design
The effects of a gamified online course on pre-service teachers' confidence, intention, and motivation in integrating technology into teaching	Wu, M.L.; Zhou, Y.; Li, L.	PubMed, Scopus	Education	Teaching
Intangible rewards versus tangible rewards in gamified online learning: Which promotes student intrinsic motivation, behavioural engagement, cognitive engagement and learning performance?	Xiao, Y.; Hew, K. F. T.	PsychINFO	Education	Business
How does students' motivation relate to peer-moderated online interactions?	Xie, K.; Ke, F.	Scopus	Education	Learning technologies
Exploring How Student Teachers' Motivation Change in Free Teacher Education Program	Xiong, S.	ACM	Education	Teaching
Research on the Motivation and Improvement Countermeasures of Students' Learning Initiative Based on Factor Analysis	Xiuli, W.	ACM	Education	Business
Effects of feedback visualisation of peer-assessment on pre-service teachers' data literacy, learning motivation, and cognitive load.	Xu, L.; Zou, X.; Hou, Y.	PsychINFO	Education	Information literacy
How Teaching Presence Facilitate Rural Teachers' Learning Engagement in MOOC for Teacher Education: The Mediating Effect of Learning Motivation	Xu, R.; Sun, Z.; Zhao, M.; Fu, M.	ACM	Education	Teaching
Characteristics and development trend of learning motivation in international blended learning environment -- visual analysis based on web of science literature from 2011 to 2021	Xuexue, G.; Zhu, N.; Zeng, Y.; Dong, Y.; Ge, W.; Liu, S.	ACM	Education	Learning technologies
An Educational Digital Game Driven Strategy to Support the Teaching-Learning of Algorithms and Motivate Female Information Systems Students	Yamashita, V. T.; Nunes, E.; Lauschner, L.; Campos,L.; Brugiolo GonçAlves, L.; Valle, P.H.D.; De Melo Quintela, B.; De Oliveira, A. M.	ACM	Education	Computer Science

Magic Brush: An AI-based Service for Dementia Prevention focused on Intrinsic Motivation	**Yang, M.; Lee, K.; Kim, E.; Song, Y.; Lee, S.; Kang, J.; et al.**	**Scopus**	**Medical**	**Dementia**
The Gamer Motivation Profile: What We Learned From 250,000 Gamers	Yee, N.	ACM	Computer Science	Gaming
Digital Game-Based Learning for Improving Students' Academic Achievement, Learning Motivation, and Willingness to Communicate in an English Course	Yeh, Y.-T.; Hung, H.-T.; Hsu, Y.-J.	Scopus	Education	English as Second Language
The Impact of Gamification Depth on Higher Educational Students' Intrinsic Motivation and Performance Levels	Yie, D.L., Sanmugam, M., Yahaya, W.A.J.W., Khlaif, Z.N.	Scopus	Education	General
Understanding the relationship between digital game addiction, academic motivation, classroom engagement and selfishness. [References].	Yilmaz, F. G. K.; Yilmaz, R.	PsychINFO	Education	Secondary education
Using games to increase exercise motivation	Yim, J.; Graham, T. C. N.	Grey lit	Computer Science	Applied computing
Intrinsic-Motivated Sensor Management: Exploring with Physical Surprise	Yuan, J.; Weng, Y.; Blasch, E.	ACM	Computer Science	Machine learning
Influence of Content Layout and Motivation on Users' Herd Behavior in Social Discovery	Yue, Y.; Ma, X.; Jiang, Z.	ACM	Psychology	Behaviours
Strengthening Motivation in the Mathematical Engineering Teaching Processes – A Proposal from Gamification and Game-Based Learning	Zabala-Vargas, S.; García-Mora, L.; Arciniegas-Hernández, E.; Reina-Medrano, J.; de Benito-Crosetti, B.; Darder-Mésquida, A.	Scopus	Education	Engineering
Motivation increase of mathematics students in Engineering-A proposal from Game Based Learning	Zabala-Vargas, S.A.; Garcia-Mora, L.H.; Ardila-Segovia, D.A.; De Benito-Crosetti, B.L.	Scopus	Education	Mathematics
Development of Computational Thinking: Student Motivation Using Ozobot	Žáček, M.; Smolka, P.	Scopus	Education	Learning technologies

