Gamified Learning in Higher Education:
An Instructional Design Method to Improve Engagement

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ABSTRACT
Gamification and Design Thinking can be thought of as part of Instructional Design (ID) in the Higher Education (HE) context. Each of these fields has much to learn from the others. For example, although there is a lack of agreed method to gamify learning, there are established models for ID. Furthermore, ID and Gamified Learning share limitations, notably a lack reflection and empathy/ systems approach in the processes used, that can be remedied by borrowing from Design Thinking. In the context of HE, it is appropriate to frame that empathy as student engagement to draw on the literature base. A gamification method is presented that incorporates reflection and student engagement in an attempt to remedy these limitations. Although conceived as a means to improve student engagement with formative assessment in UK HE, the method may applied more widely to other settings to support user engagement to enhance other relevant outcomes (e.g. satisfaction) in other global locations.

KEYWORDS: HIGHER EDUCATION, CONSTRUCTIVE ALIGNMENT, LEARNING OUTCOME, INSTRUCTIONAL DESIGN, STUDENT ENGAGEMENT, GAMIFIED LEARNING, COGNITIVE DOMAIN, AFFECTIVE DOMAIN, BEHAVIOURAL DOMAIN, GAME ATTRIBUTE.

INTRODUCTION

In this chapter, we will compare Instructional Design (ID), Design Thinking and Gamification in order to place them into the context of each other. We explore notions proposed by others that gamification is an extension to ID and Design Thinking (Broer, 2015; Hung, 2018; Patrício et al., 2020), and that gamification is in fact what educators have been doing for a long time (Broer, 2015; Rieber, 1996). We will briefly examine limitations of these theories in the context of education, paying particular regard to the Higher Education (HE) setting, before presenting our own gamification method as a solution.

The gamification method proposed, although conceived as a means to improve student engagement with formative assessment in the UK Higher Education (HE) context, can be more widely applied to support user engagement to enhance academic or social outcomes (e.g. satisfaction) in other global locations (Authors, 2021). Furthermore, gamification and ID/ Design Thinking have broad applicability to many other settings, for example training and business (e.g. see Landers & Armstrong, 2017; Patrício et al., 2018; Robson et al., 2016). This chapter will draw on many fields such as systemic design (Nelson, 2019), organisational psychology (Landers et al., 2015), student engagement (Kahu, 2013), ID (Vovides & Lemus, 2019), design thinking (Gibbons, 2003) and gamification (Nacke & Deterding, 2017), and will necessarily adopt an interdisciplinary approach.

BACKGROUND

Given the context of the discussion of gamification and ID/ Design Thinking that follow, a brief introduction to learning in the HE context is required. According to UNESCO, the HE sector can be defined as “All universities, colleges of technology and other institutions providing formal

tertiary education programmes (i.e. ISCED levels 5, 6, 7, or 8).." (*Higher Education Sector (for R&D Data)* | *UNESCO UIS*, n.d.)." The sector plays an important role in the global economy, e.g. UK HE generated an estimated 1.2% of British GDP 2017 (*The Economic Impact of Universities in 2014–15*, n.d.).

The degree programmes provided by HE are taught by subject matter experts, akin to instructors in the training field. The teaching approach of these programmes has evolved from traditional didactic strategies to incorporate a number of learning theories that have emerged over the past half century. These, together with ID models, guide curriculum design in HE institutions to support students to achieve learning outcomes (Khalil & Elkhider, 2016). There are three main theories that define learning differently. These are: Behaviourism (learning as acquisition of new behaviour), Cognitivism (leaning as organisation of knowledge) and Constructivism (learning as searching for meaning; see Table 1). In reality, educators adopt a blend of these in their practice, dependant on their own training and experience. Behaviourism is the most traditional, didactic approach, and can be viewed as somewhat exploitative. Cultural sensitivity is required when considering the appropriateness of an approach (Raina, 2011). Learning outcomes, or what is achieved through the learning process, are usually organised across the five domains of knowledge: psychomotor, cognition and metacognition, and affect and self (Gagné, 1972; Krathwohl, 2002). Achievement of these outcomes is assessed differently according to which learning theory is adopted, and we can see a trend from behavioural (exams) through cognitive (essays, reports and projects) to constructivist (ungrading and peer review) approaches as the field of education develops. Those engaged in instructional design must therefore choose appropriate strategies that support learning as they define it to achieve intended learning outcomes in the relevant domain(s) of knowledge. In other words, the components of the system used in teaching: the environment and activities (including the method and assessment approach), must all be oriented in the same direction to achieve the learning outcomes. This theory is called constructive alignment (Biggs, 1996) and its implementation is the basis of the field of ID (Reigeluth, 1987).

Table 1. Summary of traditional learning theories (After (Khalil & Elkhider, 2016)

	Behaviourism	**Cognitivism**	**Constructivism**
Primary Target Domain of Knowledge	Psychomotor	Cognition and meta-cognition	Cognitive/Affective
Definition of Learning	Acquisition of new behaviour	Organisation of knowledge	Search for meaning
Focus of Instruction	Skills and competency based	Mapping and reflection based	Reflective practice
Example Instruction Method	Passive traditional lectures and demonstrations	Active problem solving	Active collaborative authentic cases
Assessment Approach	Criterion-based exams	Essays, reports and projects	Ungrading and peer review

Instructional Design Theory and Practice

ID models were developed in the 1970s to support systematic planning, design and development of instruction to facilitate learning, and various models continue to persist (Branch & Dousay, 2015; Stefaniak & Xu, 2020). The ID approach is most prevalent in Turkey and the USA where individuals formally trained in ID undertake this work, explaining the predominance of this context in the literature (Stefaniak & Xu, 2020). However, in much of the rest of the world, subject matter experts, instructors, undertake this work with limited training, adopting a similar, albeit less formal or systematic, approach. The Analysis, Design, Development, Implementation, Evaluation (ADDIE, Table 2) model is the most common and traditional ID model, and shares characteristics with other approaches (Stefaniak & Xu, 2020). Using this model, instructional designers first analyse the goals of instruction (the learning outcomes) before designing, developing and implementing a curriculum and teaching and learning strategy to meet these needs. The final stage involves evaluating the effectiveness of the approach and may use Kirkpatrick's four level evaluation model as a guide, taking into account user Reaction, Learning, Performance, Organizational Impact (Kirkpatrick & Kirkpatrick, 2009). However, this evaluation can be difficult to achieve across all levels and many practitioners focus instead on collecting and analysing feedback data concerning the learner experience and attainment to guide revision of their materials/ approach (Khalil & Elkhider, 2016; Kirkpatrick & Kirkpatrick, 2009; Reio et al., 2017).

