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Gamification for student engagement: a framework

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ABSTRACT

Gamification, the application of game elements to non-game situations, has gained traction in education as a mechanism for improving motivation and/or learning outcomes. Although it is widely accepted that gamification enhances these aspects of engagement in business and education settings, there is equivocal supporting evidence. Research has emphasised behavioural responses to gamification, although there is some evidence that gamification can support deeper cognitive and affective aspects. It continues to remain unclear how gamification influences student engagement and leads to learning, a significant gap in the literature to date. In this conceptual article, we fill the gap between practice and theory through the synthesis of student engagement and gamification literature into a new Gamification for Student Engagement Framework. The provisional Framework should, for the first time, enable practitioners to systematically design gamified learning experiences, through the purposeful selection of game attributes according to the desired student experience, and consequence of, engagement. Although we focus on learning outcomes, the Framework has the potential to improve others such as student satisfaction and wellbeing across many settings and disciplines. It can also be used to gather much needed empirical evidence about the effectiveness of the approach on desired outcomes.

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1. Introduction

Ensuring student satisfaction and positive outcomes through 'student engagement' has become a political and economic priority in the modern Higher Education (HE) environment in the United Kingdom (UK) and elsewhere (Department for Business 2016). This term is currently applied loosely throughout the sector and is measured through a number of surrogates that have powerful consequences for institutional success (Kahu 2013; Sinatra, Heddy, and Lombardi 2015). For example, the National Student Survey, which measures student *satisfaction*, feeds into league tables and the Teaching Excellence Framework which have knock-on consequences for funding and student recruitment (Kelly, Fair, and Evans 2017). Supporting student engagement in the UK HE context is therefore of paramount importance to education providers. In addition, there are also important benefits to the student that are implicit in placing the emphasis on 'engagement' in a student-centred approach to education (Tangney 2014).

Gamification as an instructional approach to increase learner motivation and engagement is still developing. Research has mostly been focused on the perceived link between increased motivation, time & effort 'on task' and achievement (Dichev and Dicheva 2017; Linehan et al. 2011). However, there is some evidence to suggest that if gamification were extended to incorporate other experiences and outcomes of student engagement, the method could be transformed into

a powerful tool to foster student engagement for learning, achievement and wellbeing, as well as satisfaction in the current HE context (Bell 2014; Kim et al. 2018b). Indeed, effective educators have been using instructional strategies that resemble gamification for many years to support aspects of student engagement for the purpose of learning, for example using elements such as challenge, rules and goals (Rieber 1996). Therefore, gamification is something that has existed and that teachers have been employing for some time. Although the term has come into use fairly recently, the theory relating to gamification provides a helpful framework to support learning design (Broer 2015; Kim et al. 2018a; Stott and Neustaedter 2013).

As part of the design phase for a study aimed at evaluating the impact of gamification on student engagement in Higher Education, we sought a theoretical framework on which to base this research. Landers' Theory of Gamified Learning is the best available (Landers 2014). It aligns research on serious games and gamification through the shared feature of game attributes and presents a psychological theory of gamified learning, albeit with a focus on behaviour change. This theory is limited in that it does not take into account social, cognitive and affective facets of student engagement as relevant to Higher Education or the wider consequences of engagement such as satisfaction or wellbeing (Kahu 2013). Therefore, no comprehensive model currently exists. In this paper, we systematically demonstrate links between Landers' Theory of Gamified Learning and Kahu's Student Engagement Framework, through the shared lens of social cognitive psychology (Kahu 2013; Landers 2014). This approach is supported by the work of Dichev & Dicheva and Alsawaier who reported engagement outcomes of gamification in the context of social psychology theory (Alsawaier 2018; Dichev and Dicheva 2017). We go on to facilitate its application in the Higher Education context through re-framing the training outcomes underpinning Landers' work as learning outcomes using the three domains of learning common to both approaches (Bedwell et al. 2012; Kraiger, Ford, and Salas 1993; Krathwohl 2002). The resulting Gamification for Student Engagement Framework allows the practitioner to systematically apply game attribute(s) to a learning experience to implement gamification for purposeful impact on student engagement outcomes in HE. This will facilitate future research into causal relationships between game attributes, student experiences of engagement, and learning, achievement, wellbeing, and satisfaction outcomes to validate and systematise gamification approaches, and thereby extend the potential of gamification beyond behaviour change for learning into a tool to support student engagement for a wide variety of outcomes.

