FUNIFICATION 2.0

Knowledge mobilization model for corporate and educational game-based learning

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Abstract

Purpose – The purpose of this paper is to review the concepts of "fun and play" and propose a preliminary model that suggests potential benefits for quantitatively/qualitatively rating serious games and simulations associated with corporate and university game-based learning (GBL).
Design/methodology/approach – A relevant literature review was executed to locate significant references to fun and play, assessment of GBL, and the pattern for integrating those elements with knowledge mobilization (KMb). A repertory grid method (RGM) was used to propose a preliminary model.
Findings – The proposed FUNIFICATION Model will be useful as a foundation for further evaluation of GBL environments.
Research limitations/implications – Additional rationalization of the proposed model and applying it to actual games with focus groups as the observers would provide additional validity to the new model.
Practical implications – A threshold for fun involved in serious games and simulations would provide a quantitative/qualitative measure for playability of serious games and simulations. The FUNIFICATION Factor would feed into a KMb model for acquiring, codifying, disseminating, and making knowledge actionable, either within academic, corporate, or public sector environments.
Originality/value – The range of assessment models for GBL is evident from the literature review, and value could be derived in building an evaluation model based upon the RGM to identify a FUNIFICATION Factor for serious games and simulations.

Keywords Simulations, Gamification, Knowledge management, Game-based learning, Serious games, Knowledge mobilization

Paper type Conceptual paper

Introduction

The goal of this descriptive theoretical paper is to review the literature associated with "fun and play" and construct a model that reflects game-based learning (GBL) in the enterprise, governmental bodies, as well as within the higher education (HE) context. New research discoveries are emerging monthly about the advantages and disadvantages in the application of GBL within organizations and classrooms. A gap in the literature exists where the possibility of a new, emerging model to describe the value proposition for a serious game or simulation could prove very beneficial for instructional designers and instructors. This paper describes how the application of GBL processes is advantageous to organizational success within the context of education, learning, training, and development. Moreover, evidence has emerged that GBL has a significant impact upon learning outcomes within HE environments. Evidently, FUNIFICATION could be applied as a holistic knowledge mobilization (KMb) strategy to engage individuals in changing behavior in relationship to organizational strategies and goals, as well as increase motivation, engagement, and retention within a learning environment.

Fun, funology, funativity, FUNIFICATION

Definitions of fun

The concept of fun, and how that might become, or has become, a critical element of the workplace and educational institution needs to be explored. Based on at least ten years of

World Journal of Science, Technology and Sustainable Development
Vol. 14 No. 2/3, 2017
pp. 84-110

2042-5945
DOI 10.1108/WJSTSD-11-2016-0060

work experience, many from the current seniors' generations were never brought up to see fun and work within the same environment. Often, the members of the GI and Baby Boomer generations worked, and then later, after leaving work, chose to try and have fun. This approach exemplifies the prevalent Protestant work ethic during the formative years of those two generations.

Nonetheless, philosophers, theologians, and educators have been discussing fun for thousands of years. Fun, enjoyment, and pleasure are the three muses for humankind's distractions from or engagement with reality. Socrates, Aristotle, and Plato all referenced pleasure in different ways, i.e., relief from pain, the action of stimulating the senses, or the absence of pain. An historical sequence of thought leaders all grappled with the concept of enjoyment and pleasure, from St Augustine, Descartes, and Wittgenstein, to Freud. Thus, pleasure and enjoyment are concepts with a very long history. Fun and play, on the other hand, do not seem to exhibit a similar history, at least not in Western civilizations.

Monk *et al.* (2002) began their workshop at the 2002 Conference for Human Interfaces with the following narrative:

> Pleasure, enjoyment and fun are fundamental to life. As the [G]reek philosopher Epicurus wrote in his *Letter to Menoeceus*: "We recognise pleasure as the first good innate in us, and from pleasure we begin every act of choice and avoidance, and to pleasure we return again, using the feeling as the standard by which we judge every good." (p. 924)

This quote pinpoints that "[…] we begin every act of choice and avoidance, and to pleasure we return again […]." Humans cannot help but seek pleasure (Epicureanism), unless one is brought up as a Greek Spartan (Stoicism), which is rare in the modern workplace. Thus, when the idea that the workplace should encompass fun is proposed, a new business case for the definition of work will be required. Fun, enjoyment, pleasure, and play are all about choices…involving the will to experience a state of being different from our current cognitive, emotional or behavioural state.

Several very authoritative, academic sources have provided the most formal of definitions of fun. Webster defines fun as:

> FUN (noun)
>
> 1: what provides amusement or enjoyment; specifically: playful often boisterous action or speech < full of fun >
>
> 2: a mood for finding or making amusement < all in fun >
>
> 3: a: amusement, enjoyment < sickness takes all the fun out of life >
>
> b: derisive jest: sport, ridicule < a figure of fun >
>
> 4: violent or excited activity or argument

A review of the definitions above, along with synonyms, suggest that fun, like the word love, incorporates a cornucopia of meanings. An apparent relationship exists between fun, enjoyment, pleasure, and play, depending upon which dictionary one searches.