The traditional ID approach is limited by this reliance on generic models and processes which can limit designer creativity (Stefaniak & Xu, 2020). Furthermore, the learning theories on which ID is based (Table 1.) are limited in that they ignore the individual, environmental and social context of the learner, and the affect this might have on their learning and thus the effectiveness of a teaching strategy. This causes strategies to fail and is seen as learner disengagement/ lack of motivation, dissatisfaction and/ or failure to achieve assessed learning outcomes (Trowler, 2010). Part of the solution to these issues lies in refining both the learning theories and ID approaches to better incorporate the learner experience and their context. For example, Adult Learning Theory (Merriam, 2008), Cognitive Load Theory (Sweller, 2011) and Multimedia Theory (Mayer, 2002) extend the learning theories described above, and the incorporation of design thinking (Stefaniak, 2019) and systems thinking (Wolfson et al., 2014) can improve the ID approach, to better consider some aspects of the learner's individual context or the system in which they operate. However, context is not formally incorporated into traditional ID models and remains a large limitation.

Design Thinking is an approach to solving 'wicked problems' that cannot be definitively described, in contrast to the 'tame problems' dealt with by science. This approach involves empathy, abductive reasoning, framing and progressive refinement in order to define the problem and come up with a solution (Table 2). The empathy component focusses the solution on the user and has parallels in education with student-centred approaches to teaching, learning and assessment (Banter et al., 2019), and in collaborative approaches to innovation (Patricio et al., 2020). Furthermore, in this context we can also view empathy as student engagement and instructor experience. Student engagement literature (Kahu, 2013) can help to make sense of this component where we define student engagement as a variable, context-dependent psychological state experienced whilst learning. Abductive reasoning relies on an understanding of the desired outcome when all other aspects of the problem are unclear (thus

making them ‘wicked’), whilst framing is a means to articulate an approach to the problem, helping to set the problem (Hung, 2018). In HE, these outcomes are usually defined as learning outcomes which are selected according to the relevant domains of knowledge (Krathwohl, 2002). Taken together, a more interdisciplinary and reflective approach to ID, incorporating elements of Design Thinking and relevant engagement literature may help better inform the implementation of these theories and methods.

Gamification Theory and Practice

Gamification has been called upon in recent times as a solution to some of the ID limitations in training and education, especially lack of learner motivation (often conflated with engagement), and has largely evolved separately from the field of ID (Dichev & Dicheva, 2017; Rivera & Garden, 2021). However, gamification can in some ways be considered to be an extension of Design Thinking (Hung, 2018; Patrício et al., 2020) and an extension or re-packaging of well -known principles of teaching and learning e.g. badges, autonomy, relatedness and competence (Broer, 2015; Landers et al., 2015; Wiggins, 2016). Because of this, arguably it is the *process* of gamification that is more meaningful and powerful for educators than the outcome, lending focus, purpose and structure to instructional design (Broer, 2015; Hung, 2018; Patrício et al., 2020).

In the context of teaching and learning, gamification sits at one end of a spectrum with serious games at the other, and game-based learning in the middle (Fig. 1). These differ in the extent to which the approach resembles a game: serious games are games used for the purposes of education, and thus contain all the components of a game. In contrast, gamification only uses one or more game components, and not enough to fully resemble a game (Deterding et al., 2011). It is very important to disambiguate these terms, so that the evidence base may be properly interpreted and applied (Broer, 2015; Hung, 2017). Indeed, the field is currently awash with seemingly contradictory and difficult to interpret findings because of this, and the many different definitions of gamification currently in use (e.g. see Broer 2015). Here we adopt the Gamified Learning definition of Landers: ‘the use of game attributes to facilitate learning and related outcomes’ (Landers, 2014), with game attributes categorised into action language, conflict/challenge, control, environment, game fiction, human interaction, immersion and rules/ goals (Wilson et al., 2009).

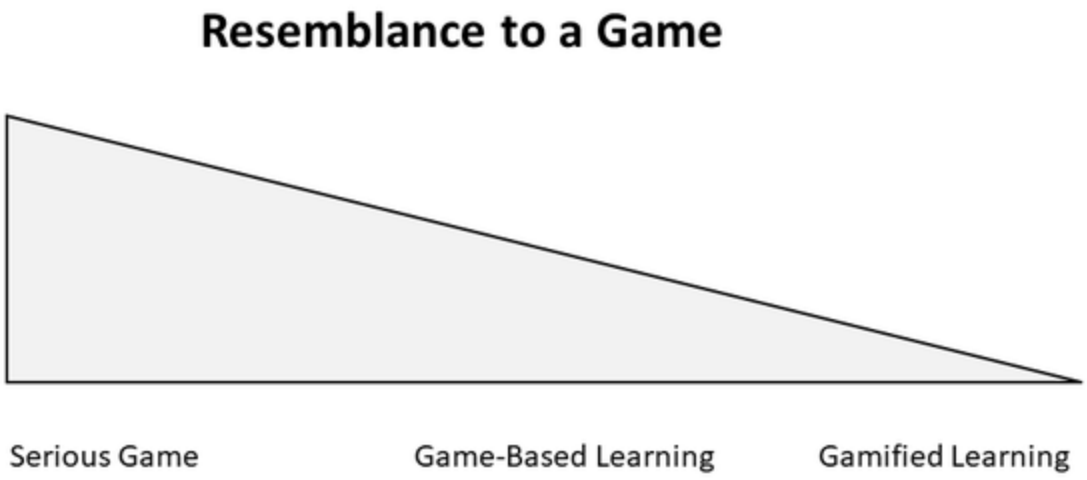

Figure 1. Gamified learning lies at one end of a spectrum with serious games at the other and game-based learning in the middle. Serious games gave the highest resemblance to games, being fully fledged games, and gamified learning has the least.

Gamified learning is thought to work by modifying the recipient's behaviour and attitude, such as interest, time and effort, to support the achievement of intended outcomes (Landers, 2014). It is important to gamify effective instructional material because gamification does not enhance learning by itself, gamification plus the instructional material/ strategy does this (Landers, 2014). There is no agreed method to gamify learning, which we attempt to remedy here. There are descriptions of *what* to do, but not *how* to do it. The gamifier = designer *may* exert choice over which aspect of the recipient's psychological state to modify, and they *will* select one or more game attributes to modify it through gamification to achieve an outcome albeit inadvertently in some cases. Outcomes may include satisfaction, spend or in the context of gamified learning, learning outcomes (Authors, 2021; Wilson et al., 2009). The meaning of the gamified experience is conveyed through feedback not just on actions, but also on decisions and guiding values (Kim & Werbach, 2016; Tobon et al., 2020; Werbach, 2014). For meaningful gamified learning, this has been framed as a requirement to build in opportunities for play, exposition, choice, information, engagement and reflection to support the user to find links between their experience with the real world (Nicholson, 2015). In other forms of gamification such as commerce, gamification adds feedback to what is an otherwise inherently transactional situation. In the case of learning, the responsibility of feedback to convey meaning is paramount (Kim & Werbach, 2016; Landers, 2014).