2. Background

2.1. Gamification

Gamification is different from game-based learning and serious games as it employs some elements of games without turning the learning process into a fully fledged game. The term 'gamification' entered the mainstream in around 2010 and there are a number of different definitions of gamification currently in circulation (Alsawaier 2018; Deterding et al. 2011). We adopt a simplified version of Landers' definition of gamification for the purposes of this study: 'the use of game attributes. outside the context of a game with the purpose of affecting learning.' (Bedwell et al. 2012; Landers 2014). Note that this definition does not stipulate which game attributes must be present in order to constitute gamification and can be extended to allow for more nuanced and powerful application of gamification than the dichotomy between traditional instruction/learning outcomes/grades, and gamification/effort/badges & points pictured by Alsawaier (2018).

Research on the impact of gamification and games on learning is limited to date by a focus on motivation, which is only one small facet of student engagement (Kahu 2013). Indeed, one of the aims of Dichev and Dicheva's systematic review of the literature was to identify 'what empirical evidence exists for the impact of gamification on motivational processes and effectiveness of learning' (Dichev and Dicheva 2017). They found equivocal evidence: 26% empirical papers report

a positive effect of gamification, although nearly two thirds of studies are inconclusive, and 10% report negative outcomes (Dichev and Dicheva 2017). Many gamification studies also focus on behavioural outcomes, possibly because of the historic use of gamification in marketing and as a device to explicitly manipulate behaviour change e.g. for fitness (Cotton and Patel 2019; Zichermann and Linder 2010). These outcomes are also the easiest to measure and do not require an understanding of complex pedagogy theory (e.g. time on task or assessment attainment: Barata et al. 2013b). These somewhat surface measures of behaviour are not good predictors of student engagement and give limited insight into the multifaceted and context dependent nature of the student experience which amounts to more than motivation (Handelsman et al. 2005; Kahu 2013). A further limitation is the small number of game attributes such as points, badges and leader-boards that are commonly studied, probably for similar reasons. This gives the impression of a somewhat instrumental or behavioural approach.

However, there is evidence that games and gamification can positively influence other aspects of the student experience such as the level of interest, intellectual intensity and intrinsic motivation through providing opportunities for autonomy, relatedness and competence (Barata et al. 2013a; Collier and Shernoff 2009). In an influential study, Wilson et al. gathered research supporting the notion that certain game attributes support certain learning outcomes (Wilson et al. 2009). They showed that in combination, several attributes such as 'challenge/surprise' (difficulty and uncertainty) and 'rules/goals' (to enable performance control) have a positive influence on knowledge application, cognitive strategies, declarative knowledge and knowledge organisation that may relate to deep learning (e.g. Driskell and Dwyer 1984; Rieber 1996). This shows that it is possible that gamification has more far reaching consequences than those commonly measured.

Studies exploring the effectiveness of gamification commonly conflate it with game-based learning and serious games (Caponetto, Earp, and Ott 2014). Indeed, the vast majority (78%) of empirical studies included in a systematic review by Dichev and Dicheva (2017) use more than one game attribute. However, evidence is still lacking on the impact of individual game attributes on student outcomes. As we seek to understand links between specific game attributes, student engagement, and social and academic outcomes such as learning, the application of multiple game attributes to a learning experience in these studies makes interpretation of the findings difficult. Without more systematic application and evaluation of the effect of game attributes on student experience, we will not understand how to use gamification purposefully. Questions such as 'which one/combination of game attributes improved self-regulation?' and 'what constitutes high-quality gamification in design, execution and outcome, and how would we know?' will remain unanswered (Landers 2014; Muntean 2011). Our framework is the first step towards answering these questions and is intended to support the gathering of evidence that will enable practitioners to apply and evaluate gamification in a more systematic and scientific way for the benefit of student experience and outcomes.