According to some sources, fun has yet to emerge as a significant characteristic of game design. Malone (1984) proposed an early attempt to identify "enjoyment" in usability interface engineering. Carroll and Thomas (1988) suggested that fun needed much deeper study. Neither imperative has resulted in serious research around fun, especially in its application to GBL.

Theory of fun

A light-hearted entry into this topical arena was Koster's (2005) *A Theory of Fun for Game Design*, providing cause to celebrate the application of fun to GBL. Although Koster's text

lacked an index, contained no bibliography or list of references, and was rather light reading, his perspective applies directly to the work we are embarking upon in serious games and simulations. Koster describes fun as the learning and mastering patterns. Later in this paper, fun is related to both motivation and flow. Koster suggested that noise (e.g. indecipherable patterns) and boredom (e.g. simplistic patterns that lack learning outcomes) destroy fun, motivation, and flow.

Castronova (2008) proposed a unique definition that is useful as a starting point. Fun is a pleasurable sensation attributed to an activity when (p. 103):

(1) the activity causes the co-activation of motivational systems;

(2) the activity is (possibly metaphorically) relevant to survival;

(3) the individual's choices promotes survival; and

(4) the situation is known to be play.

Thus, from this definition, fun could be interpreted to only happens during play. Many individuals might surmise that work is seldom play or fun for that matter. Fun is an emotional state associated with happiness. Fun tends to be an imperative as well as a mental state that games proclaim as their goal. Who wants to play a game that is not fun, or worse yet, boring?

Game theory and fun

Dixit and Skeath (2004) and Dixit (2005) attempt to teach Economics courses through an introduction to game theory. The goal is to facilitate the absorption of economic theories and models through "fun" applications of game theory. In Dixit's concluding remarks, he states:

> Imaginative use of game playing, movies, literature, and such other illustrations makes game theory much more fun to teach and to learn. This can be done without sacrificing any rigor. The ancillary material supplements and elucidates the theory; it does not supplant theory.

Here we see two authors taking seriously the need to infuse fun through games into their classroom, thus, increasing learner engagement and retention of the actual subject matter for the course.

Sorenson (2010) presents a computational model of challenge-based fun. His model suggests an evaluative measure for the entertainment value of "challenge-based" video games:

> […]"challenge-based fun" [is] the response to game structures that present challenges that are neither too difficult nor too easy; levels in challenge-based games are judged to be the most entertaining when they are not too difficult to complete, but also not so easy as to lose the player's interest (p. 3).

Sorenson and Pasquier (2010, p. 24) take a strictly mathematical approach to modeling fun in a game:

> The numerical response of the model is demonstrated […], which illustrates the amount of fun in a rhythm group as a function of the accumulated challenge in that rhythm group. Recall that accumulated challenge – that is, challenge integrated over a period of time – is referred to as "anxiety." In other words, where $c(t)$ represents the amount of challenge present at the instantaneous point t, c_i represents the total amount of challenge integrated over the duration of rhythm group i, which constitutes a quantity of anxiety. The rhythm group attains its maximal fun potential when the amount of anxiety present is exactly M. The fun provided by a rhythm group decreases if the amount of anxiety experienced in that group is greater or lesser than this critical point. This function is evaluated independently for each rhythm group, and the fun for the entire level is the sum of each independent evaluation.

The "rhythm group" is a section within a decipherable arrangement of fluctuating episodes where difficulty swings between high and low levels (Smith *et al.*, 2008, 2009);

Such a model implies that fun can be defined and described algorithmically, without input from humans who might experience "fun." Others have also taken this approach (Schmidhuber, 2010). This framework runs counter to the model we wish to propose in this paper, but is certainly a metric that might be useful in assessing pleasurable events in a game or simulation.

Entertainment, pleasure, and fun

Wiberg (2003) explored entertainment and fun, and their relationship with IT usability. After presenting an analysis of numerous definitions of entertainment, the author contrasted and compared the two definitions and synonyms (p. 58):

> For example in this dictionary there are twenty-two that are common to both words. This is 42% of the total of 52 synonyms for fun and 51% of the total of 43 synonyms for entertainment. These findings indicate a general correlation between the two ideas of 40-50%. However, it is also important to recognize that in some cases these notions differ in meaning.

Wiberg suggested that a conceptual model of the relationship between entertainment and fun might prove useful, but decided for her study that such a differentiation would only introduce confusion in her study participants (p. 59):

> […] i.e. it would probably undermine the aim of providing as natural and authentic a setting as possible for the users of the web sites. For this reason, no conceptual model concerning the relation between fun and entertainment was used in the study. Arising from this it was rather difficult to interpret participants' ideas of concepts such as fun and entertainment.

Thus, we are left with a wide range of models and frameworks presented by Wiberg to help interpret her outcomes and results.