It is possible to find aspects of design thinking and ID that are shared with gamification (Table 2). For example, the initial stage of for all three processes is an attempt to understand and articulate the problem, and there are different ways to carry this out. In traditional ID, this is the Analysis phase, where instructional goals are refined and articulated as learning outcomes. This step might incorporate abductive reasoning and framing if Design Thinking is used to get to grips with a difficult problem (Stefaniak, 2019). There is no set way to do this for gamified

learning, but reflection is a common first step that practitioners take when considering their learning and teaching strategy – indeed, reflective practice has been an important part of practice in HE for at least the past decade (Clegg et al., 2010). Empathy is found in Design Thinking and some gamification approaches (Authors, 2021) and is incorporated from the beginning of the process as a way of acknowledging and sometimes including users and their context into the design process. Although this is missing from the traditional ADDIE approach, it is possible to consider the 'system' as part of the Analysis process at the beginning (Stefaniak & Xu, 2020). This is taken one step further as engagement in our and approach to gamification (Authors, 2021). This is particularly important if gamification is to be meaningful to the user, especially if gamification is being deployed as an intervention to improve user engagement, one facet of which is motivation (Kahu, 2013). This engagement aspect missing from traditional ID and has been articulated as a need for a systems approach (Stefaniak & Xu, 2020). This remains a substantial limitation to the ID approach which would benefit from incorporating the empathy/ engagement aspects of DT and gamification. Finally, ID and DT incorporate evaluation/ refinement into their design process, but this is missing from gamification (Table 2). This may be because the iterative nature of games design is often brought over into gamification processes, but is not explicitly articulated. Nevertheless, the field of gamification would benefit from formally adopting systematic evaluation into the process in order to strengthen the evidence base (Hung, 2018). Taken together, one may consider gamification to be an approach to design, and gamified learning in particular to be one possible approach to instructional design (Hung, 2018). Therefore, the field of gamification is actually part of the larger field of design and would benefit from incorporating aspects of that field into its approach to implementation and evaluation. Similarly, gamified learning would benefit from the instructional design literature base (e.g. see (Ali et al., 2021).

There are many limitations present in the gamified learning literature, including the lack of an agreed methodology for implementation as discussed above. This may explain the limited adoption of gamified learning outside the fields of computing and game design to date (Hung, 2017). Furthermore, most evidence focuses on the use of leader boards, points and badges in Learning Management Systems, probably because they are the most familiar to practitioners and relatively easy to implement (Dicheva et al., 2015; Nicholson, 2015). This is problematic because this narrow viewpoint leaves the majority of available game attributes without an evidence base, and there is in fact no technology requirement for gamification (Broer, 2015; Nicholson, 2015; Wilson et al., 2009). Indeed according to Broer, gamification is "likely to transcend the choice of medium" (Broer, 2015), a statement agreed with by others (Hung, 2017; Rivera & Garden, 2021). The re-use of concepts already present in education e.g. stars and badges, and the focus on autonomy, competence and relatedness in gamification can also make its application in this context more difficult to study (Broer, 2015; Nicholson, 2015).

A further major criticism of the way gamification has been applied and evaluated to date lies in the (perhaps unintended) focus on behavioural elements, and concomitant failure to address cognitive and affective aspects of the user experience, something we and others are attempting to rectify (Ali et al., 2021; Authors, 2021). When extended to learners, this means there tends to be a focus on what students DO to achieve learning outcomes, ignoring what students think, and especially, feel. This is manifested as a focus on the selection of game attributes that target user behaviour such as leader boards, the effects of which are measured as behavioural

outcomes such as time on task and number of posts on LMS in evaluations of gamified learning (Landers & Landers, 2014). This behavioural approach can also be clearly seen in Lander's Theory of Gamified Learning (Landers, 2014) and Nicholson's RECIPE for meaningful gamification (Nicholson, 2015). Likewise, Kahu's work illustrates the ways in which student engagement, and therefore learning, might be endangered by a similar narrowing of account, wherein student engagement is viewed largely in terms of the behavioural (psychomotor) domain of experience (Kahu, 2013). As a further complication, in ID the learning outcomes which guide the design process are often confined to the *cognitive* domain of learning where the student's thinking occurs, with little thought to the emotionality or physicality of experience in learning (A.J. Harrow, 1972; Krathwohl, 2002; Morshead, 1965). This *also* potentially ignores who they are, and how they act and feel. This is problematic if we agree with the notion that learning and engagement have cognitive, affective *and* behavioural dimensions (Kahu, 2013; Kraiger et al., 1993; Krathwohl, 2002). By focussing on just one of these, we neglect much of what is beneficial to the student/ user in the gamified experience and render the intervention less effective.

Student behaviour doesn't always lead to a change in grades (Song and McNary 2011), perhaps because of the failure of constructive alignment between the learning strategy (often behavioural as in gamified learning), learning outcomes situated in other domains of learning (often cognitive), and assessment (often behavioural) which reinforces a reward-dependent approach that erodes intrinsic motivation (Biggs, 1996; Nicholson, 2015). This is especially important because many practitioners turn to gamification as an intervention to support improved motivation or engagement. This is also why others search for 'meaningful gamification' (Hung, 2017; Nicholson, 2015) and why we put forward the theoretical basis to our Gamification for Student Engagement Framework (Authors, 2021). This limitation also leaves practitioners open to criticism around the ethics of manipulating behaviour through gamification e.g discussions around exploitationware Hung (2017). It is this surface approach to gamification, coupled with a confusing and contradictory evidence base and the presentation of some established ideas as new that has led to cynicism in the education field (Attali & Arieli-Attali, 2015; Broer, 2015). However, like many other approaches to teaching and learning, gamification is not intrinsically good or bad, the outcome depends on how it is applied (Hung, 2017). Some limitations of gamified learning are also shared with traditional instructional design. These include over-simplification of the problem/ solution (e.g. gamification over simplifies game design and ID oversimplifies the design process), selective focus on behavioural outcomes, and lack of user input and consideration of context (depending on the model used). Engagement research is a useful means of addressing the final limitation and underpins our Gamification for Student Engagement framework (Authors, 2021).

Table 2. A comparison of Traditional Instructional Design, Design Thinking and Gamification approaches to facilitating learning. Note that it is possible to incorporate Design Thinking and Gamification into Instructional Design to move on from the traditional approach– these should not be seen as separate entities. *A list of models is available here: (Branch & Dousay, 2015).

	Traditional Instructional Design	**Design Thinking**	**Traditional Gamification**
Focus	Medium	Problem	Problem

Process	Analysis, Design, Development, Implementation, Evaluation*.	Abductive Reasoning, Framing, Empathy, Progressive Refinement.	Ill-defined.
Approach to Understanding and Articulating Problem	Analysis of instructional goals.	Abductive Reasoning, Framing, Empathy.	Not well defined. Can be incorporated as Engagement (Authors, 2021).
Role of Context	May be present in analysis of the system in the first phase, and the evaluation phase.	'Baked in' via empathy.	Not well defined. Can be incorporated as Student Engagement (Authors, 2021) or choice, exposition and engagement (Nicholson, 2015) if these approaches are taken.
Predominant Mode of Evaluation/ Measurement	Reaction, Learning, Performance, Organizational Impact .	Not well defined, includes qualitative analysis of experience.	Behaviour change e.g. time on task.
Predominant Learning Theory	Dependant on instructor approach.	Unclear, likely to be constructivist.	Behaviourism.

