Received: 13 May 2024 | Revised: 19 November 2024 | Accepted: 16 December 2024 | Published online: 7 January 2025

RESEARCH ARTICLE

International Journal of Changes in Education
2025, Vol. 00(00) 1–10
DOI: 10.47852/bonviewIJCE52023413

BON VIEW PUBLISHING

Aligning Gamified Learning Experiences to Learning Outcomes

Kayleen Wood[1,*] and Steve Drew[2]

[1]*Centre for Support and Advancement of Learning and Teaching, University of the Sunshine Coast, Australia*

[2]*Tasmanian Institute of Learning and Teaching, University of Tasmania, Australia*

Abstract: Gamified learning experiences use game mechanics and structures in curriculum and learning activities to engage students with content and scaffold toward intended learning outcomes. Using the domains of Bloom's taxonomy of learning in the cognitive domain to explore the possible relationship between games and learning for application to university learning, links can be made between thinking skills and game types. This paper describes the development of the gamification alignment table and the gamification alignment model, how these were used to design a gamified learning experience (GLE) for the intended student learning outcomes at the first-year undergraduate level, and how they could be used at master's level with different available in-game choices. The gamification alignment table allows learning designers to identify how the pedagogical lexicon matches to existing features of games and therefore can be easily transformed into GLEs. In the gamification alignment model, the six levels of knowledge in the cognitive domain, with pedagogical verbs used by educators and learning designers in planning and designing GLEs, are paired with game types involving different sorts of learning activities. The concept explored in the example GLE in this paper was the accounting and finance threshold concept of the time value of money. This research provides a further link between Bloom's levels and the Australian Qualifications Framework levels and the comparable European Qualifications Framework levels. This novel mapping provides rationale for the linking of game design and learning outcomes and will be of interest to educational designers, as well as academics, with a learning focus.

Keywords: gamified learning experience, gamification alignment table, gamification alignment model, intended learning outcomes, Australian Qualifications Framework

1. Introduction

The post-COVID higher education landscape has increased the need for online engagement in learning. Gamification of learning activities has been on the horizon for some time but there has been nothing to assist the matching of learning outcomes to types of gamified learning experiences (GLEs) and in turn with thinking skill levels required for higher education quality frameworks. There remain barriers and hindrances to the effective use of games in education generally, reported by Sousa et al. [1], as attitudinal, policy, technological, and literacy. They propose co-creation, appropriate selection of games, inclusion of the different educational stakeholders, and promotion of game-based learning training, as strategies to address this gap. This paper provides insight into the appropriate selection and design of games for learning in any area of higher education.

Gamification commonly employs game thinking, approaches, and design elements, which are used in non-game contexts of curriculum and learning activities, with a view to improving learner engagement with content [2] and learning outcomes [3–5]. Hartt et al. [6] use the domains of Bloom's taxonomy of learning to explore the possible relationship between games and learning for application to university learning and sought to make links between thinking skills and game types. Grabner-Hagan and Kingsley [7] rank primary school GLEs by gaming levels using Bloom's taxonomy (bronze – remember/understand/apply, silver – analyze/evaluate, and gold – create) to design quests and activities that scaffolded students to develop complex thinking skills. Hooper [8], on extended game play research, observes that:

> "Games generally include some form of reward system, which is used to create a positive association of success and inform the player of negative or unwanted behaviours. [Games for learning] are a significantly different medium and are far more complex. [Games for learning] utilise computational processing to receive input from one or more players, manage rules and game objects and objectives".

To examine learning design of GLEs, this can be reframed in pedagogical language by substituting the game words for learning words:

> Programs of learning generally include some form of assessment system: summative, which is the positive measure of success; and formative, monitoring learner progress, informing via feedback, and modifying teaching and learning activities to improve learning. GLEs are a significantly different medium and have the scope to be far more complex. GLEs utilize game mechanics and structure to receive input from one or more learners, and allow teachers to manage learning objectives, activities, and assessment tasks.

Fundamentally, learning activities drive student learning toward reaching the stipulated learning outcomes. In GLEs, the learning

*Corresponding author: Kayleen Wood, Centre for Support and Advancement of Learning and Teaching, University of the Sunshine Coast, Australia. Email: kwood6@usc.edu.au

activity is a generative game-based activity, or situated action, still influenced by the beliefs and values of the teacher and the learning designer. By introducing learning design as a fundamental element of GLE design, Lameras et al. [9] describe how learning design features and game properties can be planned, designed, and implemented. They proposed this through a process of reverse engineering learning activities, outcomes, feedback, and teaching techniques together, and matching these to the game attributes of rules, goals, choices, challenges, collaboration, and competition. The distillation of learning occurrences experienced through these attributes can be observed as the learner's game pathway and time spent in-game. Their learning progress is then measured by their accumulation of experience points and progress through levels earned through successful completion of in-game assessment activities. In combination with the representation of content for enhancing learning experiences, this is a gamified curriculum [10].

Gamification places the student at the center of learning where the student learns what they consider important [11], and what the student does is most important. Learning tools and resources are included in-game to achieve specific learning outcomes [2]. In design for learning in the context of a gamified curriculum, the tools and resources of game-like design [12] are game mechanics and dynamics.