Two authors built a deeper model of the Epicureanism perspective for pleasure. Tiger (1992) and Jordan (1999, 2000) proposed modeling the concept of pleasure into four themes:

(1) Physio-pleasures: human pleasures associated with sensory organs: touch, olfactory, taste, sight, and hearing.

(2) Socio-pleasures: social interaction, social identify, rank, status, title, self-image, brand, any pleasurable relationship between the subject, other subjects, and society.

(3) Psycho-pleasures: outcomes from an activity that provides emotional satisfaction, high-quality usability engineering, and software interface ease-of-use.

(4) Ideo-pleasures: individual values associated with the aesthetic of an object or event, such as an appreciation of the design of a functional object or the aesthetic impact of an art piece.

The four themes provide us with a rudimentary framework to begin to model a FUNIFICATION framework for GBL.

Wiberg's study also mentioned another useful framework for us to discuss "fun" within the context of GBL. Norman (2002, 2005) outlined a design theory-based approach to relating pleasure and emotions:

(1) Visceral design: the appearance, aesthetic, and attractiveness of objects, i.e., people, places, and things.

(2) Behavioral design: utility of the form vs function of an object or event, i.e., ease-of-use, challenging to the subject.

(3) Reflective design: personal rationalization, sensemaking, and conceptualization with an object or event, i.e., personal brand, self-image, self-confidence.

Within the context of games, McGonigal (2015, p. 225) described the concept of fun in terms of fun framing:

> what happens when you decide to do something for pure pleasure, excitement or enjoyment of it. […] Fun is not a discrete positive emotion, like joy or gratitude or curiosity or pride. Fun, instead, is a state of mind. Fun is how we describe an activity that we enjoy for its own sake. […] fun happens when we focus only on the intrinsic pleasure, excitement, and enjoyment we feel […].

Strangely, a prolific and widely recognized thought leader associated with video games, J.P. Gee, in his recent text, *What Video Games Have to Teach Us about Learning and Literacy*, neither defines fun or play. In fact, his index does not contain an entry for either concept. Yet, "play" and "player(s)" occur almost 500 times in the text within the book. However, in his earlier work Gee (2004, pp. 64-65) discusses fun, in terms of learning:

> When learning stops, fun stops, and playing eventually stops. For humans, real learning is always associated with pleasure and is ultimately a form of play – a principle almost always dismissed by schools. There is one crucial learning principle that all good games incorporate that recognizes that people draw deep pleasure from learning and that such learning keeps people playing. Good games allow players to operate within, but at the outer edge of, their competence.

In summary, the concept of fun encompasses a wide range of definitions and perspectives. As one might expect, fun appears to be very subjective. But, what if we could evaluate fun objectively?

Fun, flow, and frameworks

Schell (2014, p. 26) suggests a slightly different tact to the concept of fun:

> […] what do we mean when we say "fun?" Do we simply mean pleasure, or enjoyment? Pleasure is part of fun, but is fun simply pleasure? There are lots of experiences that are pleasurable; for example, eating a sandwich, or lying in the sun, but it would seem strange to call those experiences "fun." No, things that are fun have a special sparkle, a special excitement to them. Generally, fun things involve surprises. So, a definition for fun might be: Fun is pleasure with surprises.

This is an exceptionally original definition of fun, since it introduces surprises – the "special sparkle, a special excitement." Additionally, Schell (2014, p. 27) proposes the most obvious perplexing characteristics of fun and play: "[…] sometimes fun defies analysis" and "But what do we mean by play? This is a tricky one. We all know what play is when we see it, but it is hard to express." Schell follows both oxymorons with many insightful quoted definitions, which automatically led into the concept of flow.

Murphy *et al.* (2013) closely associate fun with Csikszentmihalyi's (1997) concept of flow summarized in seven core components, bifurcated by conditions and characteristics (see Table I).

The relationship between Flow and Fun is critical (Chen, 2007, p. 9, as cited in Murphy *et al.*, 2013, p. 148):

> Flow explains why people prefer certain games more than other games and how they become addicted towards these games. If a game meets all the core elements of Flow, any content could become rewarding, any premise might become engaging.

When describing Flow, Csikszentmihalyi inferred fun in his concept of enjoyment. Blythe and Hassenzahl (2003) also related fun and enjoyment to Flow ten years earlier.

Lazzaro (2004) has proposed taxonomy for measuring fun within games:

- Easy fun: associated with awe, creativity, curiosity, exploration, fantasy, surprise, or wonder, e.g., Myst™.
- Hard fun: associated with mastering a skill or competency through increasingly challenging quests or game journeys, e.g., EI Games.