MAIN FOCUS OF THE CHAPTER

A Gamification Method to Improve Student Engagement

We present a process that uses a modified ADDIE ID approach that focuses on the Analysis stage in order to address the lack of empathy/ design thinking limitation of ID. In addition, the process explains *how* to carry out gamification rather than listing *what* steps to take in order to address this gamification limitation. Here, an instructor is supported, through facilitated reflection by an instructional designer, to gamify instructional material to improve student engagement using the Gamification for Student Engagement Framework (Authors, 2021). The method is an attempt to enable instructors/ instructional designers to select how learning outcomes (as defined by Bloom: (Krathwohl, 2002) will be achieved through supporting an engagement state (as defined by (Kahu, 2013) they choose to influence through gamification (as defined by (Landers, 2014) through the application of appropriate game attributes (as defined by (Wilson et al., 2009). That choice is not achieved via learning analytics or student satisfaction surveys, but through reflection of expertise and empathy that can be underpinned by research in gamification and engagement to provide the substance for reasoned and accountable decisions

in learning design (see Table 1 Authors, 2021, Fig. 2). This method includes many of Hung's recommendations for instructional designers interested in gamification (2017): it is student-focused, starts small with one or two game elements, does not rely on learning analytics but is considerate of scalability, revision and reiteration.

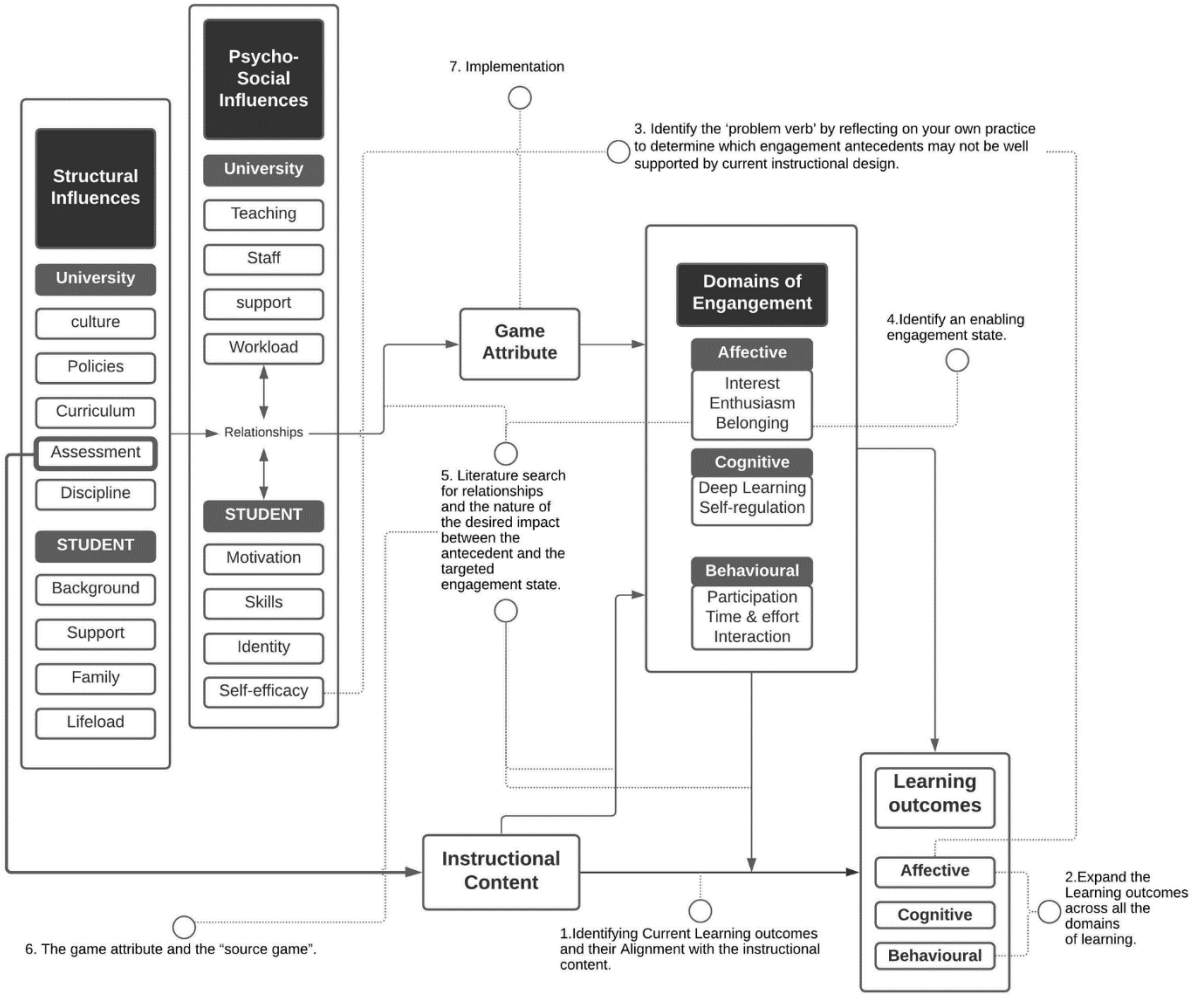

Figure 2. The gamification for engagement method involves instructor reflection and constructive alignment throughout the process. First, learning outcomes across the three domains of learning for the instructional material (curriculum/ assessment) to be gamified are clarified. Then a problematic learning outcome is identified in one domain of learning that is aligned to state of engagement to be targeted through gamification. The instructor identifies a personal quality that supports their success in the field and selects a specific antecedent and state of engagement to target that fits best. The link between the antecedent and engagement state is sought using academic literature before an appropriate game attribute is selected that would support this process, which is then implemented into the instructional material.

We use an example where gamification aims to improve student engagement with formative assessment, to improve attainment of the associated learning outcome. The Analysis phase begins by examining whether or not there is constructive alignment of the assessment and the learning outcome, because misalignment between intentions and teaching strategies/ material can result in student disengagement and failure, and gamification cannot fix broken instructional material (Biggs, 1996; Landers, 2014; Reigeluth, 1987). Once the learning outcome is better defined in the context of the assessment, it is expanded to incorporate all the domains of

learning in order to identify which is most problematic and optimise the opportunity for student engagement. The next stage is rooted in what the socio-cultural approach to student engagement identifies as a danger to student learning, wherein qualities and skills which are advantageous to a student success can be taken for granted and assumed to be inherent, becoming unwritten rules or expectations which underpin how a learning institution interacts with students, otherwise known as the institution's 'habitus' (Thomas, 2010). A habitus which succumbs to these assumptions can create methods of teaching which are exclusionary to students who may not posses these qualities or skills, but are otherwise capable of achieving the learning outcomes. In the gamification process presented, the instructor reflects on their assumptions through experience in conjunction with their learning outcomes to identify which psychological domain of engagement could be improved through gamification targeted towards an antecedent of engagement. These antecedents are factors that exist within and outside the student and influence the student's engagement states at any given moment. They can be found more proximally within the student, which are themselves influenced by more distal antecedents such as their socioeconomic background, family support, and culture (Kahu, 2013). The number and types of antecedents to engagement, and their interactions are numerous and intricate, however we focus on the proximal antecedents within the student, their skills, motivation, self-efficacy, and identity. The final part of this stage involves identifying the appropriate intervention by linking this engagement antecedent to the desired state of engagement through an analysis of the relevant pedagogic literature.

