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Gamification Design Elements in Business Education Simulations

Torsten Reiners
School of Information Systems, Curtin University, Australia

Lincoln C. Wood
Auckland University of Technology, New Zealand & School of Information Systems, Curtin University, Bentley, Australia

Sue Gregory
University of New England, Australia

Hanna Teräs
Curtin University, Australia

INTRODUCTION

While there are many teaching methods available to modern educator, here we focus on one: the use of computer-based simulations. These simulations can be designed to effectively support business education in the Higher Education Sector (HES). Careful use of both information systems and technologies can create an immersive, engaging, and authentic environment in which learners are encouraged to participate in the educational process and therefore have higher knowledge retention from the learning process; it is well known that students retain more information when immersed in activities than they do from lectures.

It is nearly impossible to reflect the complex, diverse, and multi-faceted nature of real-world businesses in a classroom using textbooks and lecture slides. Multiple organisations are deeply interlocked within a supply chain and decisions can have unexpected consequences; changes to the system can have a destructive outcome with immense capital loss. The system is influenced by external factors; e.g., weather, accidents, or market shifts. Even if we assume that a decision could be based on a complete understanding of all variables including a deterministic prediction of the future, it would not be applicable as the transaction costs generally exceed the benefit. Still, business education has to train the skill to make good decisions. Simulation allows us to immerse the learner; including stressful situation as it is the case with pilot training. It is crucial that the learner realise that decisions have to be made within short times with the danger of major (positive and negative) impacts; resulting in crashing a plane or causing a loss of millions of dollars and the lay-off of employees.

Simulation models are successfully used to train learners in business education. Nevertheless, we will demonstrate that simulation must encourage the learner to be engaged and motivated to explore the solution space being defined by the large variety of possible decisions that can be made (Jackson, 1959). Games provide an environment in which learners are encouraged to become better with every round, and failure is considered to be a learning tool rather than a risk for the survival of the business. Goldsmith and Mann (1948) created the first electronic game with the objective of hitting targets, reasoning that "skills can be increased with practice and the exercise of care contributes to success" (Goldsmith & Mann, 1948, p. 1). The games are often judged by experienced referees and focus on decisions that affect the day to day management operations of an organisation. Executive games and specialised decision-making games that deal with production scheduling, inventory control, and negotiating are discussed in detail. We assert that using these games in management training programs increases the work quality.

This article addresses the use of simulations in business education by discussing the role of authentic learning, gamification, and game-based elements in

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the simulation design. Together, these elements can significantly enhance learner enjoyment while boosting learning and training outcomes.

SIMULATION DESIGN TO SUPPORT EDUCATION OUTCOMES

Simulation design is an important topic in contemporary education as the use of simulations has increased in popularity. It engages learners and provides new approaches to learning, extending existing active learning approaches (Wood & Reefke, 2010) and can be used in classrooms or between lessons. Simulations take many forms, from token-and-paper-based simulations to elaborate, virtual-worlds-based simulations. These approaches are not without controversy as, over the last decade, virtual worlds have struggled to distinguish themselves as distinctly different to 'games' (Constable, 2008) and mature enough for serious simulation (Wriedt, Reiners, & Ebeling, 2008). Gaming has been used to "aid the development of subject knowledge and learning collaborative skills such as problem solving and teamwork" (Edmonds, 2011, p. 20). An example of simulation in higher education settings would be when one is studying to become a surgeon. When a surgeon makes an error in a real surgery room there are serious consequences. However, if one were to train using simulations that are authentic (compared to theoretical learning material or studying on a corpse), where it is perceived to be a real life training environment, then learning occurs without negative consequences (Brookes & Moseley, 2012) .