A usability evaluation method for e-learning: focus on motivation to learn	Zaharias, P.	ACM	Education	Teaching
Kahoot it or not?: Can games be motivating in learning grammar?	Zarzycka-Piskorz, E.	Scopus	Education	English as Second Language
An exploration of gendered differences in cognitive, motivational and emotional aspects of game-based math learning.	Zhang, L.; Lei, Y.; Pelton, T.; Pelton, L. F. ; Shang, J.	PsychINFO	Education	STEM
HoliCoW: automatically breaking team-based software projects to motivate student testing	Zhang, P.; White, J.; Schmidt, D. C.	ACM	Education	Computer Science
Self-regulated digital game-based vocabulary learning: motivation, application of self-regulated learning strategies, EFL vocabulary knowledge development, and their interplay	Zhang, R.; Zou, D.; Cheng, G.	Scopus	Education	EFL
Self-regulated digital game-based vocabulary learning: Motivation, application of self-regulated learning strategies, efl vocabulary knowledge development, and their interplay.	Zhang, R.; Zou, D.; Cheng, G.	PsychINFO	Education	EFL
Making the Most Cost-effective Decision in Online Paid Q&A Community: An Expert Recommender System with Motivation Modeling and Knowledge Pricing	Zheng, Y.; Zhang, X.; Xiao, Y.	ACM	Business	e-Commerce
M-CAFE 1.0: Motivating and Prioritizing Ongoing Student Feedback During MOOCs and Large on-Campus Courses using Collaborative Filtering	Zhou, M.; Cliff, A.; Krishnan, S.; Nonnecke, B.; Crittenden, C.; Uchino, K.; et al.	ACM	Education	Higher Education
Impact of Gamification on Student Motivation and Success - Insights Gained from Freshman and Junior Level Technical Courses	Zhu, H.; Baumann, A.	Scopus	Education	Design & Technology
Digital game-based learning of information literacy: Effects of gameplay modes on university students' learning performance, motivation, self-efficacy and flow experiences	Zou, D.; Zhang, R.; Xie, H.; Wang, F.L.	Scopus	Education	Information literacy

Appendix F: Consent form for quantitative arm of study

Please note that immediately preceding these questions was the information sheet (Appendix E).





















Appendix G: Pre- and post-module survey

1: Pre-module Survey

[Page 1: introduction]

Dear student

Thank you for agreeing to take part in this study investigating the effects of gamification on medical student motivation. Before commencing the otolaryngology medical module, please complete the questions below.

Dr Catherine Burr

[Page 2: Demographics]

Please enter your name: [open [redacted] text field]

Please enter your email address: [open text field]

Please answer the following demographic questions. These answers will be treated anonymously.

What university do you attend? [University of Oxford or University of Manchester]

What year are you in? [Options: Year 4 graduate at Oxford, Year 5 undergrad at Oxford, or Year 4 Manchester]

Are you male, female, transgender or non-binary? [multiple choice, also include 'Prefer not to say']

What age are you? [open field, also include 'Prefer not to say']

[Page 3: Motivation]

Below are some questions regarding your motivations for taking this module. Answer each question truthfully. All answers are anonymous.

Using the scale below, please circle the number that best describe the reason why you are taking this module.