Landers' Theory of Gamified Learning provides a framework that can be used to describe scenarios where gamification is employed to support learning, otherwise known as gamified learning (Landers 2014). This theory furthers the work of Wilson et al. (2009), who demonstrate links between specific game attributes and the pedagogic theoretical concept of training outcomes, by putting forward the proposition that game attributes directly affect a student's behaviour or attitude, which affect how a student interacts with instructional content and achieves learning outcomes (Figure 1). i.e. that the effect on outcomes is secondary to the impact of these game attributes on student behaviour and attitude (Bedwell et al. 2012; Landers 2014; Wilson et al. 2009). This view is supported by others who relate the effects of gamification to behaviour change (e.g. see Folmar 2015; González et al. 2016; Skinner 1984). Note that these behaviours and attitudes have a functional role in affecting learning but are not learning itself. Therefore, the aim of gamification is not to provide instructional content, as in serious games, but to modify the learner's state in order to improve pre-existing instruction. This mediation model is not a new idea, but does help us to reconcile gamification theories like Landers' with those of learning and engagement (e.g. Kahu 2013; Pekrun 2006). The five propositions that accompany Landers' framework do not, however, define 'behaviour and attitudes' according to any pedagogic theory and are in fact

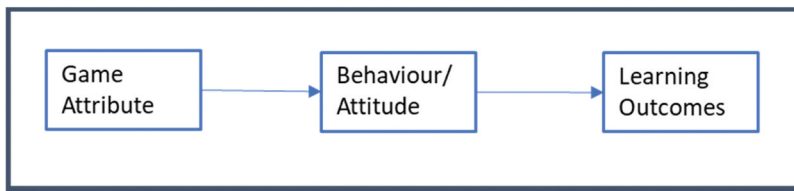


Figure 1. After Landers (2014). Gamified learning supports the achievement of learning outcomes through behaviour change facilitated by game attribute(s) employed in gamification.

a limited view of the state of engagement as described by others e.g. Kahu (2013, 2015). As a result, it cannot describe what game attributes effect which states of engagement, only that they are the primary target of game attributes. This aspect of the framework's design limits its practical use: by itself, it cannot be used by a practitioner to determine how to transform non-gamified learning into gamified learning. Landers proposed that this is the next major hurdle in gamification research, which we aim to overcome here.

2.2. Student engagement

Engagement, though not as new a concept as gamification, is still the subject of much debate. Student engagement has been extensively studied, with parsimony representing a real challenge due to the wealth of theoretical constructs (Cole et al. 2011). These interpretations have proliferated as limited aspects of student engagement have become increasingly vital to modern outcome measures of HE (Kelly, Fair, and Evans 2017; Sinatra, Heddy, and Lombardi 2015).

Landers proposed that gamification works by influencing behaviours and attitudes that moderate or mediate learning (Figure 1; Landers 2014). In order to understand how to use gamification to affect these behaviours and attitudes, and how this supports learning, we need to understand the behaviours and attitudes in question. We focus on student engagement, and Landers uses an example that describes student engagement as a target attitude (conflated with fun) modifiable by gamification that has the potential to moderate the relationship between instructional content and learning outcomes (Landers 2014). We undertook a survey of the literature to find research that discusses student engagement in terms of psychological influences on learning that would therefore fit with Landers' work. The most parsimonious framework describing student engagement available is that of Kahu (Kahu 2013). Here, multiple instances in engagement research are identified where the state of engagement is conflated with the cause or effects of engagement e.g. motivation or learning. Each approach to engagement is examined, resolving these conflations, and certain aspects of each approach begin to fall away. It is then possible to explain how what remains fits together. This is because much of the more substantial remnants of each approach cover different parts of the student experience. Two of the approaches examined are psychological and behavioural, and give routes to alignment with Landers' theory.

In the HE context, attempts are regularly made to measure student engagement by framing it as student behaviour change elicited by effective teaching practice (Coates 2010; Kelly, Fair, and Evans 2017). This is the behavioural perspective, the first to be considered as part of Kahu's framework (Kahu 2013). There are helpful parallels between Landers' proposition that student engagement is a target attitude that can be modified by gamification and the behavioural perspective that positions student engagement as modifiable by effective teaching practice that gives the approach utility in our context. Unfortunately, this definition of student engagement is limited to student behaviour (ignoring, for example, affect, which is also important) and also fails to take on board the dynamic and situational complexity of student engagement by focussing solely on what HE institutions can control (Kahu 2013). Furthermore, factors affecting engagement and the state of engagement are

also difficult to disentangle through this perspective. These criticisms are also limitations that can be levelled at Landers' theory (Landers 2014).