Businesses have set up in virtual worlds in order to increase their profits and HES institutions have used virtual worlds to demonstrate business management in authentic settings. Carr (2007) discusses how many business organisations have ventured in to the virtual world of Second Life in order to sell their products. HES institutions have followed suit to teach their students models of business in a virtual world without minimal outlay. Southern Cross University created several islands in Second Life to teach authentic business skills. Ellis, Hassett and Rowe (2009) describe the creation of an authentic virtual world based on their real campus, enabling students to interact with the tools in the island as they are able to on the real campus. They also house a 'Commerce Town', used in business simulations (Gregory, Lee, et al., 2010).

Authenticity

Authentic education is a pedagogical model based on learning occurring within environments where practices and actions replicate those found in true-to-life situations, forcing learners to engage with similarly authentic materials and responses before receiving valuable feedback (Herrington & Herrington, 2006; Herrington, Reeves, & Oliver, 2010). Authentic learning is a complex integration that is profoundly different to traditional educational approaches; careful design processes are required that addresses all of design, creation, acquisition, presentation, evaluation, and assessment methods and strategies that may be used. The approach is valuable in contemporary education as it enables an environment to mould learners in a way that the information is transformed into knowledge, supported by complex communication, reflective judgement and expert thinking. Furthermore, traditional instructional education fails to address the higher levels of cognitive, affective and conative domains (Snow, Corno, & Jackson, 1996), which can be overcome with effective authentic business simulation. Authentic learning is contextual learning - that is, putting the learning into context. Authentic learning through gamification enables the learner to make mistakes in context without the real life consequences (Brookes & Moseley, 2012). Scaffolding takes places so that students learn before learning with real subjects or activities (Brookes & Moseley, 2012; Gregory et al., 2011).

Nine essential determinants describe authentic learning (Herrington & Oliver, 2000): authentic context, authentic tasks, access to expert performances, multiple perspectives, collaborative knowledge construction, reflection, articulation, scaffolding and coaching, and authentic assessment. Such learning is strongly influenced by the learning environment (i.e., the scenario that the instructor has selected to support the learning and the needs that are driven by this choice) and the established structures of educational institutions that were usually established for a different educational era (e.g., the industrial or post-industrial economy). Authentic educational design requires access to appropriate processes and resources (e.g., suitable training for instructors, adequate technical facilities, faculty buildings, supporting learning materials, and new quality assurance processes) and the inclusion of appropriate roles within the learning process (e.g., educational technology experts and instructional designers).

Simulations provide appropriate context in support of authentic education, supporting groups and individuals to learn in realistic representations of real-world systems as they grapple with responding appropriately to given scenarios and business processes. This is valuable where the process involves subtle and elusive interactions between groups, such as those involved with new product development (Wood & Lu, 2008) and may be supported with additional resources; e.g., lectures from world-class institutions, slides, podcasts and educational blogs. The ability to change to another role in the simulation promotes discovery of multiple perspectives on outcomes and events, as perceived by different roles in the company (Tanner, Elsaesser, & Whittaker, 2001), aiding education as "a multitude of perspectives to enable students to examine problems from the point of view of a variety of stakeholders is more conducive to sustained and deep exploration of any issue or problem" (Herrington & Herrington, 2008, p. 71). Provision of multiple roles supports understanding of issues and, by extension, the solutions that are appropriate, otherwise unobtainable as many modern business processes involve interactions between individuals, groups, and companies (Wood, 2011), which are difficult to observe.

Effective use of authentic education will reflect the two key authentic learning lifecycle phases: design and evaluation. These are supported by the development, assessment and implementation processes. In the past, the assessment processes have been poorly implemented. However, effective design enables learners to capture the advantage of collaborative knowledge construction which rarely occurs unless encouraged by authentic assessment (e.g., Teräs, Leppisaari, Myllylä, and Vainio (2012)). These two elements tend to be weakly represented in traditional computer assisted learning approaches (Leppisaari, Herrington, Vainio, & Im, 2011). On the other hand, learning environments based on simulations and virtual worlds seem to carry significant potential in enhancing collaborative knowledge construction (Teräs, Myllylä, Kaihua, & Svärd, 2011). Authenticity can be developed by mimicry of real-life complexity within a simulation. This needs to include scenarios that support exchange of information (between the learner and environment) and repercussions/effects/reactions, and game-based mechanisms (Reiners, Wood, Chang, Guetl, Herrington, Gregory, et al., 2012).