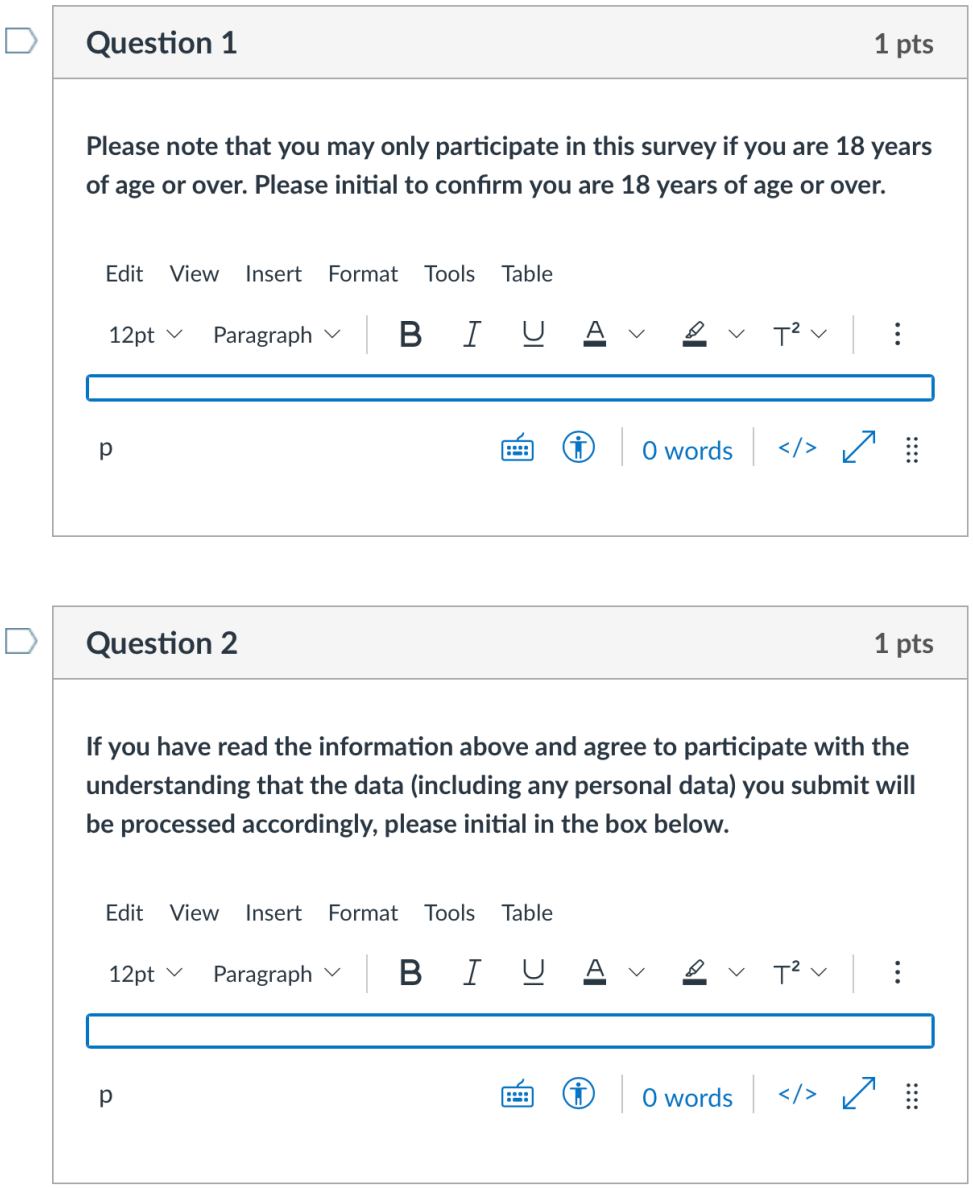
If you have a concern about any aspect of this research, please speak to [redacted] (catherine.burr@gtc.ox.ac.uk) or their supervisor Dr Jeremy Knox (jeremy.knox@education.ox.ac.uk), and we will do our best to answer your query. We will acknowledge your concern within 10 working days and give you an indication of how it will be dealt with. If you remain unhappy or wish to make a formal complaint, please contact the Chair of the Research Ethics Committee at the University of Oxford who will seek to resolve the matter as soon as possible

Education Departmental Research Ethics Committee; Email: student.curec@education.ox.ac.uk; Address: Department of Education, University of Oxford, 15 Norham Gardens, Oxford, OX2 6PY

Corresponds not at all	Corresponds very little	Corresponds a little	Corresponds moderately	Corresponds enough	Corresponds a lot	Corresponds exactly
1	2	3	4	5	6	7

1. Because I enjoy learning about otolaryngology.

2. Because I am doing it for my own good.

3. 

   Because I am supposed to do it.

4. There may be good reasons to do this activity, but personally I don't see any.

5. Because I think that this activity will be pleasant .

6. Because I think that this activity will be good for me.

7. Because it is something I have to do.

8. I will do this activity but I am not sure if it is worth it

9. Because this activity will be fun

10. By personal decision

11. Because I don't have any choice

12. I don't know; I don't see what this activity will bring me

13. Because I feel good when doing this type of activity

14. Because I believe that this activity will be important for me

15. Because I feel that I have to do it

16. I do this activity, but I am not sure it is a good thing to pursue it

[Codification key: Intrinsic motivation: Items 1, 5, 9, 13; Identified regulation: Items 2, 6, 10, 14; External regulation: Items 3,7, 11, 15; Amotivation: Items 4, 8, 12, 16. (Guay, 2000)]

How motivated are you to do this module?