No.	Taxonomy element	Taxonomy element description
1	Challenge	A test of the learner's skills, set at a level to stretch his/her abilities
2	Fantasy/narrative	Imaginary environment, characters, or story which can stand as a metaphor for the real world
3	Feedback	Response to the learner's actions or progress within the game
4	Goals	Clear aims that are meaningful and achievable but stretch the learner's abilities
5	Sensori stimuli	Engaging visual and sound effects
6	Social aspects/ community	Playing with or against other people and social interaction inside and outside the game
7	Active learning	Learning "by doing", i.e., actively engaging in the game-related task
8	Adaptivity/ individualization	The difficulty of the game or task adjusts itself to suit the learner's ability level
9	Assessment	Learners can review how well they are doing in the game and compare it with others
10	Authenticity/realism/ fidelity	Visual, sound, and tactile effects and character behavior that contribute to making the game more lifelike and convincing
11	Competition	Can be with others or with oneself, with the aim of outperforming others or self-improvement
12	Control	The learner is able to manage and direct his/her own actions in the game
13	Creativity	Using imagination to solve problems or produce (and share) artifacts in the game
14	Mystery/curiosity	Element of novelty, surprise, and informational complexity within the game
15	Puzzle-solving	Mental puzzles, riddles, or problems need to be solved to progress in the game
16	Rapid decision making	Having to make a series of choices fast and continuously to move forward in the game
17	Relevance/interest to the learner	Being able to relate to the game in a meaningful way
18	Reward	Prize or incentive given in return for what the learner has achieved, matching his/her increasing skills level
19	Role	The learner takes on a specific part in the game and thus acquires skills and knowledge relevant in the real world
20	Rules	Conditions and restrictions that direct the actions the learner can take within the game
21	Safety	Consequences of risk-taking in the game have no impact on the real world
22	Scaffolding and sense of improvement	Gradually increasing level of difficulty and seeing oneself make progress in the game
23	Transfer	Learning from the game can be applied in other games or in a real-world context

Table I.
Bober (2010, pp. 33-42) taxonomy of digital games elements

- Serious fun: associated with an altered state of reality, where the subject is relaxed, but sharply focused and are immersed within an emotional experience, e.g., Candy Crush Saga™.
- Social fun: founded upon the interaction of multiple subjects that cooperate, collaborate, or communicate on a particular topic, theme, or event, e.g., World of Warcraft™.

Funativity and funology

Sweetser and Wyeth (2005) proposed a very detailed framework of criteria to evaluate enjoyment. The criteria were assessed against two real-time strategy (RTS) games. The criteria consisted of:

(1) concentration: games should require concentration and the player should be able to concentrate on the game;

(2) challenge: games should be sufficiently challenging and match the player's skill level;

(3) player skills: games must support player skill development and mastery;

(4) control: players should feel a sense of control over their actions in the game;

(5) clear goals: games should provide the player with clear goals at appropriate times;

(6) feedback: players must receive appropriate feedback at appropriate times;

(7) immersion: players should experience deep but effortless involvement in the game; and

(8) social interaction: games should support and create opportunities for social interaction.

A numerical value range was used to evaluate the RTSs, with at least one decimal place to provide gradations for the criteria, ranging from:

- 0.x – N/A.
- 1.x – not at all.
- 2.x – below average.
- 3.x – average.
- 4.x – above average.
- 5.x – well done.

The authors identified criteria that made RTS games enjoyable, along with the weighting of each GameFlow element exhibited in these types of game.

A recent addition to the conversation on fun by McLaughlin *et al.* (2012) proposed a new term to describe measurements associated with fun:

> Game-specific measures of usability (often called "funativity") have included measures of flow and immersion in the game, feelings of presence, and measures of emotion indicated by posture and pressure on input devices.

The authors were studying costs and benefits associated with older adult players in terms of perception, cognition, and emotional challenges with Nintendo Wii™. The study team focused on qualitative metrics from established game usability research (Mandryk and Atkins, 2007; Yannakakis and Hallam, 2006), such as observations, survey questions, and a flow questionnaire that tracked frustration and preference levels, time, and accuracy for tasks completion, and biometrics, i.e., heart rate, heart rate variability, and galvanic skin response.

We located an additional author referencing "funativity," Falstein (2005), who suggested a theory of natural funativity (and a subsequent funativity quotient), which is based upon a breakdown of fun into four categories, all based upon the ancestral concept of our roots in hunter/gatherer societies:

(1) Physical fun: situations where the subject attempts to successfully overcome threats to survival, i.e., exploration, sports, racing, casino activities, etc.

(2) Social fun: dynamic, multiplayer gaming based upon tribes, teams, and groups, including activities associated with language skills development and storytelling.

(3) Mental fun: pattern manipulation, recognition, and sensemaking, such as a game like the Rubric's Cube.

(4) Blended fun: a synthesis of the three previous types of fun in a singular game.

This bears some familiarity with Lazzaro's (2004) taxonomy above, but with a critical difference: the separation and blending of intelligence, hand and tool capabilities, and

language proficiency in terms of the conceptual framework of our ancestral roots in hunter/gatherer societies.

The research literature established that unique frameworks exist to try and define and describe the concept of fun. In fact, an addition to the corpus on the subject is dedicated to a new work used to describe the elements of this emergent field: Blythe *et al.* (2004). This volume warrants additional study not within the scope of this paper. Subsequently, this paper will build the foundation for FUNIFICATION as an emergent model for assessing and evaluating the integration of fun with gamification and GBL. The next section will construct the context for games, gamification, and GBL.