Gamification

Gamification is "the use of game design elements in non-game contexts" (Deterding, Dixon, Khaled, & Nacke, 2011, p. 10) to achieve specific outcomes while making "non-game material more engaging in order to encourage engagement in activities that might otherwise seem routine and boring" (Edmonds, 2011, p. 20). One can gain points and status by completing tasks (Smith-Robbins, 2011). The HES used rudimentary gaming techniques for centuries - providing rewards (i.e., assignment marks) culminating in graduation. There needs to be a goal [outcomes], obstacles [intellectual challenges], and collaboration or competition [classmates or faculty] to be a game (Smith-Robbins, 2011). Incorporation of gamification principles in education can significantly improve outcomes through greater engagement in a traditional classroom environment (Cronk, 2012; Landers & Callan, 2011) and the same principles can be used to enhance business simulations (Wood & Reiners, 2012) supporting active learning.

Martens and Maciuszek (2013) discuss the need for genre conventions when designing games. That is, knowing the "essential game mechanisms of an adventure game" (p. 25). Gamification requires the player, culture and computer game to intertwined (Egenfeldt-Nielsen, 2007). Games need to be tailored to the learning outcomes and should be blended with other curriculum and practice. There are several types of games: *Serious games* raise awareness of issues, develop crisis response skills, improve organisational management skills, and develop social skills; Alternate reality games make reality engaging, Social games use social network relationships to teach life skills and community building; and simulations where learners experiment with issues without real-life consequences (Edmonds, 2011, p. 22)

There are several ways to describe gamification systems and the constituent elements. Here we adopt the classification of Werbach and Hunter (2012), where a gamified system is comprised of components, mechanics and dynamics. This overview describes a selection of gamification elements (intention, dynamics, mechanics, and components); see Werbach and Hunter (2012), Wood and Reiners (in review), Reiners et al. (2012) and Reiners et al. (2014) for further details.

Intention describes the wider context with particular outcomes that the system designers desire to encourage and support with gamification. Objectives may be related to classic key performance indicators (e.g., revenue); but may include other targets (e.g., social engagement or becoming environmentally sustainable). The objectives and intended key outcomes must be clearly decided in advance. Failure to do this may result in the design and use of game-based elements that compel some users to become more engaged while driving other users away, or providing a disincentive for new users to become involved in the system. Intentions are the most abstract in gamification, the other elements are *dynamics*, *mechanics*, and *components* (from abstract to concrete).

Dynamics consist of the dynamic interactions amongst learners and game objects. Dynamics are relatively abstract and are largely based on the behaviours exhibited by the learners within simulations.

- **Emotions:** Are often driven by their engagement within the system. Most pertinent is a sense of curiosity to effectively drive and motivate further self-directed learning. In a business context, competitiveness and cost reduction could be two dynamics that trigger emotions.
- **Narratives and storylines:** Are elements supported by a long tradition in successful video game use. They draw users into a moving river of events and encourage intense participation to reach a sequence of objectives, while the narrative provides scaffolding to support enthusiasm for progressing further; see Reiners et al. (under review). Using scenarios supports instructors in educational settings (Masters, Gregory, Dalgarno, Reiners, & Knox, forthcoming) and should be customisable to facilitate creation of flexible situations enabling a progression of difficulty. Appropriately sequenced and suitably developed instructional materials improve educational outcomes (Aly, Willems, Noortgate, & Elen, 2012).

Mechanics relate to the evolution of a specific component or on-going and repeated interactions within the environment. These elements are driven by algorithms that enable effective analysis to derive measures of success, rapid response, and feedback to support the desired dynamics.