Current literature looks at the broad themes of research into gamification in higher education in isolation: learning design, game mechanics [9, 12], linking learning with game attributes [2], education design for games, and engagement and motivation [7, 13]. However, these themes have not been looked at as a cohesive group to map the relationships between games and learning for application to university learning, linking thinking skills and game types. As identified by Alsawaier [14], the gap between theory and practice in the study of gamification persists, with limited research on guidelines for implementation of GLEs. Addressing the gap in current knowledge and application, and used to guide the design of gamified learning in a contemporary higher education setting, this paper describes the development of the gamification alignment table that equates the learning lexicon to gaming terminology. With that as a foundation, the development of the gamification alignment model is presented. The paper then proceeds to show how these pedagogical resources were used to design a GLE to achieve intended student learning outcomes for an undergraduate accounting and finance threshold concept. We then discuss how the model could be applied for use at the master's level.

2. Literature Review

2.1. Learning design of GLEs

The term GLE used in this research encompasses both the gamified structure around the content and the plot-driven narrative – the story that illustrates and carries the content – to describe the pedagogical practice of using gamification for learning. Various researchers writing about the relationship between GLEs, learners, and teachers report a growing interest in the pedagogy of a GLE [15, 16] recognizing "potential and intrinsic educational value but little integration". Elsewhere the emphasis has been on game artifacts and the relationship of the learner with the game to measure "viability and efficacy of games as learning resources".

While, from an epistemological perspective, researchers [16, 17] claim high potential and positive correlation between gaming and learning, there remains a paucity of empirically grounded literature exploring games as teaching tools in formal learning settings; that is, within the constraints of a designed curriculum with teacher supplied resources, to enable measurement and replication. However, "using [only] the fulfillment of pre-defined learning objectives as an effectiveness parameter does not allow developers and researchers to see unexpected and unintended changes in practice that occur as a result of the eLearning program" [18]. There are a few research studies in the current body of literature that present generic gamification designing methods and frameworks [19] and more specific to management economics [20]. Yet to gain a broader understanding of the value of GLEs, the quality of the pedagogical structure and components, as well as the quality of their artifacts or activities, in the learning design needs to be studied. Foster and Shah [21] propose that one of the most prominent areas for discussion is the gap between learner analytics and gamification components.

In the following sections, the current models for learning outcomes, Bloom's taxonomy, digital taxonomy, and the flipped learning model, are discussed as elements for developing a gamification alignment framework.

2.2. Taxonomy of learning outcomes

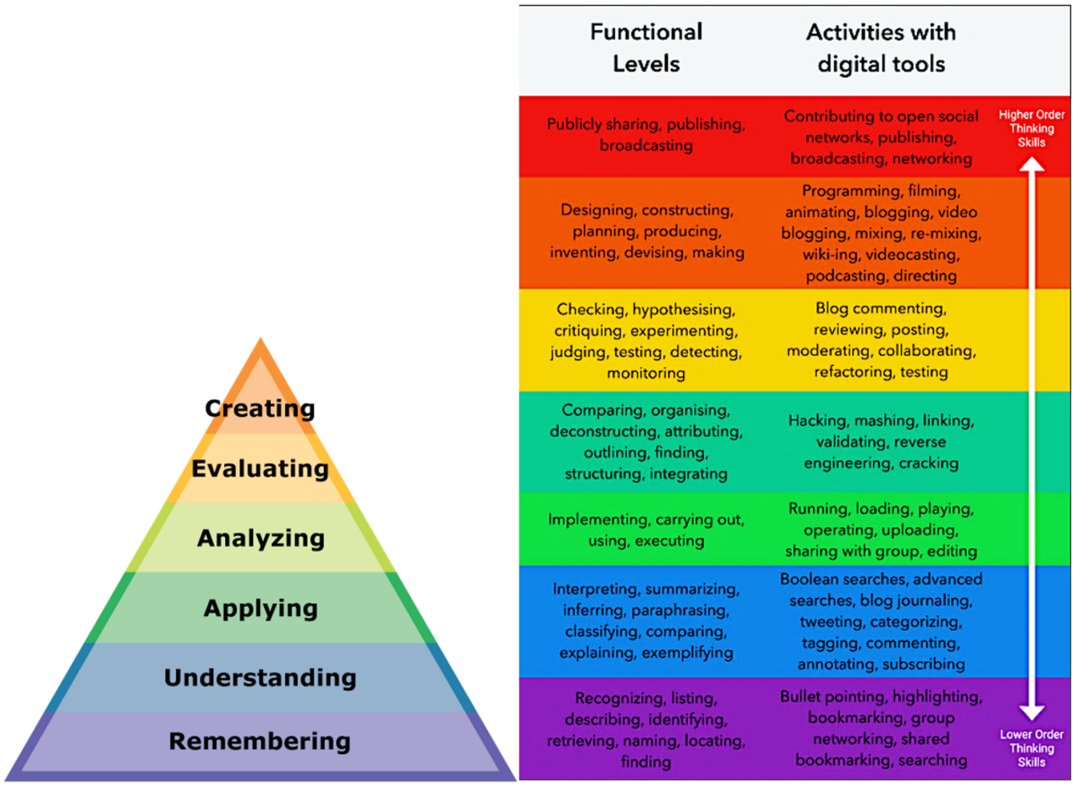
Mapping Bloom's revised taxonomy of learning outcomes (Figure 1) [3, 4] in the cognitive domain (i.e., the intellectual ability to know and organize ideas, using active learning levels) and Bloom's digital taxonomy [5] (which added digital activity related verbs to describe technology processes) to game attributes provides a broad framework of what learning activities, and therefore outcomes are possible. In Figure 1, the functional levels of the learning outcomes are populated with descriptive learning verbs and are shown in parallel with integrated gamified activities that advance learning and knowledge. In addition, Churches provide an extra functional level at the top for publicly sharing, publishing, and broadcasting; desired learning outcomes we see becoming more common as universities adopt outwardly focused graduate attributes around communicating socially just and environmentally sustainable qualities.