In the Design and Development stage, the instructor identifies which game attribute influences player engagement in much the same way that the intervention (described in the pedagogic literature in the previous stage) impacts the student (Table 1 (Rivera & Garden, 2021). At this point, it is important to remember that while there are only 19 game attributes, their uses are very variable, and they are often implemented in various ways and in conjunction with other game attributes.

How to Gamify Learning in Seven Steps, an Example

Analysis

1. Identify Learning Outcomes and their Alignment with Assessment

The example used here is the gamification of a formative assessment (a multiple-choice quiz) for a first-year undergraduate course in cell biology, where the learning outcome for the course, and thus the formative assessment, is written as follows:

Understand the structure of animal cells and identify its composite parts.

This part of the process considers how the verb in the learning outcome (understand, a cognitive learning outcome, Table 3) is aligned to the design of the assessment by re-writing the learning outcome to describe the intended result of formative assessment:

By the end of this formative assessment, the student will be able to identify the correct response to questions about the fundamental principles of cell biology.

In taking a closer look at this learning outcome, it can be seen that 'identify' is an accurate way to describe what happens during the formative assessment, but applies more to the cognitive act of remembering than understanding, stated in the original learning outcome (See Table 3). In a situation like this, we begin to question whether the formative assessment could be better

aligned to the learning outcome. Perhaps a redesign of the formative assessment is required. Alternatively, we may start to question whether a multiple choice quiz is actually an act of association (a verb in the category of understanding), rather than simply identifying or choosing. That questioning is key to this art of the process.

No matter what position is taken, the process benefits from this reflection. At this stage, semantics are everything, as this more accurate learning outcome will serve as the foundation for the next stage, integrating the other domains of learning.

Table 3: Typically, learning outcomes are written exclusively using verbs from the cognitive domain of learning as found in Bloom's Revised Taxonomy, describing the cognitive aspect of learning (Krathwohl, 2002). The outcomes increase in complexity from left to right, the ones used in the example are highlighted.

Cognitive Domain: Categories of Learning Outcomes Aspects of learning dealing with knowledge, how it is obtained, recalled, processed, and manipulated.									
Remember		**Understand**		**Apply**	**Analyse**	**Evaluate**		**Create**	
Retrieval of knowledge		Constructing meaning from knowledge		Procedural use of knowledge	Networked knowledge to extrapolate/ interpolate	Utilisation of knowledge as criteria		Reorganising/repurposing of knowledge	
Arrange Cite Choose Count Define Describe Duplicate Identify Label	List Locate Match Outline Recall Recite Record Review State	Abstract Associate Categorize Clarify Classify Conclude Contrast Exemplify Extrapolate	Generalize Illustrate Interpret Map Predict Represent Summarize Translate	Apply Carry out Demonstrate Determine Develop Employ Execute Implement Operate Show Sketch Solve Use	Analyse Attribute Deconstruct Differentiate Discriminate Distinguish Focus Organize Outline Parse Select Structure	Argue Assess Check Conclude Coordinate Criticize Critique Detect	Judge Justify Monitor Prioritize Rank Rate Recommend Test	Assemble Build Combine Compose Construct Create Design	Draft Formulate Generate Hypothesize Integrate Plan Produce

2. Expand the Learning Outcome

Consideration of all domains of learning is necessary when gamifying instructional material such as a formative assessment for engagement (Rivera & Garden, 2021). This is best done by re-writing learning outcomes that includes verbs from all three domains of Bloom's Taxonomy of Learning: affective, cognitive and psychomotor (Krathwohl, 2002), and contextualising them within the formative assessment.

To begin with, most courses do not incorporate learning outcomes that acknowledge the affective or psychomotor domains. In the case of the example, we must focus on the verb of 'understanding' in the learning outcome and consider the ways in which the formative assessment tests that understanding and look for verbs in the other domains of learning with similar complexity. 'Understand' refers to a lower complexity level of the cognitive domain of learning in Bloom's revised taxonomy of learning (Anderson et al., 2001; Krathwohl, 2002), thus a lower complexity verb from the affective domain would likely be appropriate (Morshead, 1965). However, if the lowest complexity 'remember' is more appropriate (Table 3.), the most

basic levels of complexity in the affective and psychomotor domains should also be selected (Tables 4 &5). The verbs in those domains are chosen according to which is more representative of what the student does in the yet-gamified formative assessment. It is helpful to write formative assessment tailored learning outcome in the present tense:

In this formative assessment, the student identifies (cognitive) the correct response to questions about the fundamental principles of cell biology by asking (affective) fundamental questions about biology, replicating (psychomotor = behavioural) the command of cell biology the instructor showed in week 1.

In the above example, the instructor has concluded that while the learning outcome for the *course* is written using a cognitive verb from the category of understanding, the *formative assessment* is in fact asking the student to display learning that is more appropriately categorised as remembering (highlighted in Table 3). They have decided that this is appropriate for where the formative assessment falls in the semester. They have also chosen to use verbs from all three domains of learning in a single learning outcome that describes what the formative assessment currently asks the students to do (highlighted in Tables 4 &5).

Table 4. Verbs used in the articulation of learning outcomes in the affective domain of learning (Morshead, 1965). The outcomes increase in complexity from left to right, the ones used in the example are highlighted.

Affective Domain: Categories of Learning Outcomes This domain concerns the aspects of learning that deal with emotions as expressions of value and attitudes.									
Receiving		**Responding**		**Valuing**		**Organization**		**Characterization**	
Openness to new experiences		Interaction with new experiences		Attaching worth to new experiences		Integration into an existing value system		New attitudes/beliefs through internalisation	
Ask	Identify	Answer	Practice	Complete	Join	Adhere	Generalize	Act	Propose
Choose	Locate	Assist	Present	Demonstrate	Justify	Alter	Identify	Discriminate	Qualify
Describe	Name	Compile	Read	Differentiate	Propose	Arrange	Integrate	Display	Question
Follow	Select	Conform	Recite	Explain	Read	Combine	Order	Influence	Revise
Give	Reply	Discuss	Report	Follow	Share	Compare	Organize	Listen	Serve
Hold	Use	Greet	Select	Form	Study	Complete	Prepare	Modify	Solve
		Label	Tell	Initiate	Work	Defend	Relate	Perform	Verify
		Perform	Write			Formulate	Synthesize	Practice	Use

Table 5. Verbs used in the articulation of learning outcomes in the psychomotor (behavioural) domain of learning (Armstrong, 1970; Harrow, 1972). The outcomes increase in complexity from left to right, the ones used in the example are highlighted.