- Stochastic and random elements provide a sense of uncertainty that, when mixed with the prospect of positive outcomes (e.g., revenue) is strongly connected to positive feelings. In business education this may be related to the development of markets, customer behaviour, machine failures, and environmental influences like weather or nature disasters.
- Feedback on success and progress can be provided through the provision of scores (requiring appropriate use of components); messages, tips, and hints; other visual displays or methods of representing information that can support a sense of progress. These may take metaphoric forms such as an image of a tree that grows with success, or shrivels and dies if success (e.g. measured by profit) is not forthcoming (Cronk, 2012). Hints and tips can help learners to frame their thinking constructively through the narrative (Reeve, 2011; Wood & Reiners, 2013); they aid learners in finding alternative ways to approach and solve problems in complex scenarios. Feedback must be framed constructively and allow learning from mistakes and reflection on what can be done better by listening to others' experiences and reading books or articles (Young, 2008). Simulations support learners making significant mistakes that would detrimentally impact a business, while allowing learners to face the outcomes of mistakes and learning from them leading to increasingly self-confident learners (Zulkosky, 2012, p. e32) better prepared to face a real problems. Learning learn from mistakes has long been considered vital in education and training of medical practitioners (Aron & Headrick, 2002; Burhans, Chastain, & George, 2012).

- Resources are items or objects that learners can acquire and use to support completion of challenges. These may be used, consumed, and even traded between learners as appropriate to reach objectives.
- Transactions can occur directly between learners as individuals or groups seek to acquire resources (i.e., through bartering) or information that will support progression in challenges.
- Learning tasks or objectives should not focus on the goal itself, but on encouraging the use of specific skills to attain the goal (Malone, 1980, p. 162). Objectives and challenges designed hierarchically can stretch, extend, and expand learners' skill sets. This engages over the long-term and ensures retention of motivational factors, by matching the simulation requirements accurately with the learners' abilities.

Components are the simple and basic building blocks that form the basis for system construction; gamified systems are a construct of specific (and not necessarily exhaustive) selection of components. These are selected to support the mechanics and dynamics of the designers' intentions.

- Points provide a measuring system that enable tracking of progress and can be easily connected to specific learner outcomes. They provide a simple quantification of success.
- Badges are awarded for specific and well-defined achievements and represent success and attainment. These are flexible and are a convenient supplement to points; even new learners in the simulation can quickly obtain badges so that they can quickly get some recognition. Furthermore, they can be used to stimulate self-directed learning in a more flexible.
- Leaderboards to allow comparison between different learners by displaying a list of learners and points. These allow an individual to judge, compare, and measure their success against a quantitative benchmark. The leaderboard may not display all learners' results, so as to protect new learners from realising just how close they are to the "bottom" of the leaderboard.
- Levels of difficulty must increase through task progression to ensure that interest is engaged with tasks that are adequate to the learner's ability and to ensure that they are continually stretched to achieve outcomes. Levels must be staggered as a reasonable "staircase" of success, and not jump significantly, leaving a learner feeling overwhelmed. Given tasks must be considered essential to a given objective, provide a learning outcome and should match an appropriate level of difficulty and be adapted for learners to accurately reflect their progression. Levels should have obstacles that must be overcome to reach the goals (Mungai, Jones, & Wong, 2005, p. 3), complete with methods of measurement to assure learners that they have reached objectives appropriately. A knowledge base with details about the workings of the simulation can help prevent learners from feeling overwhelmed and support rapid advancement without feelings of frustration (Irvine, Thompson, & Allen, 2005, p. 3), particularly as new challenges arise with higher levels of sophistication in the difficult levels.
- Virtual goods are resources and assets that are valuable to learners. They may confer advantage, support progress, or strengthen a sense of individualism.

Game-based elements are extremely valuable in business simulations, but are not included in the commonly used definition of gamification (Reiners et al., 2012).

- Awards incentivise particular behaviours or outcomes. These may be positive, encouraging an occurrence (e.g., providing an award for an outcome achieved in a group, to encourage collaborative efforts), or negative, encouraging certain outcomes to not occur (e.g., an award for trading resources).