2.3. Flipped learning model

Talbert and Bergman [22] theorize that the commonly used triangular model of Bloom taxonomy suggests most learning time and effort is spent in the lower order thinking skills demonstrating learning outcomes of remembering and understanding. In their flipped learning model (Figure 2) for application in undergraduate learning, Talbert and Bergmann suggested the pyramid shape of Bloom's taxonomy should be more like a diamond. Flipped learning is a pedagogical approach where direct instruction is moved from the group learning space to the individual learning space. This transforms the group space into a dynamic learning environment. In Talbert and Bergmann's model most of what goes on in the active or gamified learning classroom is in the middle levels of Bloom's taxonomy of learning outcomes: the Applying and Analyzing bands. These align with Australian Qualifications Framework[1] (AQF) levels 7 (Bachelor Degree) and level 8 (Bachelor with Honours, Graduate Certificate, and Graduate Diploma) (equivalent to European Quality Framework [EQF] levels 6 and 7, respectively) descriptors: where courses are designed to ensure learning to these levels. He therefore shows these middle bands as larger areas to indicate more learning time and effort spent in these learning activities. Lower order skills of understanding and remembering and higher order skills of evaluating and creating are indicated with smaller areas above and below where most of the time and effort is expended.

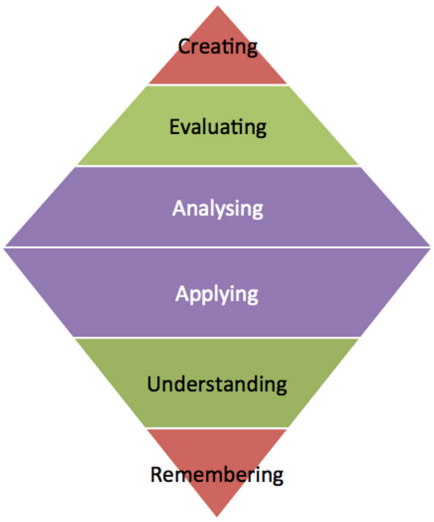
[1]Australian Qualifications Framework. "AQF levels"

Figure 1
Bloom's revised taxonomy of learning outcomes: Existing taxonomy and digital taxonomy



Note: Revised taxonomy triangle [2, 3]. Functional levels [2]. Activities with digital tools [4]

Figure 2
Flipped learning model



2.4. Problem statement

The review of current literature reveals that there is little to guide the GLE designer in the choice of game type or features that facilitate the attainment of defined learning outcomes at levels appropriate for higher education. The gamification alignment table and gamification alignment model were developed, in part, to assist with constructive alignment and the assurance of learning requirements for a professional degree program using game-based learning in an online environment. In institutions where academics collaborate with educational technologists, it provides an important shared touchpoint in terms of language for designing learning through games.

2.5. Development of the gamification alignment table and the gamification alignment model

Social constructivism and cognitive learning theory, encapsulated by Laurillard's [23] conversational framework of the interfaces between teacher and student within the constructed learning environment, were adapted to investigate the research question. This guided an exploration of the interactions and relationships that take place in the GLE, and how these contribute to learner engagement in, motivation for, and performance of learning.

As part of a larger study, a gamification alignment table (Table 1) and a gamification alignment model (Figure 3) were developed. These were then operationalized to create a GLE for the accounting and finance threshold concept of time value of money[2]. Data collection and analysis from the testing of the GLE for learner engagement are reported below. This paper details how that GLE for undergraduate use was designed and mapped to AQF 7 (EQF 6) using the gamification alignment model and suggests how the model could be used to guide the design and mapping of more advanced learning activities at the master's level (AQF 9) (EQF 7)[24].

[2]Southern Cross University. "A Gamified Learning Experience. The Time Value of Money" https://learn.scu.edu.au/bbcswebdav/institution/courseware/projects/Business%26Tourism/TVOM/index.html

Table 1
Gamification alignment table

Pedagogical Lexicon	Gaming Lexicon
Unit/course description	Story
Curriculum	Game map
Learner	Avatar
Learning outcome	Mission
Successful completion of unit/course	Goal
Activity	Challenge
Resources/learning tools	Artifacts
Peers/team-based learning	Team
Formative assessment	Lives
Assessment	Quest
Marks	Trophies
Grade	Score
Student ranking	Leaderboard
Extra activities	Side quests
High distinction opportunities	Bonuses
Discussion board	Chat

With respect to the internationalization of the gamification alignment model, a joint European Union-Australian study examined how by comparison the AQF and EQF could aid in "international cooperation to improve qualification transparency ... and enable confidence around EQF referencing" [25]. The resulting joint technical report produced from this collaborative analysis of the AQF (a national framework) and the EQF (a regional framework) detailed the use of 5 principles for comparison allowing for the similarities of each application to be transferrable. In particular, Principle 2, Comparability of the AQF and EQF and their levels, was directly mapped, and they found the levels of the AQF compared well to the levels of the EQF, with a high level of correlation identified. AQF level notations only are used for the remainder of the paper.