Psychomotor Domain Levels: Categories of Learning Outcomes This domain concerns the aspects of learning that deal with physical experiences and skills.									
Imitation		**Manipulation**		**Precision**		**Articulation**		**Naturalization**	
Copying via observation		Reproduction via instruction		independent adroit execution		Consistent execution of networked skills		Automatic high level execution	
Adhere	Repeat	Build	Perform	Calibrate	Demonstrate	Adapt	Develop	Design	Project
Copy	Replicate	Execute	Recreate	Complete	Perfect	Combine	Formulate	Invent	Specify
Follow		Implement		Control	Show	Construct	Master	Manage	
						Coordinate	Modify		

3. Identify the Problem Learning Outcome and Learning/ Engagement Domain

Once the learning outcome is envisioned across all three domains of learning, it becomes easier to identify which domain is proving problematic for student engagement and subsequently, achievement. This stage employs empathy, where the instructor considers their experiences with students and reflects on the design and effectiveness of their formative assessment. This is done by contrasting observed student experience to the instructor's experience in the discipline, i.e., what strengths does the instructor have (but students may not) that makes inhabiting that learning outcome verb easier for the instructor? This stage is an attempt to enable the instructor to identify their role in creating an assumptive habitus in the design of a specific learning experience, such as a formative assessment. After having expanded their aligned learning outcomes to all three domains of learning, the instructor may now step back from the material to reflect on their own experiences as a student and a practitioner. Here, they may begin a simple list of personal characteristics, strengths, or attitudes that helped them master the material. This gives the instructor the chance to consider how the formative assessment may have been designed amidst their own blind spots, assumptions, or narrow expectations for what a successful student must be capable of during or even prior to the formative assessment. Likewise, the instructor may also remember challenges they may have experienced as a student, subsequently, overcome, and have since forgotten about. The goal here is for the instructor to articulate their own personal strengths which have contributed to their success in their discipline, and articulate them as clearly as possible. Instructors who have used this method have been encouraged to sum up each quality in a single word where possible, and prioritise clarity where not. Every item on the list should be clear enough for the instructor to remember exactly what was meant when they were written down. This kind of specific and positive reflection/ articulation can be an uncomfortable and even embarrassing experience because it is experiential. At this stage, it is important for an instructor to be aware of that type of reticence and dissuade themselves of it, as it can lead to creating a list of personal strengths that is generalised or otherwise hedged. Modesty is also counterproductive because while each item on that list is one of the instructor's strengths, each one is also a potentially crucial challenge to one or even all of their students.

Completed lists of strengths may range from three items to fifteen, taking between five and twenty minutes to complete, and often require a colleague to provide a sounding board. Once complete, it can then be looked at as a list of challenges, wherein the instructor should take further time to reflect on whether students have expressed or displayed difficulty with any of the items on the list. This should be done primarily within the context of the activity that is being gamified using experiences of previous students who had difficulty with it. This reflection can be supported by referencing records available to the instructor such as student feedback, class representative meetings, or marks and achievement statistics. However, in nearly every case since this method was first tested, a instructor's own experiences with their students has allowed them to quickly and confidently identify the personal strength or quality they have which historically has proven most challenging to students' success with the assignment in question.

For the example used thus far, the instructor made a list of their own traits and qualities that would aid them in their discipline, particularly where this formative assessment and its subject matter is concerned:

1. *Good memory*
2. *Diligent*
3. *Excited to prove myself*
4. *Disciplined*
5. *Comfortable admitting when I don't know something*

6. *Optimistic*
7. *Like working with others*

The instructor looked over this list while thinking about their past students and found themselves thinking of students who displayed lots of enthusiasm for the material but performed poorly on this formative assessment. They even thought of students with whom they often 'butted heads'. This reflection was enough for the instructor to hone in on item 5: *'being comfortable admitting when I don't know something.*'

This is where the 'problem learning outcome' is identified, i.e. where the instructor begins to understand which domain of learning is more directly suffering from students' current level of engagement. If one of the learning outcomes is synonymous with the most problematic challenge, or if one of them has a more immediate and logical causal relationship with that challenge, then it is most likely the 'problem learning outcome'. In our example, the instructor in has written three separate learning outcomes:

Cognitive: *<u>Identify</u> the correct response to questions about the fundamental principles of cell biology.*

Affective: *<u>Ask</u> fundamental questions about biology.*

Psychomotor (Behavioural): *<u>Replicate</u> the command of cell biology the instructor showed in week 1.*

After reflecting on their own strengths, the instructor concluded that a personal characteristic of their own is also something they typically observed in promising students, that being:

Quality 5: *'being comfortable admitting when I don't know something.*'

In this case, the instructor considers which verb (underlined) would be rendered most difficult if they were not comfortable admitting when they didn't know something. After discussing the matter with a colleague, it quickly becomes obvious that asking a question is in and of itself an admission that you *'don't know something.'* From this, the instructor concludes that 'asking' is the 'problem verb', and thus 'affective' is the problem domain.

However, it is not always that straightforward. For example, imagine that same instructor elected to use all three domains in a single learning outcome, which was also less ambitious and more descriptive in its articulation, such as:

In this formative assessment, the student adheres (psychomotor) to the fundamental principles of cell biology by identifying (cognitive) the correct response to questions after choosing (affective) from a bank of similar but incorrect responses.

In this situation, the quality still remains the guiding influence, however the instructor cannot see a clear relationship between it and any of the verbs used in this version of the learning outcome. In which case, rather than the specific verbs used, the quality/challenge can be compared to other verbs within the same category, or the category itself (see Tables 3-5). Here, the instructor observes that being 'comfortable admitting what I don't know something' is conceptually very similar the category of affective verbs known as 'receiving', described as 'an openness to new situations' (see Table 4). Thus, the instructor has established the 'choosing' as the problem

verb, and subsequently the affective domain remains the most problematic of the three domains of learning.

NB: Currently, it is advised that this means of identifying the 'problem learning outcome/domain' only be used when a clear relationship cannot be established between the quality and learning outcomes as written, as instructors have had better success gamifying when they remain rooted in the learning outcomes that have been aligned to the activity in question.

4. Identify an Enabling Engagement State

Like the domains of learning, student engagement is divided among the affective, cognitive, and psychomotor (behavioural) domains (Kahu, 2013). However, where learning outcomes are characterised by verbs, Kahu describes student engagement using states of being. In *Framing Student Engagement in Higher Education (2013),* Kahu provides a non-exhaustive but critical list of states of engagement within each domain.

Table 6. Domains of engagement, and the states within those domains, as described by Ella Kahu (Kahu, 2013).

Student Engagement		
Affect	**Cognition**	**Behaviour**
Enthusiasm Interest Belonging	Deep Learning Self Regulation	Time and Effort Interaction Participation

This stage of gamification is about identifying the 'target' student engagement state, and making an important choice about how the instructor will impact that student engagement using gamification. It should be emphasised that this is more a matter of choice for the instructor. Unlike the previous stages of gamification, this stage requires the instructor to make a proposition about the most useful state of engagement they wish to impact, and by what means. To do this, there are crucial assumptions we make about Kahu's framework that must be accepted:

Assumption 1: states of engagement are dynamic, i.e. there is no ideal level at which these states must exist for learning to be possible. E.g. A particular level of enthusiasm may be appropriate for one activity, and that same level of enthusiasm in the same student could be insufficient for a different one.

Assumption 2: to *learn* within a domain the student must be appropriately *engaged* in that domain. For example, if the instructor has concluded that the affective learning outcome has proven challenging for their students, it reasonable to assume that the affective domain of engagement is likely not sufficient for the student to achieve the desired learning outcome. In implementing this method, choosing which affective state of engagement to augment has proven to be the most subjective activity. Instructors have been served well by interrogating both their own quality and the description of engagement states that Kahu employs, looking for overlaps.