Games, gamification, and GBL

Games

Definitions. Understanding the application of GBL within organizations requires the prerequisite of understanding the basic and essential components of games and gamification. Salen and Zimmerman (2004, p. 80) provide a useful starting point for the definition of the concept "game":

> A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome.

Regretfully, this definition contains an element not necessarily intrinsic to an organizational or educational context, i.e., "artificial conflict." Additionally, we need to differentiate between commercial games – (for entertainment purposes only) – and serious games, simulations, and gamified immersive learning environments.

Many games that stimulate engagement and learning use another venue other than "artificial conflict" to mobilize knowledge within a group of learners. Koster (2005, p. 46) proposes a more pragmatic definition:

> Games might seem abstracted from reality because they are iconic depictions of patterns in the world. They have more in common with how our brain visualizes things than they do with how reality is actually formed. […] Games are puzzles to solve, just like everything else we encounter in life. They are on the same order as learning to drive a car, or picking up the mandolin, or learning your multiplication tables. We learn the underlying patterns, grok them fully, and file them away so that they can be rerun as needed. The only real difference between games and reality is that the stakes are lower with games. (p. 34) […] The definition of a good game is therefore "one that teaches everything it has to offer before the player stops playing."

Game models. Kapp (2012), one of the established thought leaders in this emerging field, built a game model from specific elements that he suggested are exhibited in game design and deployment:

(1) system space;

(2) players;

(3) abstracted game space;

(4) challenge;

(5) rules;

(6) interactivity;

(7) feedback,

(8) quantifiable outcomes; and

(9) emotional reactions.

Kapp (p. 9) concluded that:

> Together these disparate elements combine to make an event that is larger than the individual elements. A **player** gets caught up in playing a game because the instant **feedback** and constant **interaction** are related to the **challenge** of the game, which is defined by the **rules**, which all work within the **system** to provoke **emotional reaction** and, finally, result in a **quantifiable outcome** within an **abstract** version of a larger **system**.

McGonigal (2011) defines a game as sharing four defining traits:

(1) goal: outcome to be achieved by the player(s);

(2) rules: limitations and constraints on achieving the goal;

(3) feedback system: progress bar, points, levels, and leadership board – indicators of how well the player is achieving the goal; and

(4) voluntary participation: players accept the authenticity of the goal, rules, and feedback.

She does not believe that the defining features of a game are winning, interactivity, rewards, competition, etc. The four defining features outlined above are the core around which all other features are orbiting.

Schell (2014) provided two approaches to define a game:

(1) Marco (complex): an activity comprises of numerous qualities:

- Q1: Games are entered willfully.
- Q2: Games have goals.
- Q3: Games have conflict.
- Q4: Games have rules.
- Q5: Games can be won and lost.
- Q6: Games are interactive.
- Q7: Games have challenge.
- Q8: Games can create their own internal value.
- Q9: Games engage players.
- Q10: Games are closed, formal systems. (p. 34)

(2) Micro (simple): "A game is a problem-solving activity, approached with a playful attitude" (p. 37).

Finally, Bober (2010) outlined a very useful taxonomy comprising 23 learning elements of digital games (see Table I).

Thus, these well-articulated models of game elements are useful in formulating the foundation of a new model for evaluating and assessing fun, i.e., the funification of a game by building a model to calculate the "fun factor."

Gamification

Gamification as a concept has been covered in detail by other thought leaders (Chou, 2015; Kapp, 2012; Kapp *et al.*, 2014; Zicherman and Cunningham, 2011). For the purposes of this paper, three acceptable definitions are proposed that will move our discussion quickly into GBL. Kapp *et al.* (2014, p. 54) propose the following simple definition:

> Gamification is using game-based mechanics, aesthetics, and game thinking to engage people, motivate action, promote learning, and solve problems.

They further bifurcate the concept into structural gamification and content gamification. Structural gamification provides a subject with a process (game interface) that facilitates navigation of information without altering the content. This type of content normally consists of readings, videos, or audios that need to be completed to achieve points, badges, the movement to new levels (leveling), and comparison to other players on a leaderboard. Content gamification, on the other hand, applies game elements and game thinking as a process to alter content, such as adding stories to a personal journal that is within the game.

Gamification is not the same as a game. A game normally begins with the goal of achieving the winning state through challenges, a storyline, and different states of play (beginning, middle, and end game). Gamification is simply the process of applying game parts and mechanics that normally occur within a game environment. Kapp *et al.* (2014) posit that gamification is effective for:

(1) encouraging learners;

(2) motivating action;

(3) influencing behavior;

(4) driving innovation;

(5) building skills and competencies; and

(6) acquiring knowledge.

Chou (2015) reduces gamification to the "craft of deriving fun and engaging elements found typically in games and thoughtfully applying them to real world or productive activities […] we can look through the lens of games to understand how to generate certain behaviors by combining different game mechanics and techniques" (pp. 8-9). Thus, we can begin to perceive the connection between fun, games, and gamification. The discussion can now move to GBL.