3. Method

To ascertain how game terms and learning terms relate to each other, the primary approach was to investigate literature that describes the lexicons relating to each area. By aligning actions, or verb statements, relating to education learning outcomes for different levels of learning with those for games, a rationale for elements of GLE design was achieved. To test the alignment empirically, a GLE for a business threshold concept was designed and implemented with student learning outcomes and experiences recorded.

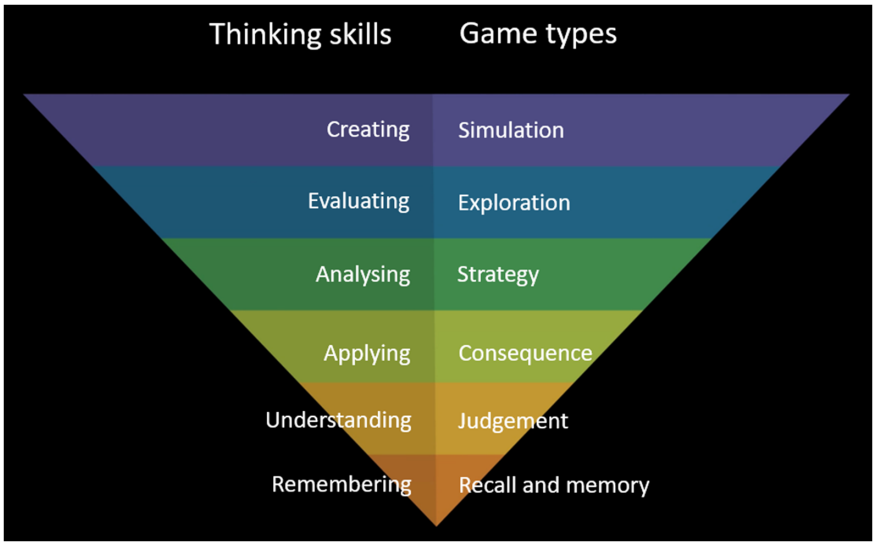
3.1. Language of teaching and learning in gamification terms

Henry et al. [26] group learning mechanics and game mechanics and go as far as classifying them as lower or higher order thinking skills. Lameras et al. [9] have identified the need for "establishing a comprehensive and common vocabulary for describing game-based learning concepts and design features". In another direction, Toda et al. [27] classify just the game elements into dimensions, grouping the game elements themselves into a hierarchy for designing gamification in a broad context. They found the gamification literature still lacked formal definitions to support the design and analysis of gamified strategies. To develop an evaluation and design framework for the GLE, a gamification alignment table was produced, linking gamification, pedagogy, learning design, and accounting education via congruent meaning of terms for elements and structure. This will enable elucidation of how the GLE works for both teachers and learners, identification of which game mechanics optimize learning, and the development of a framework to assist learning designers and teachers.

3.2. Gamification alignment table

Integrating games into a new culture of learning [28] involves coupling game designs, learning principles, student engagement, and learning outcomes, by means of gamification alignment: mapping the elements and language of gaming against curriculum components. For this research, to support integrating games into learning, the following alignment of pedagogical and gaming terminology was created (Table 1). By equating the terms and beginning to think of how gaming can function in an educational context, learning design of gaming as a curriculum entity can

Figure 3
Gamification alignment model



Note: Adapted from Anderson [2], Baer [35], Talbert and Bergmann [22], Bloom [3]

deliver learning synergies through student engagement and motivation [16]. The gamification alignment table allows learning designers to readily see that their pedagogical lexicon can be easily transformed into GLEs because the attributes of learning resource elements match to the existing features of games. Once this connection is made, the development of the GLE is less daunting and more intuitive and obvious.

3.3. Gamification alignment model

While the mapping of the language and terminology results in a gamification alignment table, how game types are matched to thinking skills are shown in a descriptive gamification alignment model. Together these tools identify a way to examine how gamified learning can be described and applied to threshold concepts in accounting education.

The integration of games into the harmonious part of a bigger ecosystem of learning is the combining of game designs, learning principles, student engagement, and learning outcomes. It is apparent that to construct a gamified curriculum requires the cooperation of the content expert, the learning designer, and the digital learner to derive benefit from the synergistic pedagogical practice of using gamification for learning. Sezgin and Yüzer [17] go so far as to propose that both gamification designers and online course designers should have the necessary knowledge and experience to be able to design the algorithm structure in order to bridge the gap between learner analytics and structural gamification components. While this is largely beyond the capacity, in both expertise and time, of most educational designers and academics with a learning focus, a clear need has emerged for where to start and how to make GLEs. Drawing on the research and literature from the fields of games for learning [15], curriculum theory [29], cognitive learning [30], learning styles [31], motivation[32, 33], engagement [34], and the teaching of threshold concepts [35], this research provides a model for designing and evaluating GLEs. This is made possible by using the taxonomy in the gamification alignment table (Table 1) and the gamification alignment model (Figure 3) together.

Research into pedagogical approaches for different learners has suggested that learners in different disciplines may benefit from different learning styles found in games. For example, Egenfeldt-Nielsen et al. [15] define a system of four genres based on games' criteria for success: (1) strategy games, (2) adventure games, (3) process-oriented games, and (4) action games. This fits well in the context of games for learning in which action, thinking, and systemic understanding are clear goals aligned with learning requirements at different levels of thinking skills, in different disciplines. To develop the gamification alignment model, the researcher began by looking at common game types. To understand the commercial game types currently in use, an inspection of business and game producers' sites revealed industrial design company, Allen Interactions', and taxonomy of gaming [36]. Aligned with the thinking skills elucidated in Bloom's taxonomy of learning Baer identifies six types of games for learning: recall, judgment, consequence, strategy, exploration, and simulation games.