Assumption 3: to change engagement, one must first know what influences it. In much the same way that learning is a *consequence* of engagement, states of engagement are themselves a result of what Kahu refers to as *antecedents* to engagement (Kahu, 2013).

In the example case, the instructor must focus on augmenting an affective state of engagement (as per assumption 2). The instructor examines Quality 5: 'being comfortable admitting when I don't know something' and finds synergy in between their own use of the word 'comfort' and Kahu's concept of 'belonging' in the affective domain of engagement (Finn, 1993; Kahu, 2013). This reflection feels compatible with student informal feedback that their discipline can feel elitist. The instructor reflects on which antecedent of the four antecedents to engagement: skills, motivation, self-efficacy, and identity (as they exist within the student) can be intervened upon to create the state of belonging they wish to engender in students. They may look for the antecedent they believe will result in an optimal state of belonging, or one they believe is more directly responsible for the students' current state of belonging. After reflection, discussion with colleagues, and even students, the instructor proposes that being comfortable with admitting what they don't know has allowed them to avoid feeling like they don't belong, because it allowed them feel secure in the way they perceived current skill level even if they knew it wasn't yet up to the task. Thus, the instructor chooses to continue targeting the engagement state of belonging, and elects to impact that state via the antecedent of students' self-efficacy, which is most allied to belonging in this context.

NB: At this point, after articulating this relationship between their personal quality (comfort), a specific antecedent (self-efficacy), a specific state of engagement (belonging), and a specific learning outcome (ask) in a specific domain (affective), the power of this method will begin to assert itself. Previous instructors have described this as an "ah-ha moment", many of their experiences with struggling students (and their course feedback) quickly make sense in a way they had not before. Every instructor who completed this process took comfort in their newfound ability to articulate something they previously could not always perceive, or claimed to have experienced a kind of professional catharsis. If an instructor has completed this stage and is not confident in their conclusion, they are advised to work backwards from this point, reviewing their progress for the point at which their conclusions began to feel arbitrary or forced, perhaps in discussion with a colleague.

5. Explain the Relationship between the Engagement State and the Antecedent to Define the Desired Intervention

This stage builds on the propositions made by the instructor in the previous stage with more substantial and objective considerations. To do this, the instructor must identify pedagogic literature that describes the relationship between the target state of engagement (e.g. belonging) and the antecedent they've proposed to be most crucial (e.g. self-efficacy). The goal here is for the instructor to be able to conceptualise the relationship between the antecedent and the state of engagement, and how an intervention might impact that relationship. Instructors have done this with a simple search through peer reviewed pedagogy research and scholarship, using their chosen antecedent and engagement states as search terms. Continuing with our example, the instructor finds pedagogic literature after searching for research that links belonging to self-efficacy. They also include additional search terms that ensure the findings of the research are compatible with the learning theories underpinning their own teaching practice, e.g. constructivism.

This stage challenges the instructor/ designer to understand and analyse the literature well enough to be able to succinctly narrate the relationship between the antecedent and the state of engagement. The literature that instructors used varied in how succinctly they described the nature of those relationships, what impacted those relationships, and the nature of that impact. Often, instructors found literature with clear implications, e.g. a peer reviewed article entitled "Student Motivation and Self-Regulation" which has both an antecedent and a state of engagement in the title, and concluded that students with low motivation showed higher self-regulation with they collaborated with a partner and a clear reason as to why. Other, less well-defined articles may have similar value, but use different language, so support and discussion with colleagues can be vital for this stage as well as a firm grasp of the decisions, terms, propositions, and rationale the instructor has established thus far.

Here, our example instructor identifies an influential article that describes how a specific concept intervenes in the relationship between their chosen engagement antecedent and their chosen engagement state, and writes out a succinct encapsulation of the article:

Discussions (intervention) of the subject material between students helps students' confidence (self-efficacy) by allowing them to see that they are not the only ones (belonging, affective engagement) who have been unsure about the material, making them feel more comfortable with asking questions of the teacher in class (learning outcome, affective).

It is this narration of the relationship and how it may be intervened upon which forms the basis for the choice of game attribute to be employed, and how it must be employed to achieve the effect. This intervention is the ultimate objective for gamification.

<u>Design and Development</u>

6. Identify an Appropriate Game Attribute and the Source Game

In this stage the instructor identifies the game attribute to be used to gamify their learning, and describe what it will need to accomplish. At this point, it is important to remember that while there are only 19 game attributes, their uses are incredibly variable, and they are often implemented in various ways and in conjunction with other game attributes. The goal is to find a game that utilises a game attribute to create engagement in a player in much the same way that the intervention (described in the pedagogic literature in the previous stage) impacts the student. The challenge for the lecturer to is be able to conceptually translate the intervention identified in stage 5 with one of the game attributes described by Wilson and Bedwell (Bedwell et al., 2012; Wilson et al., 2009).

In our example the instructor reads descriptions of game attributes (Wilson et al., 2009) and selects the game attribute of 'interpersonal interaction' as the most similar to the description of discussion found in the literature used in stage 5. The instructor does not play games frequently, and is unsure about whether they can identify relevant examples to exemplify how this game attribute may be implemented. However, in this case, simple games such as pub-quizzes employ many of the concepts described by the relationship/intervention in stage 5: employing a group dynamic, picking a team, choosing team name, thematic questions, competition, and time limitations, and a question master. Moreover, interpersonal interaction is employed to a similar effect, i.e., people in groups, where self-efficacy is key, and interaction requires individuals acknowledging that they may not know a key piece of information, facilitating the engagement state of belonging. The instructor suggests that the formative assessment can be restructured to

ensure students have similar discussions during the quiz, while trying to meet all of the original learning outcomes of the formative assessment, as well as the newly expanded learning outcomes written to reflect the affective and behavioural domains of learning.

Implementation and Evaluation

7. Incorporate the Game Attribute into the Instructional Material: Gamification

The end-goal for the previous step is the identification of a game attribute to use and a specific game to serve as a model for its implementation. Rather than recreate the game itself, (which would be game-based learning, and not gamification) the instructor simply extracts the game attribute used in the game and implements it within the part of the instructional material most associated with the 'problem-learning outcome'. The multiple-choice quiz formative assessment is restructured (or gamified) to incorporate the 'interpersonal interaction' attribute to ensure students have discussions during the quiz (as described in step 5 above), while trying to meet all of the original learning outcomes of the formative assessment (step 1), as well as the newly expanded learning outcomes written to reflect the affective and behavioural domains of learning (step 3).

In our example, the final gamified formative assessment is now a quiz that is taken by teams instead of individual students. Each question is generated by a team of students given a limited amount of time to discuss what they do and don't know and formulate a question that the other teams must answer. This ensures students ask questions as well as answering them, all through discussion which is implemented in a co-operative, competitive atmosphere that makes it easier for students to feel welcome within the discipline, despite any knowledge gaps they may possess in the subject matter. This makes them feel less self-conscious about actions that reveal what they don't know, including actions necessary for learning more, such as asking questions or asking for help.