GBL

GBL emerged on the academic and enterprise scene in the late 1990s. One of the first works to describe GBL was Prensky (2001, p. 5), where he proposed:

> *Digital Game-Based Learning* is precisely about fun and engagement, and the coming together of serious learning and interactive entertainment into a newly emerging and highly exciting medium – Digital Learning Games […].

Digital GBL is still a radical idea. It is based on two key premises that are still not fully accepted in the training and adult learning community. The first is that the learners have changed in some fundamentally important ways… The second "radical" premise is that these "under-36" individuals are of a generation that when growing up deeply experienced, for the first time in history, a radically new form of play – computer and video games – and that this new form of entertainment has shaped their preferences and abilities and offers an enormous potential for their learning, both as children and as adults.

A game is enjoyable because the subject (player) must learn the game while play is underway. The progress of a player in terms of learning can be directly attributed to the volume of play and the clarity of the mental model constructed around the game rules and structure.

The mind of the player must invoke a sensemaking paradigm (Weick *et al.*, 2005) to grasp and comprehend the new game space and system. The progress of understanding a new concept through gaming facilitates a sense of reward for the player. The game might be commercial entertainment or a serious game. When a game is well designed,

then the player will be motivated to participate in the gaming space. A game builds upon experiential learning theory (Kolb, 1984; Kolb and Kolb, 2005). The game complements the flow model developed by Csikszentmihalyi (1991), within an experiential learning cycle (Figure 1).

A serious game or simulation, when constructed with discernable learning outcomes, can create interactive experiences that actively engage the players in the learning process. Experimentation, graceful failure, and identification of lessons learned can result from a GBL environment, where decisions and actions are chosen, consequences are experienced, goals are achieved, and feedback is furnished. Risks are mitigated and a sense of discovery is instilled in the player (Shearer, 2011).

Experiential learning model and flow

Kiili (2005) further proposed to combine Csikszentmihalyi's (1991) flow model with Kolb's (1984) experiential learning model, resulting in a powerful GBL model combining flow with experiential learning. Prensky synthesized the elements we have discussed so far (fun, games, generations of gamers, and gamification) into a well woven, cogent "manifesto" for radically transforming education and training. Since education and learning are integral instances of knowledge acquisition, codification, mobilization, and dissemination, the educational context for GBL and KMb will now be discussed.

KMb, serious games, and simulations

Individuals are surrounded by games as entertainment since childhood. Games and simulations encompass board games (Chess, GO, or Risk) that simulate symbolic situations or digital games that simulate virtual worlds (World of Warcraft, Dungeons and Dragons, or Call of Duty). With the advent of various internet-based simulations, we see a parallel dimension in terms of immersive virtual environments, increasing the exposure and access to a greater

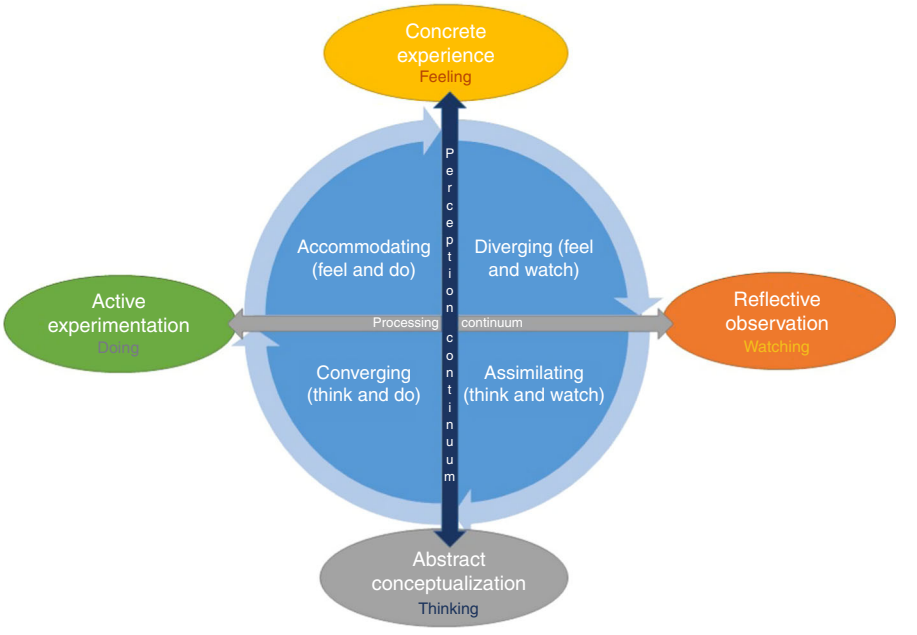

Figure 1.
Experiential learning cycle

Source: Adapted from Kolb and Kolb (2012, p. 44)

number of people. Actual parallel worlds have evolved, such as Second Life and new instances of Virtual Reality, where "sim cex" is possible and virtual currency can be used to purchase land, clothing, and experiences. Because of the experiential nature of the flow experienced during a game, the critical KMb taking place within the minds of the players can be described.