- Ghost images within a machinima (a recording created in-world) can record an expert demonstration or a learner's effort in a way that it can later be played-back and observed by learners. This supports a future-proofed record that captures expert knowledge and how they respond to scenario-specific events to support future learners. Alternatively, individuals can monitor the outcome of a previous attempt to learn where key errors in judgement were made.
- Multi-player aids learning, yet early business simulations and virtual world learning environments lacked the collaborative experiences that could be unlocked with multi-player environments. Emphasis on single-user has resulted in undesirable dropout rates and poor learning quality due to learners' sense of isolation, procrastination, difficulties in self-regulation to progress and a paucity of communication channels (Bernard & Rubalcava, 2000; Guetl, 2008).
- Non-player characters (NPCs) are scripted bots that enable authentic and effective simulation of characters that learners can interact with. This is detailed in a following section.
- Rewind allows a player to repeat crucial moments and provides the opportunity to build confidence in their ability to manage specific scenarios or outcomes. It can also 'reset' a scenario; e.g., if items have been unsuccessfully or unsafely moved between two points, the learner can reset the items to their initial configuration to allow another attempt. It is therefore necessary to restart an entire learning module but merely rewind to recommence a specific learning task.
- Save points in computer games are associated with the conclusion of a phase in the game (e.g., following attainment of an objective) or at the start of a new, challenging phase. In educational contexts a save point allows a particular point to be quickly and easily revisited at another point or to allow a learner to restart a learning sequence if they fail part way through. This encourages learners to take breaks in their learning activities to prepare for the next phase while signalling the significance of achievements.
- Slow motion enables time to be adjusted to assist comprehension of processes that may otherwise imperceptible; e.g., a newspaper press process can be slowed to allow an observer to see the complex movement of paper
- Unlimited lives allow learners to take risks and try new approaches to problems. In some real scenarios the risks of injury, death, or catastrophic financial loss cannot be excluded, making a simulation with the ability to have multiple opportunities attractive. Authenticity requires training in extreme scenarios; yet, real-world training cannot provide these opportunities as they occur infrequently and the results are often too significant for a learner to be entrusted with managing the process.
- Unpredictability removes the sense of repetition and boredom and there are four key mechanisms for implementation Malone (1980, p. 163). Variable difficulty levels, selected by the learner, determined based on their progress or based on an opponent's skills. Multiple level goals, to challenge talented learners where similar challenges may require different approaches; points and fast responses support this. Hidden information revealed progressively during the narrative increases curiosity and creates compelling questions for learners that enhance their critical thinking skills. Finally, randomness is the inbuilt uncertainty regarding outcomes, such as the uncertainty about which number will result on the throw of a die.

Authenticity Supported by Non-Player Characters

Learners can progress more quickly and understand content better through appropriate support and guidance, often through providing hints and tips that give alternate perspectives. However, instructor support is not always available. Here, the use of programmed, automated, scripted object in a simulation is a 'bot' which can become a NPC where appropriate responses can be anticipated and planned to give the semblance of a suitable level of artificial intelligence (Wood & Reiners, 2013). Martens and Maciuszek (2013) present an eight-degree scale of automation in virtual worlds: "(1) The computer offers no assistance; the human must do it all; (2) task; (3) the computer selects one way to do the task, and (4) executes that suggestion if the human approves, or (5) allows the human a restricted time to veto before automatic execution, or (6) executes automatically, then necessarily informs the human, or (7) executes automatically, then informs the human only if asked and (8) the computer selects the method, executes the task, and ignores the human" (pp. 26-27).