Lastly, the instructor can now evaluate the learning outcomes based on the accuracy of students' answers and the quality of the questions they formulate. This is the beginning of the evaluation step, which is also informed by other forms of student feedback, e.g. course survey.

LIMITATIONS

The goals of this method, and the Gamification for Student Experience Framework that underpins it are to highlight that context is important, and to provide a gamification method as a way through which this context can influence the design of learning (Authors, 2021). However there are some limitations present in our method that remain:

1. The method focuses most on the Analysis step of the ADDIE process, and does not adequately describe how the gamified material may be evaluated or modified, the final ADDIE step. However, the learning outcomes are clearly articulated as part of the process, and achievement of these may be measured. Furthermore, student feedback mechanisms are commonplace in HE and may easily be incorporated (e.g. see Jessop et al., 2013; Shah et al., 2017, Figure 3)
2. This method of gamification is not designed in partnership with students and so therefore some assumptions about the student experience may have carried over, impacting on its effectiveness. However, incorporation of user feedback during and after the process would remedy this to some extent.

3. Although this method is reflective in approach and incorporates engagement theory, the resulting gamified learning experience does not necessarily include aspects of design that others have put forward as being necessary for it to be meaningful (e.g. play, Nicholson, 2015). However, it is necessary to simplify the process, at least while the evidence base is being built, and not all these aspects need to be present for the experience to be meaningful (Hung, 2017). Therefore, it is likely that the game attributes selected as part of this process are compatible with meaningfulness because of the purposeful incorporation of engagement theory.
4. It is likely that not every gamification strategy will benefit all learners, therefore an element of choice should be incorporated (Hung, 2017; Nicholson, 2015), a concept borrowed from Universal Design for Learning (Rose & Meyer, 2009). Repeating the gamification process one or more times would result in different gamified versions of the instructional material that could conceivably offer choice.

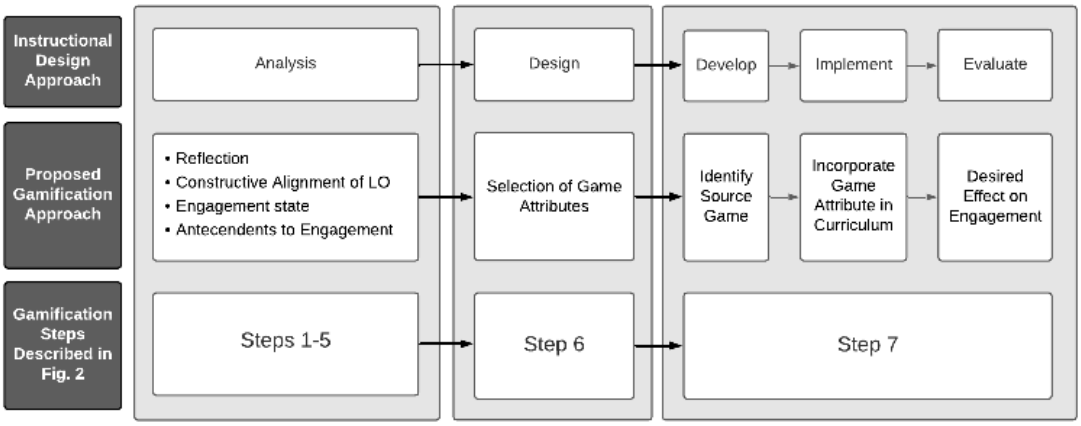

Figure 3. The gamification method outlined in this chapter can be mapped to the ADDIE approach to instructional design to further situate it into this body of work. The first step in the method involves instructor reflection (the Analysis step, akin to Empathy in Design Thinking) to take into account their context and experiences in order to identify a problematic learning outcome and engagement state, and constructively align them. In the Design and Development steps a relevant game attribute is identified that should theoretically facilitate engagement, and an example or source game is found that demonstrates how the game attribute might usefully be applied to the curriculum in the Implementation stage. The Evaluation stage is not explicit in the method shown but would logically include investigations into whether the gamified approach improved desired learning outcomes and student experience of engagement.

Game Attributes were applied to instructional material (curriculum/ assessment) to improve learning outcomes according to our Gamification for Student Engagement framework (Authors, 2021). However, ‘curriculum’ and ‘assessment’ are just two possible antecedents of engagement that may be amenable to gamification and there are many other aspects of a student’s individual and socioeconomic context that are not addressed here. Therefore, gamification of instructional material using this framework is not a panacea that fixes all elements of student engagement. Rather, it is the part that as instructors, we can influence. Furthermore, there are consequences of engagement other than learning outcomes, e.g. satisfaction and a sense of community that may be affected by gamification. Therefore, the potential to gamify other aspects of the student experience to support other outcomes is tantalizing.

CONCLUSION

We have shown that gamification is one approach to instructional design that, in order to be successful, must contain elements of engagement, something that Design Thinking and meaningful gamification have in common. The method of gamification for student engagement detailed here was built on the principle that current best practice must be reflected upon and that instructional design, student engagement, and gamification must be reconcilable if each is treated as an opportunity to provide checks and balances to the other. Building on Hung's contemplation of meaningful gamification (2017), this method demonstrates that the quality of meaning a student derives from a gamified learning experience is dependent on the quality of reflection pursued by the instructor in the gamification process itself. During the development and testing of the gamification example presented here, the instructor's reflections led them to consider the intricate influence of personal values and physical actions (the context) on their instructional design and articulate these as facets of affective and psychomotor/behavioural domains of learning. More generally, instructors found that reflecting on the context of their practice led to great insight into the students' learning experience.

Moving beyond the application of gamification onto learning, the incorporation of engagement literature into ID/ Design Thinking and Gamification theories has the potential to revolutionise practice through clearly articulated relationships between designer input and user experience that impact on outcomes. This approach may be more widely applied to support user engagement to enhance other outcomes (e.g. satisfaction). Furthermore, gamification and ID/ Design Thinking have broad applicability to many other settings, (e.g. see Landers & Armstrong, 2017; Robson et al., 2016), therefore this approach may be applied to disciplines outside learning and education to broaden the evidence base for gamification, something that is necessary for the progress of the field (Hung 2017).

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KEY TERMS AND DEFINITIONS

Affective Domain: The psychological category related to feeling, or affect.

Behavioural Domain: The psychological category related to doing, or behaviour. Analogous to the psychomotor domain.

Cognitive Domain: The psychological category related to thinking, or cognition.

Game Attribute: Distinct game design features used in gamification.

Gamified Learning: The use of game attributes to facilitate learning and related outcomes.

Higher Education: All universities, colleges of technology and other institutions providing formal tertiary education programmes.
Constructive Alignment: Orientation of system components used in teaching: the environment and activities (including the method and assessment approach), in the same direction in order to achieve the learning outcomes.

Instructional Design: Design of instructional material, taking into account constructive alignment.

Learning Outcome: What is achieved through the learning process, organised across five domains of knowledge: psychomotor, cognition, metacognition, affect, self.

Student Engagement: The variable, context-dependent psychological state students experience while learning.