Fortunately, the psychological view of engagement also incorporates a behavioural dimension and is the second approach scrutinised by Kahu (Fredricks, Blumenfeld, and Paris 2004; Kahu 2013). It is helpful in that it separates the antecedents of engagement from the state itself, allowing for a purposeful exploration of the relationships between the two. This perspective of engagement focuses on the internal psycho-social process and incorporates behaviour, cognition, affect, and sometimes conation, some aspects of which are incorporated into the behavioural view of engagement described above. These dimensions are shared with popular models of attitude (Jain 2014), and include behaviour, making it possible to map the psychological elements of engagement onto Landers' gamification framework. Ultimately, this allows us to use Kahu's comprehensive engagement framework as a tool to link the concepts of gamification and engagement and potentially extend the understanding of how gamification works as proposed by Landers to incorporate other aspects of the experience of engagement such as cognition and affect, and outcomes of engagement such as student wellbeing or satisfaction (Figure 2.; Kahu 2013; Landers 2014).

Kahu goes on to evaluate two further overlapping but distinct perspectives on student engagement: the socio-cultural context, and attempts at a more holistic view. The psychological approach to engagement is used as a basis to establish engagement as a variable state, whereupon all other aspects of engagement become either the causes (antecedents/influences) or the results of engagement (outcomes/consequences), synthesised into one overarching framework that incorporates all the elements (Figure 2; Kahu 2013). For example, the holistic approach contributes a sense of belonging to the state of engagement. As such, motivation is moved from engagement and placed under antecedents. Given the focus of gamification literature on motivation, it is helpful to note that motivation is one facet of the cognitive dimension of engagement that also includes self-regulation and self-efficacy amongst others (Jimerson, Campos, and Greif 2003; Payne 2019). Therefore, motivation and engagement are not the same, the one being a small part of the other, and the literature describing the effect of gamification on participant motivation should be viewed with this in mind. This is another instance where Kahu's view of engagement extends Landers' theory and broadens its potential application and impact.

Kahu's framework contains three concepts which serve as points of connection to the theory of gamification, as well as potentially expanding it. The first two are *curriculum and assessment* which are found in the structural influences of engagement, and *learning*, a proximal consequence of engagement (Figure 2). Third, and more importantly, Landers' reference to engagement as an attitude fits with Kahu's reconciliation of approaches that suggests student engagement is a complex variable state comprising affect, cognition and behaviour: components of the widely accepted models of attitude in social psychology (Jain 2014). It is important to note

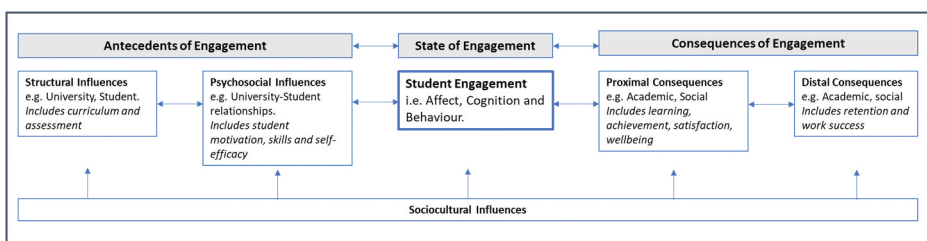


Figure 2. After Kahu (2013). Student engagement can be conceptualised as psychological state, influenced by a number of antecedents from curriculum design to motivation and the wider sociocultural context. Application of Landers' theory leads us to suppose that gamification may be applied to antecedents of engagement such as curriculum design through the employment of game attributes that modify the state of engagement (Landers 2014). The consequences of engagement are the intended benefits of gamification such as improved achievement or satisfaction.

that of the two theories being brought together here, it is Kahu's that is by far the most developed and sophisticated which extends our thinking about gamification. This model of engagement incorporates wide-ranging socio-cultural influences as the context for the student experience at the centre. It also articulates the structural and psychosocial influences of the university and student on the experience of the student as the state of engagement (Kahu 2013). It is possible to map the antecedents of engagement onto categories of game attributes, the most obvious of which are assessment and curriculum, though it is not difficult to see how more sophisticated categories of game attributes such as conflict/challenge and environment may map onto the sociocultural context of student engagement (Bedwell et al. 2012). This gives us the opportunity to extend the exploration of how and why gamification works by incorporating the notion of game attributes as tools that modify the sociocultural, structural and psychosocial influences on student engagement.