Very unmotivated	Somewhat unmotivated	Neither motivated, nor unmotivated	Somewhat motivated	Very motivated
1	2	3	4	5

[Page 4: Thank you]

Thank you for completing this survey.

2: Post-module Survey

[Page 1: introduction]

Dear student

I hope you have enjoyed the otolaryngology module. Please complete the post-module survey below.

Dr Catherine Burr

[Page 2: Motivation]

Please enter your name: [open text field]

Please enter your email address: [open text field]

[Page 3: Motivation]

Below are some questions regarding your motivations for taking this module. Answer each question truthfully. All answers are anonymous.

Using the scale below, please circle the number that best describe the reason why you took this module.

Corresponds not at all	Corresponds very little	Corresponds a little	Corresponds moderately	Corresponds enough	Corresponds a lot	Corresponds exactly
1	2	3	4	5	6	7

1. Because I enjoy learning about otolaryngology.

2. Because I did it for my own good.

3. Because I was supposed to do it.

4. There may be good reasons to do this activity, but personally I don't see any.

5. Because I thought this activity will be pleasant .

6. Because I thought that this activity will be good for me.

7. Because it is something I had to do.

8. I did this activity but I am not sure if it is worth it

9. Because this activity was be fun

10. By personal decision

11. Because I didn't have any choice

12. I don't know; I don't see what this activity will bring me

13. Because I felt good when doing this type of activity

14. Because I believed that this activity would be important for me

15. Because I felt that I had to do it

16. I did this activity, but I am not sure it was a good thing to pursue it

[Codification key: Intrinsic motivation: Items 1, 5, 9, 13; Identified regulation: Items 2, 6, 10, 14; External regulation: Items 3,7, 11, 15; Amotivation: Items 4, 8, 12, 16. (Guay, 2000)]

How motivated were you to complete this module?

Very unmotivated	Somewhat unmotivated	Neither motivated, nor unmotivated	Somewhat motivated	Very motivated
1	2	3	4	5

[Page 4: Thank you]

Thank you for completing this survey.

I would really appreciate the opportunity to hear more about your opinions of the module in an interview. The interview would last 15-20 minutes. As a token of my appreciation for the interview, you will receive a certificate for your portfolio recognising your participation in research. Please select yes or not to being included in the interview: [Yes/No]

Appendix H: Semi-structured interview consent and questions

The semi-structured interview questions were adapted from Maheu-Cadotte et al. (2023).

1. *Did you enjoy the module? (Intrinsic motivation - affect)*
2. *Do you usually enjoy teaching methods that incorporate features of games?* [Intrinsic motivation - does individual usually like gamification?]
3. *Did you complete all the gamified activities in the module? Why/why not?* [Intrinsic motivation - behaviour]

4. Did you see a difference in your motivation and enjoyment of this module, compared with other online modules which do not feature e.g. crosswords, etc? [Intrinsic motivation - affect]
5. Did you see a difference in your attention span when doing this module, compared with other online modules which do not feature e.g. crosswords, etc? [Intrinsic motivation - cognition]
6. How do you think the module could have been improved? [Was the gamification module well designed? Could ask specifically about game mechanics, narrative and aesthetics]
7. Did you miss working directly with others? [Relatedness - needs satisfaction for intrinsic motivation, game mechanics]
8. If any specific questions (1-2) related to survey response, ask here.
9. Is there anything else you would like to add that we haven't already covered?

Appendix I: Participant information for semi-structured interviews

Department of Education
15 Norham Gardens, Oxford, OX2 6PY
[redacted]
University telephone: +44 (0) 1865 274024
University email: [redacted]

Primary researcher: [redacted]
MSc in Medical Education student
University telephone: +44 (0) 1865 274024
University email: [redacted]

How does gamification impact medical students 'academic motivation towards otolaryngology, and what demographics influence this: a mixed methods study.