Furthermore, NPCs support a more realistic feel to the simulation, enable automation, and strongly support authentic simulation environments (Masters et al., 2012). The design process requires a thorough understanding of the simulated environment, culminating in a map of what actions learners will be required to undertake and what appropriate reactions (from the environment, considering other, non-learner people and objects to be part of the environment) will be required. These reactions are modelled as learner-bot interactions with various NPCs developed to expand instructor capabilities while enabling the simulation to reflect real-world practices, equipment, and facilities that the learner will face in a real environment. As an example, authentic simulations, such as VirtualPREX - virtual professional experience (Gregory et al., 2011; Masters et al., 2012) use a series of scenarios and realistic interactions in a virtual environment. VirtualPREX provides three different scenarios in virtual worlds are useful in teacher training (Knox & Gregory, 2012). First, learners view Machinima of teaching lessons with authentic, assessable tasks from an educator or student's point of view (Masters, Dalgarno, & Gregory, 2012). Second, learners engage in role-plays where pre-service teachers act as the teacher or student during a lesson where roles are broadly scripted for primary school students to be either "on task" or "off task" (Masters, Gregory, Dalgarno, Reiners, & Knox, forthcoming). Finally, bots/NPCs allow pre-service teachers to practise their teaching skills asynchronously with bots that are either programmed to be "on task" or "off task" (Reiners, Gregory, & Knox, forthcoming).

Complex simulations allow instructors to increasingly challenge learners, while exerting control of a range of factors that are difficult to simulate in real life (e.g., working with toxic materials) or cannot be controlled (e.g., weather). Then, internships provide learners the opportunity to consolidate their knowledge while remaining under close supervision (Reiners & Wood, 2013). In contrast, simulations often have a single level of challenge; e.g., the Beer Game (Sterman, 1989) presents a highly abstract supply chain with a limited focus and a single scenario which allows few parameters to be changed and NPCs are not available. Several simulations in business education include:

- The Beer Game (or Beer Distribution Game) was developed by MIT in the 1960s and has been used globally. It illustrates challenges and the way that specific structures create or influence the development of specific behaviours. The small supply chain consists of four firms, one product, and a single change in demand from the consumers. Feedback is provided to students based on the amount of inventory that they can see and they can track their costs associated with this. Play may occur several times using different parameters to help learners recognise key lessons.
- Capstone (Smith, 2013) is used by many business schools to develop team-based, cross-functional alignment as learners develop and enhance the firms' strategic positioning. Significant levels of feedback are provided to students as they work through the simulation with a high degree of authenticity in reports provided to the learners.
- The Fresh Connection uses the Internet to enable a team-based approach to managing operations and supply chain decisions in a firm. Learners soon recognise that almost any decision will impact one of their teammates. Multiple forms of feedback are provided with authentic reports as they might be found in business environments. Time is compressed so that a single turn encompasses six-months of business. Leaderboards and ranking systems allow comparisons within the group and between groups. Stochastic elements include random demand and 'shocks'; e.g., a disasters at the supplier. As the simulation progresses,

more options become available and the difficulty level is raised.

- Blackstone/Celanese by Harvard Business Publishing (El-Hage & Luehrman, 2011) allows students to competitively re-create the 2003 corporate acquisition of Celanese AG by Blackstone Group, a private equity group. In addition to an authentic re-creation of the scenario for role playing, this leads students to develop capabilities in due diligence within mergers and acquisitions including extensive financial analysis; the underlying process of evaluation, which the key decisions are directly influenced by; and negotiation, including online-supported chats.
- Hamburg Harbour Simulator focuses a single learner narrowly on port logistics. The splendid 3D graphics and realism create a high level of authenticity, with significant feedback data provided. However, time compression is poorly developed, forcing play to extend for uncomfortable periods at time during slow-moving periods.

All of these simulations were crafted using appropriate visualisation techniques. Those focusing on managerial decision-making emphasised the use of reports, reflecting authentic activities and replicating the real-use of the data within the reports. However, the physical flow and spatial relationship of elements can also be important (as in the Beer Game and the Hamburg Harbour Simulator), where appropriate 2D or 3D visualisations are incorporated. Suitable amounts of feedback and leaderboard ranking systems are used. In all cases there is little development of support for both individual and group-based learning. The better-managed or financed examples include extensive training materials and support for instruction. Most that are used in instruction tend to have very strictly controlled narratives with only a small range of actions available, artificially limiting learners' options in a way that may reduce motivation to explore different approaches to the problems. Few simulations provide the opportunity to develop an appreciation for management from multiple perspectives.