To further illustrate the investment in time and practice spent at each level, the researcher incorporated the diamond shape of Talbert and Bergmann's [22] flipped learning model. However, Talbert and Bergman's diamond model only accurately represents volume of learning at Bachelor (AQF7) and Bachelor Honours, Graduate Certificate, and Graduate Diploma (AQF8), the middle levels. Once a learner has achieved AQF7 or AQF8, then the volume of learning needs to be refocused at the next highest level, say AQF9. To accurately represent Master's, the diamond shape was revised so that Evaluating is now the widest band. An analysis of the verbs used in each of the AQF descriptors indicates that there is a normal-like distribution of verbs from different levels with the majority (mode) centered on a particular Bloom's level in the cognitive domain. For AQF7, the majority of verbs relate to the Application level and for AQF8 the Analysis level, and so on. The construction of the gamification alignment model as an inverted triangle, with more area as the levels build, illustrates the cumulative nature of the thinking skills: each successively higher level builds on and incorporates the level/s below so that at any time during higher level activities, lower levels are still being called upon. The lower order thinking skills of remembering, understanding, and applying equate to recall and memory, selection, and consequence games. While these are important foundations for learning, they require and should demand less activity time to embed and master, than higher order thinking skills of analyzing, evaluating, and creating, which equate to games of exploration, strategy, and simulation.

The gamification alignment model is then populated with concepts and pedagogical verbs for use by educators and learning designers in planning and designing GLEs. The game types involve different sorts of learning activities, which relate to thinking skills matched to the six levels of knowledge in the cognitive domain [3, 4]. Ideally, the learning activity prepares the student for success in the assessment, which demonstrates that the student has reached the learning outcome. The six levels were aligned and described as follows:

1) Bloom's remembering level is aligned with games of recall and memorization where students are required to demonstrate memory of already learned facts and concepts by recalling and selecting from presented materials, for example matching terms with definitions. As in Churches' [5] digital verbs for digital processes (Figure 1), digital activities within GLEs include searching, highlighting, and bookmarking.
2) The understanding level is aligned with comparison games, where students demonstrate their understanding of learned facts and concepts by classifying and comparing concepts and ideas, for example choosing the most correct answer from a selection of options. Digital activities performed within these games include tagging, tweeting, and commenting.
3) The applying level matches to games of consequence, where students attempt to solve problems using acquired knowledge in new scenarios through planning and experimentation and then select from the best outcome. Digital activities in these games include playing through, sharing, and editing.
4) The analyzing level aligns with games of exploration which require students to dissect game world scenarios and make inferences about possible choices and outcomes. These are games where students can explore different options within the game to find the optimal pathway or result. Digital activities within these games include cracking, linking, and hacking.
5) The evaluation level matches to strategy games where students need to validate and defend their opinions and choices, making judgments and recommendations based on learned material. These are games where students bring multiple criteria together to prioritize and validate their choices within the GLE. Digital activities within these games include reviewing, posting, and testing.
6) Lastly, creating is aligned with simulation games. These are not just games which utilize the game mechanics to create worlds and characters, but the capstone unit games where students compose and construct the whole of game world using multiple sources of

information and combinations, to propose, develop, test, and theorize all their previous learning. The digital activities used in these games include programming, animating, and mixing. Examples of these type of games are Minecraft and Fortnite, where students/players build more sophisticated avatars and cities as they progress through the GLE, demonstrating a synthesis of their accumulated knowledge.

3.4. Gamification alignment model

To test the validity of the gamification alignment model, the time value of money GLE was created and tested using experimental research. A parallel control group learning experience was created and matched exactly to the GLE using traditional linear pedagogy delivered through a PowerPoint video. Participants were students taking courses housed in the School of Business and Tourism at Southern Cross University and allocated alternatively to either a treatment or control group. After data screening, the sample was $n = 67$: 40 treatment group and 27 control group. The instrument used to test the validity of the model was eLearningGameFlow survey [37]. To ensure accurate, valid, and reliable results and interpretation, the data was measured for validity and reliability, to ensure it met the assumptions about the parameters before it was analyzed using MANOVA.

For testing of the eLearningGameFlow survey's impact on overall learning experience, a 2 × 2 between-subjects multivariate ANOVA was performed on the four dependent variables of the survey: concentration, challenge, autonomy, and immersion. SPSS general linear model MANOVA was used for the analyses with descriptive statistics and $p < 0.05$. The independent variables were entered in the contrast order of control followed by treatment. All other evaluations from assumption testing for normality, homogeneity of variances, linearity, and multicollinearity were fulfilled. Because there were no missing values, each of the multivariate F tests (Pillai's trace, Wilks' lambda, Hotelling's trace, and Roy's largest root) returned the same exact result; therefore, just Pillai's trace is reported and is considered most robust [38]. The MANOVA showed there was a significant effect of the GLE treatment on overall learning experience/engagement regarding the technical threshold concept of time value of money, $V = 0.164$, $F(4, 62) = 3.036$, $p = 0.024$.

The next section of the paper demonstrates the use of the gamification alignment model mapping for time value of money, an undergraduate-level threshold concept, GLE to achieve intended learning outcomes. We then explore how the model can be applied to create GLEs for higher order thinking skills.