KMb

Origins. The earliest appearance of the phrase KMb in print may be in an article published by Florida and Kenney (1993, pp. 648-649). The phrase is used twice to reference the emergent knowledge economy:

> Indeed, advanced industrial economies are changing from a system premised on the mere extraction of physical labour to one based on continuous knowledge mobilization and innovation. This is not simply the knowledge and intellectual capabilities of R&D researchers and engineers, but the knowledge and capabilities of all workers-including regular factory workers. Workers' knowledge is now a fundamental and explicit element of production and of continuous innovation-a source of direct value-creation and productivity improvement. Although it may appear exceptionally remote or even impossible from the current vantage point, government itself will in time come to reflect the core principle of continuous knowledge mobilization under innovation-mediated production.

Within a year, the phrase was used again by Florida and Kenney (1994a, b, pp. 252-254) as it is related to manufacturing and R&D contexts:

> Japanese manufacturing came to be characterized by high degrees of knowledge mobilization and learning-by-doing (Dore, 1986; Aoki, 1988; Koike, 1988; Cole, 1989). This not only increased productivity but reduced certain aspects of worker alienation. The end result was a powerful synthesis of intellectual and physical labor. […] Knowledge mobilization at a variety of levels gave the Japanese firm extraordinary problem solving capabilities (Nonaka, 1991; Cole, 1989). […] The just-in-time system can be viewed as yet another mechanism for knowledge mobilization, in this case from outside suppliers (Baba and Imai, 1991).

In neither case did Florida and Kenney define the term KMb. Thus, the reader is expected to discern the meaning by disambiguating the phrase into its two simple words: knowledge and mobilization. During the mid-1990s, the phrase was not connected to the concept emerging earlier in the mid-1980s, knowledge management (KM).

KM and KMb

Wiig (1997) outlined the history of the emerging cross-disciplinary field of KM. He pegged 1986 as the first time an attempt was made to discuss the Management of knowledge at a European management conference sponsored by the UN's International Labour Organisation. Wiig suggests that the first book that discussed KM was by Sveiby and Lloyd (1987), while the first journal article was by Stata (1989) and appeared in the *Sloan Management Review*. In the USA, the first books relating to KM were authored by Savage (1990) and Senge (1990), while in 1991 *Harvard Business Review* ran its first article on KM (Nonaka, 1991) and *Fortune* publishes its first article on KM (Stewart, 1991). Wiig omitted the seminal texts by Machlup (1962, 1980, 1982, 1984), which were the foundation for the emerging concepts building toward KM and the knowledge economy.

KMb continued to gain popularity through a range of authors during the next five years (1995-2000):

- Florida (1995), lacking a formal definition.
- Machiels-Bongaerts and Schmidt (1995), lacking a formal definition.
- Hardstone (1998), lacking a formal definition.

- Florida *et al.* (1998), where KMb is combined with organizational learning.
- Herschel and Nemati (1999), where KMb is associated with information exchange.
- Dede (1999), where KMb is discussed within the context of education.
- Herschel and Nemati (2000), where KMb is discussed in terms of KM.
- Schaaf (2000), where KMb is discussed in terms of teaching.
- Davis (2000), where KMb is discussed in terms of a knowledge pattern taxonomy.
- Gherardi and Nicolini (2000), where KMb is discussed in terms of organizational learning.
- Ojha (2000), where KMb is discussed in terms of KM transfer practices.
- Crawford (2000, p. iv), where KMb is discussed within the context of "moving research and new knowledge into action through seminars, presentations, [and] training."

After the year 2000, KMb gained significant visibility, research, and application, especially in Canada, and reached its zenith with the publication of Bennet *et al.* (2007). Finally, a useful definition was proposed by Bennet *et al.* (2007) for KMb, which has since been enshrined within the concept:

- Knowledge mobilization is on the cutting edge of knowledge management, moving new ideas and shared understanding into the hands of the people at the point of action. This is where the day-to-day decisions are made that will improve our communities, our businesses, and our nations (p. XIII).
- Knowledge mobilization is the process of creating value or a value stream through the creation, assimilation, leveraging, sharing, and application of focused knowledge to a bounded community (p. 17).
- Knowledge mobilization also leads to the creation of new knowledge through the growth of shared understanding and learning from feedback, its focus is on learning and behavioral change through the application of developed knowledge, i.e., research findings (p. 19).

Bennet *et al.* (2015, p. 22) integrated knowledge flow into its KMb process, identifying three significant nodes:

(1) Kresearch (evidence-based knowledge): includes theoretical as well as empirical knowledge and represents the fundamental concepts that explain why things happen. Such knowledge serves as a guide for setting expectations and possibilities and provides the user a level of confidence.

(2) KPraxis (pragmatic knowledge): represents the practical understanding of situations and how they change or can be changed. Much pragmatic knowledge is tacit, experiential, and intuitive.