The state of engagement described by Kahu is not the simplistic behaviour change of Landers' Theory of Gamified Learning. Rather it incorporates all elements of the student experience across the affective, cognitive and behavioural domains, with the potential to extend our understanding of what affect gamification has on the experiences of the learner e.g. on self-regulation. The consequences of engagement in Kahu's model also extend far beyond the achievement of learning outcomes that are the focus of Landers' Theory. This opens up further possibilities for gamification which could improve other consequences for the student such as deep learning and social consequences such as satisfaction and wellbeing. This makes Landers' theory potentially more functional by (1) clarifying the target of game attributes as antecedents of student engagement, (2) providing links to existing research that would enable practitioners to evaluate the student's experience of gamification, and (3) make theoretically informed decisions about instructional design to enable the achievement of learning outcomes, and indeed other engagement outcomes such as student wellbeing and satisfaction. This paper, however, will concentrate on learning outcomes.

2.3. Gamification aligned to learning or training outcomes as a measure of student engagement

The achievement of learning outcomes is a measurable way of determining whether there are academic consequences of better student engagement. This is potentially the most relevant measure for practitioners, given the focus on assessment in many university classrooms. Therefore, in order to build a gamification for engagement framework that not only aligns desired engagement states with relevant game attributes, but allows us to measure the consequences, we must take into account how this fits together with learning outcomes, a view supported by others (Landers and Armstrong 2017).

Carrying on the work of Wilson et al. (2009), Bedwell's taxonomy defines 19 game attributes organised into 9 categories mapped against training outcomes (Bedwell et al. 2012). They provide evidence of scope across all game attribute categories to cover all three domains of learning (cognitive, affective and psychomotor; Table 1; Bedwell et al. 2012; Krathwohl 2002). The explicit use of Bloom's taxonomy, commonly used in HE in the UK, facilitates the application of Bedwell's taxonomy in this setting, and provides a point of connection to Kahu's student engagement framework through the cognitive and affective domains (Table 1; Krathwohl 2002). In the Theory of Gamified Learning, Landers reframes Bedwell's taxonomy, positioning game attributes as modifiers of learning outcomes, influencing learning-related behaviours and attitude (Landers 2014). It is important here to remember that although correlated, evidence that certain attributes will support student experience in particular ways to achieve certain outcomes is lacking (Bedwell et al. 2012; Dichev and Dicheva 2017). Research on the effects of individual game attributes on learning outcomes is required, facilitated by our framework. This will provide evidence for determining what exactly makes gamification appropriate for learning.

Table 1. After Table 4 (Bedwell et al. 2012). Map of Bloom's Taxonomy of Educational Objectives (Bloom 1956; Krathwohl 2002) against Bedwell's Taxonomy of Game Attributes. +, ++, +++ denote increasing evidence of link between game attribute and learning/training outcome examined by Bedwell et al. (2012). *, ** denote increasing evidence of link where only one game attribute was studied. *Italics*: cognitive domain, **bold**: affective domain, underlined: cognitive and affective domain, no formatting: psychomotor domain (Bloom 1956; Krathwohl 2002).

Bloom's Level	Level 1/2 <i>Remembering/</i> <i>Understanding</i>	Level 3 <i>Application</i>	Level 4 <i>Analysis,</i> <i>Organisation</i>	Level 5/6 <i>Synthesis/</i> <i>Evaluation</i>	Level 3 <i>Valuing</i>	Motivation	Level 1/2 <i>Receiving/</i> <i>Responding</i>	Psychomotor
Assessment	++		+			++	+	++
Conflict/Challenge	++	+	+		+	+	+	++
Control	++	+		+		++		++
Game Fiction	**				+	+		++
Human Interaction		+	+			*		+
Immersion	++	+			+	+	+	++
Action Language		+						
Rules/Goals		+				++		+
Environment	+	+		+		+		

3. Results: gamification for student engagement framework

We have demonstrated systematic links between the behaviours and attitudes moderated by gamification in Landers' Theory of Gamified Learning (Landers 2014) and the state of student engagement, as framed by Kahu (Kahu 2013), through the common lens of social cognitive psychology. This has resulted in a series of testable propositions:

- (1) Gamification is a process through which *student engagement states*, not solely behaviours and attitudes can be modified to support the achievement of learning outcomes (Figure 1).
- (2) The achievement of learning outcomes can be a measurable consequence of the state of student engagement which spans affective, cognitive and behavioural domains (Figure 2).

We also show through the work of Bedwell, Wilson and Bloom that game attributes can be linked to specific learning objectives in the HE setting (Bedwell et al. 2012; Wilson et al. 2009). This led to our third proposition:

- (3) It is possible to select game attributes appropriate to support the achievement of specific learning objectives categorised into the three domains of learning: cognitive, affective and psychomotor (Table 1).