4. Discussion

4.1. Undergraduate-level mapped example

This section shows how the gamification alignment model, with the gamification alignment table used as a translation tool to show how terms in games relate to learning and teaching, was operationalized in the creation of a GLE for teaching undergraduates the threshold concept of time value of money. To create the GLE, the researcher used iSpring, an e-learning add-in package for developing training courses in PowerPoint. iSpring enables embedded quizzes, surveys, and interactions including the authoring components (1) iSpring QuizMaker; (2) narration screen recording tool; (3) iSpring content library visuals (templates, characters, backgrounds, objects, and icons); and (4) a publishing interface for output compatible with mainstream learning management system standards (SCORM files). Because the GLE is aimed at undergraduates then the highest learning outcome (or activity) related verbs should be mostly from the Application layer of Bloom's taxonomy. Following the lexicon of the gamification alignment table, the time value of money GLE used a game map for the threshold concept, where the learner's avatar achieved the learning outcome via a mission. Along the way, as part of the story, they completed learning activity challenges which scaffolded their learning, using various resources or artifacts. There were optional extra learning activities as side quests as well as opportunities for formative assessment by repeating sections of the game with additional lives. Assessment was measured via a final quest. Within the applying and analyzing bands of functional levels and activities with digital tools (Figure 1) are finding, comparing, integrating, playing, sharing, and editing.

4.2. The time value of money GLE

Business finance texts [39] universally outline the learning outcomes for the study of the time value of money to be, at the completion of this unit the student will be able to:

1) Explain what the time value of money is and why it is important in the finance.
2) Explain the concept of future value, including the meaning of the terms: principle, simple interest, and compound interest, and use the future value formula to make business decisions.
3) Explain the concept of present value, how it relates to future value, and the use of the present value formula to make business decisions.
4) Discuss why the concept of compounding is not just restricted to money and use the future value formula to calculate growth rates.

These learning outcomes are all situated in the lower order thinking skill of comprehension, with reference to Bloom's taxonomy [4]. The purpose of the GLE for the time value of money is to allow students to demonstrate higher order thinking skills by solving problems and making decisions. These are features of the GLE that can improve on the teaching and learning of the threshold concept. Referring to the Gamification Alignment Model (Figure 3), it can be seen that a GLE to address the learning outcomes for a bachelor's degree (AQF 7) equates to the applying and analyzing bands. The lower order thinking skills are still included in the content of the game to scaffold learning, and the students have the opportunity to demonstrate their learning in the game-based assessment in the final level of the game. The following sections show how the GLE aligned to the model and operationalized the applying and analyzing bands.

4.3. Applying

From the gamification alignment model, the applying level aligns with games of consequence (Figure 3). Here students attempt to solve problems using knowledge already acquired in the game, but to new scenarios. Through planning and experimentation, they select from the best outcome. This works for both active learners who retain and understand information by applying and reflective learners who use thinking and processing. At the end of the game, the game-based learning outcomes assessment, which consisted of eight application and six theory questions, required students to identify values for elements of the time value of money formula, perform calculations applying the content covered, and examples given, in the game, make decisions about optimal choices, and show evidence of understanding definitions and content. Learning outcomes are measured by what a student can do. At undergraduate level (AQF7), this means that

beyond knowledge there must be skills (problem-solving, communicating, analyzing, comparing, etc.,) and the application of knowledge and skills.

4.4. Applying: Time value of money GLE example

To capture the essence of a game and provide a positive learning outcome, the GLE used structural gamification by the application of game elements and content gamification, with the addition of narrative. The mechanics, objects, and tools comprised the structure and defined the actions allowed within the GLE. The learner was still able to exercise autonomy through making choices, investigating alternatives, and collecting artifacts. This was achieved through hyperlinked objects containing hard scaffolds and second chance type pop-up prompts. Meaning is created through exploring in real-world situations that are relevant to the learner. Of the authentic activities that lead to authentic learning, identified by Herrington and Oliver [40], in particular, the GLE incorporated:

1) Real-world relevant activities matched to scenarios encountered by learners: buying a car, purchasing coffee, saving for graduation.
2) Activities that spanned the whole of concept, with formative development scenarios building the time value of money formula toward a final solution as an assessment item.
3) Opportunities to reflect on choices and consequences, by considering implications of alternate actions: The pop-up prompt in Figure 4 – "Are you sure?" – asks the learner to reconsider the choice they made by clicking on waiting until the end of the year to receive money. By clicking on either the alternative artifact – the money bag – or the yellow prompt "Are you sure?", they are directed to additional information about the time value of money.

The evolution of the GLE can therefore be different for different learners, because of the mechanics and structures that determine how the learner interacts with the GLE. For example, which decisions and choices the learner takes, in what order, and how many times, determines their path through the GLE.

4.5. Analyzing

In the gamification alignment model, the analyzing level equates to games of exploration (Figure 3). Here, students dissect game world scenarios and make inferences about possible choices and outcomes. These are games where students can explore different options within the game, without penalty, to find the optimal pathway or result. The game activity is designed according to the desired learning objectives of the curriculum, to produce quantifiable learning outcomes. The game provides multiple choices to demonstrate learning, all potentially as valid as each other. Students pursue solutions to problems by employing the skills of synthesizing, analyzing, evaluating multiple modes of information, and critical thinking skills to formulate strategy, problem solve, and propose new avenues of enquiry [41]. Traditional teaching of techniques can fail to engage learners because content is not contextualized. Learners identify concepts and apply processes but fail to use the higher order thinking skills by not analyzing, evaluating, or questioning what they are learning [4]. Willingness to problematize issues is not developed [35].