FUTURE RESEARCH DIRECTIONS

Technology has changed the role of simulations in business education to move from relatively abstract simulations (e.g., the Beer Game) to extremely educational and immersive simulations in virtual environments (e.g., VirtualPREX - virtual professional experience). At present, most business simulations in virtual environments remain difficult and non-intuitive to control. Fertile research in the future will focus on improving user engagement in simulation through enhanced interaction with the simulated environment and increasingly natural controls. Recent gaming technology has seen movements in this direction, with the use of motion-sensing devices such as the Xbox 360 Kinect system. Module design of simulation scenarios enabling individual instructors to rapidly and significantly change the simulation settings remains elusive but the impact on simulation use in education would be significant.

Games and simulations imply rules defined and often restricted to by the creator and developer of the system; offering learners a secure and focused environment for their learning experience; but also less opportunities to explore and discover further elements. Board games are restricted by their means as the board and other game pieces are created for the objective of the game. Simulations allow for more flexibility, but for the developer and not the learner; creating a new scenario would require knowledge beyond the scope of the learning unit. On the other hand, immersive virtual environments often include the development tools such that creating objects and associated functionality can already be achieved after a short introduction into the topic (Gregory, Reiners, & Tynan, 2010). The instructional designer obtains more options to create scenarios and even include the learner; while keeping freedom and guidance for the learner in balance for a successful learning outcome (Dron, Reiners, & Gregory, 2011).

CONCLUSION

Simulation approaches have changed rapidly since 2000, with a shift towards extensive use of computer-based approaches to improve business education simulation. Virtual environments can significantly improve the authenticity of a business simulation in support of authentic learning. Gamification and game-based elements can improve learners' engagement in the simulation, driving them to achieve more, learn in their own time and at their own pace and can significantly improve the outcomes that they achieve. Incorporation of learning elements can further improve the design and useability of simulations. Finally, simulations have a particular role to play in education and are thus not appropriate for all types of learning in all situations. We contend that careful consideration of these elements in the initial phases of business simulation design will enhance long-term flexibility of the simulation, increase the ability of instructors to make use of the simulation, and aid learners in attaining superior outcomes from the use of the simulation.

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KEY TERMS AND DEFINITIONS

Business Simulations: Representations of real-world processes and activities that provide appropriate context in support of authentic education. The use of computers, information systems, database, and algorithms enable a high degree of realism in educational simulations.

Component: Individual building-blocks that are combined in various ways to gamify a system; individually, these may be found in games in support of an overall structure, but are they are not necessarily inherently related to fun of the experience.

Dynamic: The involvement of users within gamified systems depends on their attributes which alter the dynamics between the system and users. These dynamics involve time-based relationships, user emotions, and storylines or narratives; all designed to alter attributes as users progress within the gamified system.

Gamification: The use of game-based mechanics and game-based design elements in non-game settings to engage users and encourage achievement of desired outcomes through motivation of users.

Gamify: The process of incorporating of game-based elements and game-based components, mechanics, and dynamics to a process in order to attain specific outcomes.

Learning Element: Parts of an education simulation design that are deliberately crafted and incorporated in a way to support the learning experience (c.f. the introduction of gamification elements).

Mechanic: Desired interactions as users and gamified system components interact over repeated interactions or within a single interaction over time. The mechanics are designed to encourage users' progression throughout a gamified system.

Non-Player Character (NPC): A highly developed bot, programmed into a simulation to mimic a character or person (as opposed to an object). These NPCs are capable of interacting with learners in a meaningful way to enhance immersion, authenticity, and improve learning experiences.

Role: Simulations are useful for learners to explore multiple perspectives held by various individuals with different requirements; each perspective can be crafted into a specific role that the learner can be encouraged to experience.