Taken together (Figure 3), this leads to the fourth proposition:

- (4) It is possible to select a game attribute for employment in a gamification strategy by identifying the psychological domain shared between the learning outcome/educational objective and the desired, modifying the student experience of engagement (Figure 3).

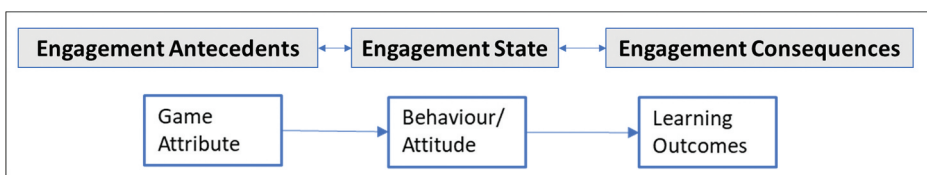


Figure 3. The Gamification for Engagement Framework takes Kahu's student engagement framework (top line, Kahu 2013) and applies it to Landers' Theory of Gamified Learning (bottom line, Landers 2014). In this way it is possible to systematically identify the appropriate game attribute from Bedwell's list as modified in Table 1 (Bedwell et al. 2012) to apply to the antecedents of engagement e.g. curriculum (Kahu 2013) in order to affect the engagement state of the student (Kahu 2013; Landers 2014) to achieve certain linked learning outcomes (Bedwell et al. 2012), which are a consequence of engagement (Kahu 2013).

For example, consider the following scenario: a practitioner wishes to enhance the organisation of a particular type of knowledge as a learning outcome for their course using gamification. This may be because they have feedback that implies that this is something students are finding difficult. The practitioner follows the process outlined in [Figure 3](#) by following these steps:

- (1) Review [Table 1](#). to identify an appropriate game attribute. e.g. assessment, conflict/challenge or human interaction are the best evidenced to support the learning outcome of analysis and organisation.
- (2) Identify an enabling engagement state from the same domain of learning as the learning outcome to be targeted (e.g. knowledge organisation learning outcome would be enabled by the cognitive domain, deep learning state of engagement).
- (3) Using the literature if required, consider how the relationship between that state of engagement (e.g. deep learning) and a student engagement antecedent (e.g. assessment, curriculum design or self-efficacy) could be supported by one of the game attributes within the course (e.g. human = social/interpersonal interaction).
- (4) Implement the game attribute (e.g. human interaction) into the course using a task designed to affect the antecedent (e.g. self-efficacy). This task may be based on the practitioner's knowledge and experience of the game attribute in a specific game, in which case the task may be a modified form of that game that retains the game attribute but strips out any others that are not necessary and focusses on the purpose of the task.

Hence, the Gamification for Engagement Framework allows the practitioner, with knowledge of the desired student experience of engagement and learning outcome to select appropriate game attributes for gamification of learning in the HE setting. The four testable propositions above are amenable to hypothesis testing to gather the further empirical evidence linking game attributes to student experience of engagement and learning outcomes so lacking in current literature (Dichev and Dicheva [2017](#); Landers and Armstrong [2017](#)).

4. Discussion

4.1. Implementation and evaluation of the framework

Our four propositions can be tested by empirical study to gather much needed evidence as to the effectiveness of specific game attributes in modifying experiences of student engagement and its outcomes. For example, the state of engagement as defined by Kahu incorporates measurable elements of affect, cognition and behaviour. It is therefore possible to ask research questions such as 'what is the effect of game attribute A (e.g. human interaction) on engagement state (affect/cognition/behaviour) B' (proposition 1), using pre-existing measures of student engagement (e.g. Appleton et al. [2006](#))? We can take the research question one step further and ask 'given game attribute A's (e.g. human interaction) effect on engagement element B (e.g. deep learning), what are the measurable consequences of this' ? (proposition 2) by measuring effects on academic consequences of engagement using pre-existing instruments, for example assessment of learning outcomes (e.g. Caspersen, Smeby, and Olaf Aamodt [2017](#)). Indeed, Dichev and Dicheva ([2017](#)) categorise reported outcomes of the application of certain game elements/attributes into cognitive, behavioural and affective components providing a foundation for this work (Dichev and Dicheva [2017](#)). Following on from this, further research focused on proposition 3 would ask 'does game attribute X (e.g. human interaction) support learning outcome Y' (e.g. knowledge organisation)? This is a less complex research question than that required to test proposition 2 above. The culmination of the research supported by our framework would be a test of proposition 4, which would ask 'given the desired engagement state B (e.g. deep learning) and learning outcome Y (e.g. knowledge organisation), does game attribute X = A (e.g. human interaction) positively affect these'? The results of this research

would be a helpful toolkit of game attributes applicable purposefully in any educational scenario focussed on modifying student engagement to improve learning outcomes.