4.6. Analyzing: Time value of money GLE example

To support the learner's constructivist developmental processes, the GLE uses built-in feedback mechanisms. Feedback is the consequence of the active learning choice a learner takes relative to the intended goal. The time value of money GLE requires the learner to interface with the digital platform via a personal device anywhere and anytime. It is self-paced and provides immediate feedback according to the pathways embedded in the design of the GLE program (Figure 5). This choice calculates the present value (PV) based on the interest rate offered: $PV = 947.38$. The learner is then immediately challenged to consider sticking with this choice or doing further investigation.

Gamefully designed curriculum will be able to use a cycle of learning something new with scaffolds, using and applying that knowledge independently with immediate reward for performance,

Figure 4
Opportunity to reflect on the choice of "money today or at the end of the year?"

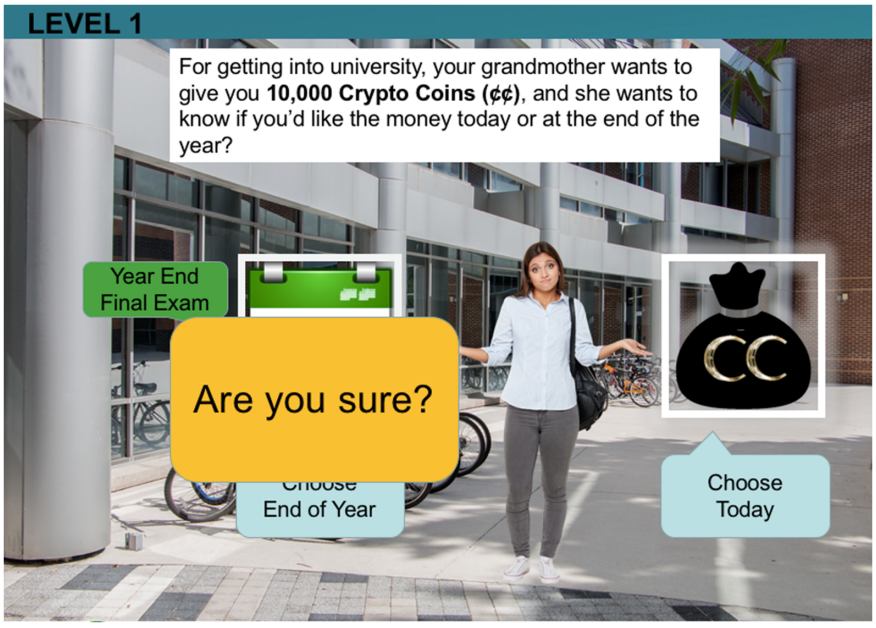
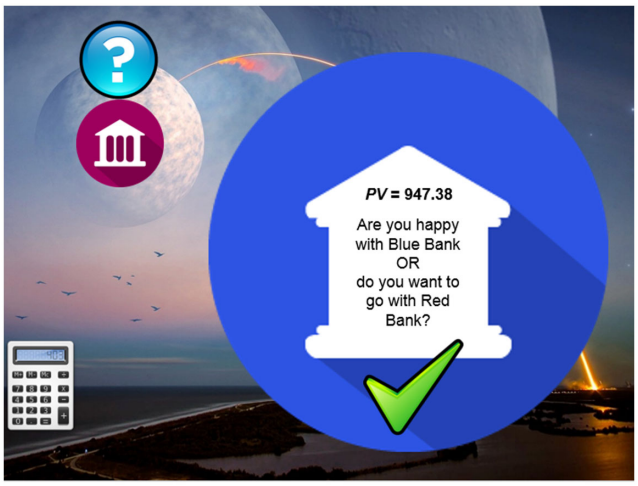


Figure 5
Red bank or blue bank: feedback provided after learner chooses blue bank



building on recently assimilated skills, and taking on increasing challenges where higher order thinking skills of analyzing, evaluating, and creating are evoked.

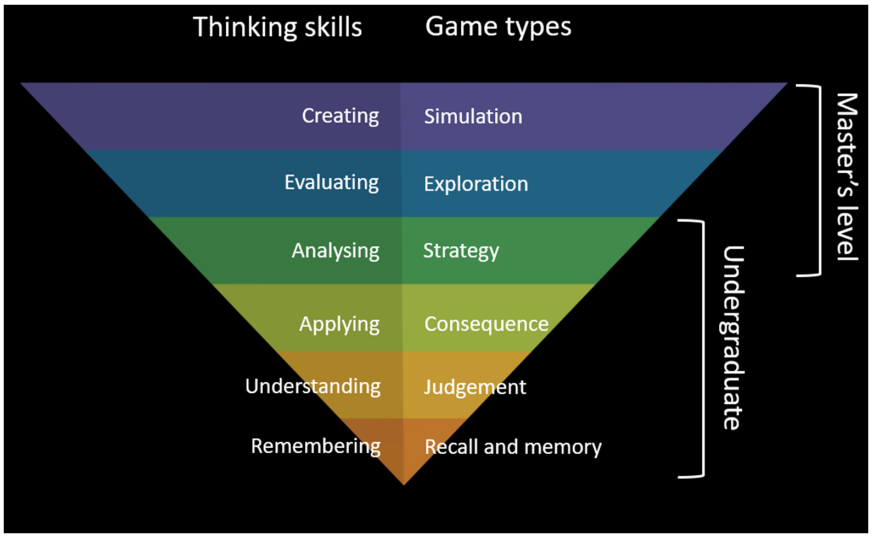
4.7. Master's level mapped potential example

Using the gamification alignment table and model to inform the learning design, the GLE can be adapted to elevate the time value of money GLE to master's level learning. Changes to in-game activities and assessments might be effective to focus on higher level learning outcomes. At Bachelor level (AQ7), students applied and analyzed information in self-directed learning activities (Figure 6). At master's level (AQ9), students are required to also demonstrate critical analysis and evaluate and interpret information. This evaluation level matches to strategy games in the gamification alignment model (Figure 6) where students synthesize more complex information and both apply and communicate their knowledge, to validate and defend their opinions and choices, making judgments and recommendations based on learned material. These are games where students bring multiple criteria together to prioritize and validate their choices within the GLE.