PARTICIPANT INFORMATION SHEET: INTERVIEW

Central University Research Ethics Committee Approval Reference: **EDUC_C1A_23_343**

1. Introductory paragraph

You are being invited to take part in a research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part.

2. Why is this research being conducted?

Gamification, the use of gaming elements in non-gaming contexts, is being increasingly used in teaching. However, there are concerns that gamification reduces students' enjoyment of learning, and may impact on their motivation to learn in the long-term. The effect of gamification on student motivation may be dependent on the subject and student demographics, such as age and gender. This study aims to investigate how gamification impacts medical students' motivation to learn otolaryngology, compared with self-directed learning, and how student demographics may influence this.

3. Why have I been invited to take part?

You have been invited to take part as a medical student enrolled at the University of Oxford or the University of Manchester, who is learning about otolaryngology in their current academic year, and who has opted in to be interviewed.

4. Do I have to take part?

No. It is up to you to decide whether to take part. You can withdraw yourself from the research, without giving a reason and without negative consequences, by advising me of this decision. Up to the point when the data has been anonymised, you can withdraw from the study any personal information you have provided by sending an email stating your request to [redacted] until 1st September 2024. After this date, it will not be possible to withdraw your data.

5. What will happen to me if I take part in the research?

Prior to the interview, you will be sent the questions I will ask you in the interview. If you have any questions at this point, either about the information in this document or the interview questions, feel free to discuss this with me prior to the interview.

The interview will take place on Microsoft Teams. At the start of the interview, I will ask for your consent to carry out the interview. This will be video recorded, but with your camera off.

During the interview, I will ask how you found the module and some questions about your motivation. The interview should last approximately 20 minutes. I would like to record our Microsoft Teams interview to keep an accurate record of our conversation. Interviews will be video recorded for the purposes of transcription only. The interview will be transcribed manually as much as possible, but transcription using approved and safe third party software may be used if time is restricted.

At any point during the interview, if you would like to take a break or have changed your mind about participating, please let me know so that we can pause or end the interview as necessary.

6. What are the possible disadvantages and risks in taking part?

This research will involve being interviewed on Microsoft Teams, if you volunteer to do so. Although every reasonable effort has been taken, confidentiality during actual internet communication procedures cannot be guaranteed.

Interviews will be limited to a maximum of 30 minutes. However, you may finish the interview and feel it was a waste of your time.

7. Are there any benefits in taking part?

Those who take part in the interviews will gain an insight into qualitative research methods, which may be a beneficial experience for you in future if you decide to do medical education research. As recognition of your participation in research, you will be provided with a certificate for your medical portfolio.

8. Expenses and payments

Students participating in the interview will receive a £25 Amazon gift voucher and a portfolio certificate recognizing their contribution to research.

9. What information will be collected and why is the collection of this information relevant for achieving the research objectives?

Your spoken consent will be video recorded and stored, as this is auditable and provides evidence that the research was carried out ethically.

A video recording will also be made of the interview to allow me to transcribe our conversation. It will be deleted once the interview is transcribed. The interview will give me the opportunity to ask you about your motivation in more detail.

Identifiable data will be encrypted and stored on a personal laptop and Nexus 365 OneDrive for Business, an online storage platform that complies with the University of Oxford's security requirements. Identifiable data will be stored until 1st September 2024. Unidentifiable research data will be stored for at least 3 years after publication or public release of the work of the research to allow me to answer queries from other researchers. The researcher and supervisor will have access to the research data. IP data will not be collected.

10. Will the research be published? Could I be identified from any publications or other research outputs?

The findings from the research will be written up in a thesis, presented at a local and national conference, and submitted for academic publication. A copy of my thesis/ dissertation will be deposited both in print and online in the Oxford University Research Archive where it will be publicly available to facilitate its use in future research.

All data will be anonymised, and so your data will not be identifiable. I would like your permission to use direct quotations in any research outputs, but you will not be identifiable from these quotes.

11. Data Protection

The University of Oxford is the data controller with respect to your personal data, and as such will determine how your personal data is used in the research. The University will process your personal data for the purpose of the research outlined above. Research is a task that is performed in the public interest. Further information about your rights with respect to your personal data is available from the University's Information Compliance web site at https://compliance.admin.ox.ac.uk/individual-rights.