4.2. *Benefits of the framework*

Dichev and Dicheva (2017) find that points, badges, levels, leader boards and progress bars are the most common game elements used in educational contexts and propose that this is because of the familiarity of practitioners with traditional assessment models, and their ease of implementation. They propose that learning tasks that can be broken down into constituent parts, or have a measurable outcome are the most amenable to gamification. These common elements form the 'assessment' game attribute category in Bedwell's taxonomy, leaving 8/9 other categories ripe for further investigation in HE (Bedwell et al. 2012; Dichev and Dicheva 2017). Indeed, examples of deeper game elements like action language, environment and human interaction are rare in the gamification and education literature. The proposed Gamification for Engagement Framework goes some way to support practitioners to make different choices and seek empirical evidence as to the effect of purposefully chosen game attributes on student engagement and its consequences, only one of which is the achievement of learning outcomes (Kahu 2013). Indeed, it would be possible to extend the evaluation of the effectiveness of a gamification intervention to consider other consequences of engagement such as student wellbeing and satisfaction (Douglas, Douglas, and Barnes 2006; Kern et al. 2015).

4.3. *Caveats of the framework*

The Gamification for Student Engagement Framework is intended to support further empirical research into gamification. It is based on the work of others that take a shared social cognitive psychology approach to learning, student engagement and gamification (Bedwell et al. 2012; Kahu 2013; Landers 2014; Wilson et al. 2009). We acknowledge that this is not the only valid approach to studying these phenomena. However, the pursuit of parsimony has necessitated this constraint and has facilitated the production of a framework with clear research applications.

In the proposed framework we clarify that gamification is applied, through game attributes, to antecedents of engagement such as curriculum, assessment, motivation, identity, teaching and self-efficacy (Kahu 2013). Further research would be required to explore this connection and would include other work that views engagement in terms of behaviour (e.g. Trowler 2010; Whitton and Moseley 2014). We extend Landers' mediation model of gamification to include all facets of the student experience of engagement imagined by Kahu, encompassing cognitive and affective domains in addition to behaviour (Kahu 2013; Landers 2014). We also extend the outcomes of gamification beyond learning/training outcomes of Landers and Bedwell to incorporate other measures of student engagement such as wellbeing and satisfaction, as described by Kahu (Bedwell et al. 2012; Kahu 2013; Landers 2014). We accept therefore that the framework currently has theoretical status until it is implemented and evaluated as outlined above.

Lacking in the framework is a clear link between educational objectives as imagined by Bloom and learning outcomes used by Landers (Bloom 1956; Krathwohl 2002; Landers 2014). However, the work of Wilson and Kraiger go some way to remedy this (Kraiger, Ford, and Salas 1993; Wilson et al. 2009). Furthermore, Bloom's taxonomy neglects the behavioural components seen in Kahu and Landers' work (Kahu 2013; Landers 2014). However, it is possible to reframe psychomotor skills as sets of behaviours which may aid further research into the application of gamification to this component (Allan 1996; Dave 1970; Harrow 1972), as laid out in Table 1.

There may be barriers to adoption of our framework by HE practitioners because of its perceived complexity or novelty. However, practitioners gamify naturally over time, the outcome of a diffuse, reflective process (Broer 2015; Stott and Neustaedter 2013). It begins with cognitive dissonance on the practitioner's part, wherein a carefully crafted, time-tested, peer-reviewed, or institutionally

verified learning design does not produce an expected quality of learning within the students. Practitioners who naturally gamify become experimental, one of the primary teaching qualities required to make gamification work (Bell 2018). At the end of this process, all changes and interventions to original lesson design (interventions which might qualify as gamification in the end), can be reflected upon by the practitioner as changes which were iterative, responding to the unique combination of their background, discipline, lesson, student demographic, etc. As a result, this journey as seen by practitioners belies the possibility that there was operating throughout that journey a series of observations, evaluations, and judgements that are not only replicable, but common, amenable to systematisation, and inherent to creative processes and techniques in the design of any experience which seeks to produce meaning or change the participant. Therefore, re-framing gamification as a natural outcome of the practitioner's reflective process may aid more widespread adoption of gamification and our framework. Our aim was to provide a structure with which to support and articulate this process in a systematic way.