Students at this level often have professional knowledge and experience and in general are more advanced learners. An expectation might be that they will scale up to higher level learning outcomes more quickly than an undergraduate student. Game content and activity types accordingly change for students with cognate knowledge of an area of study. The focus is on evaluation-level learning and includes features relating more to strategy games where the student demonstrates autonomy, expert judgment, and responsibility as a practitioner not just a learner. Gamification at this level can use role playing in multi-player complex scenarios, where students are presented with practitioner-type scenarios, for example, choosing between two or more parcels of share or annuities, to advise a client.

While this paper reported on the creation and refining of replicable tools for mapping and creating game-based pedagogical resources, using accounting and finance as an example, the gamification alignment table and model are discipline-agnostic tools for matching intended learning outcomes to game design. It will readily translate into design of GLEs for concepts, threshold or otherwise, in other disciplines at higher education level, with the potential to move into broader andragogy and heutagogy in workplace-situated learning. The gamification of learning the concept of time value of money in business studies is extendable to learning about differentiation and integration in engineering mathematics, or statistical methods in psychology, or recursion in computer programming. Recently, Trinh et al. [42] report on the use of gamification of a graduate-level statistics course for graduate management education. They demonstrated how gamification was used in the difficult, but essential, subject of statistics, to provide an easy entry into digital literacy for graduates, resulting in a fun, low stakes pedagogical resource which yielded positive results. Such is the potential for gamification to achieve positive learning experiences, we now see Master's degrees being offered in educational gamification

Figure 6
Undergraduate and master's level GLE positions on the gamification alignment model



(e.g., University Euneiz offers Master's Degree in Games, Gamification, and Technology applied to Education)[3]. The key advantages that the gamification alignment table and model provide are a way to choose appropriate game types that will facilitate achievement of learning outcomes at the appropriate level and a shared touchpoint for both curriculum and pedagogical designers and educational technologists in the construction and testing of learning experiences.

Future research relating to the applicability and effectiveness of the gamification alignment table and model would be to confirm their discipline-agnostic nature and explicitly test their generalizability to other areas of learning. Such research might include the evaluation of the experiences of academics, educational designers, and educational technologists who collaborate on creating the GLEs. While using games as learning experiences is broadly applicable to a range of students, future research into assuring accessibility and their limitations with respect to universal design for learning would be a valuable addition.

5. Conclusion

While acknowledging the existence of gamification frameworks, contemporary research has not focused on the gamified learning context in higher education. This research further supported the integration of games into university level learning by aligning the gaming language to corresponding pedagogical terminology at a granular level, to assist with GLE conversions and game builds from conception. As a product of our research, a gamification alignment table was created to link the pedagogical and gaming terminologies coupling the elements and language of gaming against curriculum components. Equating the lexicons allows and encourages learning designers and educators to think of how the GLE can function in an educational context. From this vocabulary alignment and through the experience of the GLE designing came the recognition and communication language for a cooperative relationship between the content expert, the learning designer, and the digital learner to construct an optimal GLE. For use in conjunction with the gamification alignment table, a gamification alignment model was developed that can assist learning designers and teachers to match the types of games to deliver different GLEs. This aligns with the thinking skill levels of Bloom's [4] taxonomy of learning. The gamification alignment model, populated with concepts and pedagogical verbs, can be readily used by educators and learning designers in planning and designing GLEs in any discipline area. We demonstrated how the application of the gamification alignment table and model could be focused on learning at different AQF and the corresponding bloom levels using the time value of money GLE as a learning example for undergraduate AQF7 level and the potential for adaption to the master's AQF9 level.

More and more is expected of online course designers in the higher education sector to create pedagogical resources that have a positive effect on student engagement with the learning experience while meeting their needs using critical thinking in the digital space. The gamification alignment table and model presented in this paper will assist in the necessary knowledge and ability for the creation of such resources. Further, they provide mapping such that student learning can be assured for higher education regulators and professional accrediting bodies. Subsequent GLEs will continue to be guided by the question, "How do we make the games where the learning can happen?"

[3]EUNEIZ. "Master's Degree in Games, Gamification and Technology applied to Education." https://www.euneiz.com/en/masters/masters-degree-in-games-gamification-and-technology-applied-to-education/

Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

The data that support the findings of this study are openly available in UniSC Research Bank at https://doi.org/10.25907/00887.

Author Contribution Statement

Kayleen Wood: Conceptualization, Methodology, Software, Validation, Formal analysis, Validation, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Project administration. **Steve Drew:** Conceptualization, Investigation, Writing – review & editing, Supervision.

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How to Cite: Wood, K., & Drew, S. (2025). Aligning Gamified Learning Experiences to Learning Outcomes. *International Journal of Changes in Education*. https://doi.org/10.47852/bonviewIJCE52023413