12. Who has reviewed this research?

This research has received ethics approval from a subcommittee of the University of Oxford Central University Research Ethics Committee. (Ethics reference: EDUC_C1A_23_343**)**.

13. Who do I contact if I have a concern about the research or I wish to complain?

If you have a concern about any aspect of this research, please contact [redacted] and we will do our best to answer your query. I will acknowledge your concern within 10 working days and give you an indication of how it will be dealt with. If you remain unhappy or wish to make a formal complaint, please contact the Chair of the Research Ethics Committee at the University of Oxford who will seek to resolve the matter as soon as possible:

Education Departmental Research Ethics Committee; Email: student.curec@education.ox.ac.uk; Address: Department of Education, University of Oxford, 15 Norham Gardens, Oxford, OX2 6PY

Further Information and Contact Details

If you would like to discuss the research with someone beforehand (or if you have questions afterwards), please contact:

[redacted]
Department of Education
15 Norham Gardens, Oxford, OX2 6PY

University telephone: +44 (0) 1865 274024
University email: [redacted]

Appendix J: Oral consent for semi-structured interviews

Introduction

I would like to thank you for agreeing to participate in this interview. This should not last more than 20 minutes.

Before we begin, I would like to remind you that the interview will be video recorded so that we can write out what you have said, and refer to this in the results of the study. I would also like to record your consent that the interview can proceed.

Consent

Please can you state your name and the date. [participant's response]

The aim of this study is to investigate the impact of gamification on medical students' academic motivation, compared with traditional self-directed learning, when learning about otolaryngology. This study also aims to explore the demographics that may impact on students' academic motivation when learning through gamification.

Are you aware that your participation is voluntary, and you can withdraw at any point until 01/09/2024? [Yes/No]

Are you aware who will have access to personal data provided, how the data will be stored and what will happen to the data at the end of the project? [Yes / No]

Do you consent to the interview being recorded? [Yes / No]

Do you agree to being quoted in a way which would not identify you? (Yes/No):

Do you have any further questions? [Yes - if so, answer questions/No]

Do you agree to take part? (Yes / No):

Today I would like to talking about your experience of the gamified otolaryngology module. I have some questions already prepared to guide our discussions, which I sent to you prior to this interview. Please express your thoughts about the module and how it affected you freely, as I would like your honest answers. However, please let me know if there is a question you would rather not answer or if you would like to end the interview early. In addition, if you decide after the interview that you no longer want to take part, please let me know and I will withdraw your responses if it is still possible to do so. Do you have any other questions? If not, we will proceed with the interview and I will start the recording.

Appendix K: University of Oxford's Central University research Ethics Committee Ethical Approval

SOCIAL SCIENCES & HUMANITIES
INTERDIVISIONAL RESEARCH ETHICS COMMITTEE
DEPARTMENTAL RESEARCH ETHICS COMMITTEE

Department of Education
15 Norham Gardens, Oxford OX2 6PY
student.curec@education.ox.ac.uk; staff.curec@education.ox.ac.uk

[redacted]
Department of Education, Social Sciences Division
University of Oxford

5 December 2023

Dear [redacted]

Research ethics approval

Research title: How does gamification impact medical students' academic motivation towards otolaryngology, and what demographics influence this? A mixed methods study.

Research ethics reference: EDUC_C1A_23_343

The above application has been considered on behalf of the Education Departmental Research Ethics Committee (DREC) in accordance with the University's procedures for ethical approval of all research involving human participants.

I am pleased to confirm that, on the basis of the information provided to the DREC, ethics approval has now been granted for this study.

Please note the following:

Personal data: It is the responsibility of the PI to ensure that all personal data collected during the project is managed in accordance with the University's guidance and legal requirements.

In-person activities: Any data collection involving in-person interactions with participants must have an up-to-date fieldwork risk assessment in place; further guidance is available from the Safety Office's website.

Amendments: Please notify the committee if you intend to make any amendments to the information in your ethics application as submitted at date of this approval, as all changes must receive ethical approval prior to implementation. The amendment form is available on the SSH IDREC webpage.

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to staff.curec@education.ox.ac.uk / student.curec@education.ox.ac.uk or ethics@socsci.ox.ac.uk.

Yours sincerely,

DREC Dr Jenny A. Wynn

cc: [redacted]