We acknowledge the limitations of gamification as defined and applied in our framework, which some believe to be more than the systematic use of game attributes (Dichev and Dicheva 2017). However, we do go beyond the mere exchange of terms (e.g. assignment = quest; Dicheva et al. 2015) and simplicity is required in order to formulate meaningful research questions about the connections between game attributes, student experience of engagement (whether they be affective, cognitive or behavioural in nature) and outcomes of student engagement such as learning outcomes. There is evidence to suggest that at least some effects of gamification are dependent on the extent to which the experience resembles a game (Howard-Jones et al. 2016). Recently, Alsawaier (2018) summarised much more positive effects of gamification on engagement and motivation than Dichev and Dicheva (2017). This may be due to the comparatively narrow definition of gamification used by Dichev and Dicheva who filtered out fully fledged games, in contrast to the approach taken by Alsawaier who included studies of video game attributes and put negative results down to limited features of gamification e.g. no challenge, fun or element of choice. Thus, it seems likely that the types of game attributes, as well as how they are embedded in the learning experience, influence the outcome. For example, the effect of gamification on some aspects of engagement may to some extent depend on the playfulness and immersion achieved by game-like experiences, often called the lusory attitude, which may or may not extend to those that have been gamified (Codish and Ravid 2015; Holman, Aguilar, and Fishman 2013). Indeed, the mixed empirical evidence of the effectiveness of gamification on motivation also seems to depend on both context and the individual learner. This makes sense given the context-dependent nature of motivation as a psychological process and the multi-faceted nature of student engagement as imagined by Kahu (Broer 2014; Buckley and Doyle 2016; Domínguez et al. 2013; Hamari, Koivisto, and Sarsa 2014; Kahu 2013; Tu et al. 2015).

Finally, it is important to state that gamification has ethical limits and runs the risk of creating situations where the context of an experience is changed to the point of obscuring the true nature of a task, potentially invalidating the consent of participants (Kim and Werbach 2016). When the attributes of a game are applied to non-game contexts which are mandatory, invasive, or exploitative, then gamification ceases to be about supporting learning and becomes a tool for decreasing resistance. It is for this reason that we recommend that practitioners consider preliminary application of the framework to non-mandatory parts of a course. The moment game attributes are added in order to deceive, coerce, or mollify participants with regards to the nature of the task, gamification becomes unethical. Therefore, attempts to gamify a task should have ethical checks with regards to these concerns, and make transparent and available the ways and purpose by which a task was gamified (Kim and Werbach 2016). The application of gamification to the HE setting is, as previously described, an extension to the practitioner's reflective cycle. It is anticipated, therefore, that the quality frameworks that currently support this practice may be modified to incorporate ethical safeguards facilitating gamification in this setting, and that our framework could be modified for this use by providing a way to articulate the process of gamification.

5. Conclusion

The main purpose of this research was to synthesise a theoretical framework that would allow for the systematic application of gamification for the specific purpose of affecting student engagement for the achievement of learning outcomes. We achieve this by mapping Kahu's Student Engagement Framework (Kahu 2013) onto Landers' Theory of Gamified Learning (Landers 2014) to produce the Gamification for Student Engagement Framework. This novel theoretical framework unlocks the possibility for the scientific application and evaluation of gamification through a series of four testable propositions:

- (1) Gamification is a process through which student engagement states can be modified to support the achievement of learning outcomes.
- (2) The achievement of learning outcomes can be a measurable consequence of the state of student engagement which spans affective, cognitive and behavioural domains.
- (3) It is possible to select game attributes appropriate to support the achievement of specific learning objectives categorised into the three domains of learning: cognitive, affective and psychomotor.
- (4) It is possible to select a game attribute for employment in a gamification strategy by identifying the psychological domain shared between the learning outcome/educational objective and the desired, modifying student experience of engagement.

It is possible to extend proposition 4 to include other outcomes of student engagement such as wellbeing and satisfaction. The potential impact of this innovative framework extends beyond the context of Higher Education learning outcomes, and could hypothetically affect any application of gamification for the purpose of modifying engagement. We look forward to the development of this more rigorous approach to gamification.

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