(3) Kaction (knowledge in action): represents the ability to take specific actions that achieve the desired result. It includes understanding the local context and situation within which the action is taken.

A recent addition to the body of knowledge associated with KM, Ahmed and Elhag's (2014) Smart KM Model, introduced the concept of sustainability within KM processes. These two authors also alluded to KMb in Stage 3 of their KM Model: Deployment and Business Change Management. This theoretical framework of KMb processes integrated with knowledge flow provides us with the complimentary foundation to building a FUNIFICATION Model 2.0.

Bennet *et al.* (2015) proposed a framework that can be overlaid upon the GBL and fun models to produce a rudimentary FUNIFICATION Model.

KMb and GBL

Jorge and Sutton FUNIFICATION Model Version 1.0. So, how is all this relevant? Jorge and Sutton (2016) initially proposed the FUNIFICATION Model Version 1.0. The original FUNIFICATION Model was developed within a totally different context – organizational behavior – and was never applied to evaluating or assessing games and GBL. The model version 1.0 (see Figure 2) was strictly a conceptual model used to explore elements of gamification within the field of organizational intelligence. In this paper, the authors have extended and re-crafted the model, considering the new frameworks and models introduced above and the need for developing a quantitative/qualitative tool for assessing and evaluating GBL, serious games, and sims.

This conceptual model portrayed the organizational environment and basic structure of games in terms of basic elements for serious games and gamification. The game is a triangle with two components that sustain games, the rules and goals. The components inside the triangle are the characteristics that transform the game through gamification. The organization itself is the basic structure of goals and rules. In fact, the gamified environment can stimulate new employee behaviors. The bigger challenge to gamification and their designers in organizations is to transform workplace activities through fun through winning, problem solving, explore, chilling, teamwork, recognition, triumphing, collecting, surprise, imagination, sharing, role play, and goofing off.

Assessment and evaluation of GBL, serious games, sims. Assessment of GBL, in terms of measuring learning outcomes, has only recently drawn significant interest from the academic research and reaching communities. In organizational environments, assessing GBL learning outcomes has also only been recently accepted as a form of currency and methods for measuring ROI. Assessment and evaluation of GBL, serious games, and sims has progressed significantly in the last four decades (Kirriemuir and McFarlane, 2004; Prensky, 2001; Randel *et al.*, 1992; Szczurek, 1982; VanSickle, 1986; Virvou *et al.*, 2005). During the last decade, increased attention and research has been paid to the impact of GBL, games, and sims on education and training (Baalsrud-Hauge *et al.*, 2015; Bober, 2010; Boyle *et al.*, 2016; de Freitas and Neumann, 2009; Gee, 2014; Gibson and de Freitas, 2016;

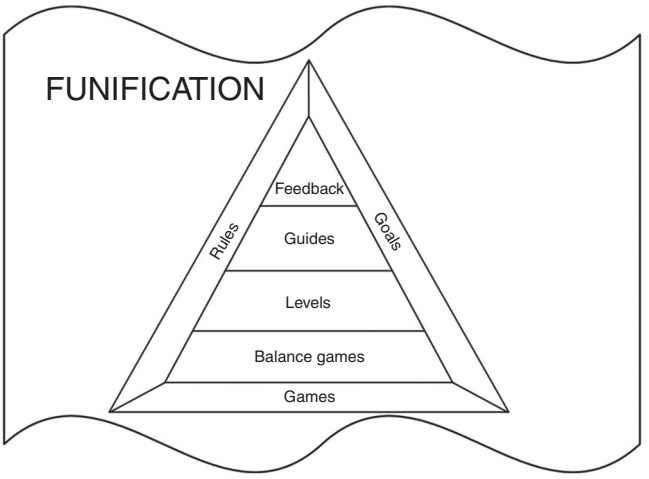

Figure 2.
Jorge and Sutton (2016) FUNIFICATION conceptual model version 1.0

Groff *et al.*, 2010; Papastergiou, 2009; Perrotta *et al.*, 2013; Steiner *et al.*, 2015, 2016; Van Eck, 2006). Rubrics are prolific for evaluating the serious game deliverables of learners in HE. Several associations, such as the Online Learning Consortium, EDUCAUSE, and Association for Talent Development, promote many evaluation tools.

Assessment encompasses multiple, macro-levels of measurement of online and face-to-face classrooms, educational programs, and institutional effectiveness. Assessment includes a rigorous approach to collecting, analyzing, and interpreting information associated with the macro progression of a learner. Evaluation is the micro-level process of determining the impact and effectiveness of teaching andragogy on a learner's course deliverable (work products), usually demarcated in a grade. Ifenthaler *et al.* (2012) published an in-depth book that exhibits a very broad and deep perspective on the processes and outcomes of GBL. They have described that assessment occurs after the game is completed, usually through reflection and interviews. On the other hand, evaluation takes place in real time during the game experience, where scores, badges, leaderboards, rewards, etc., provide immediate feedback on the progression of the learner in the GBL experience. None of these studies approached GBL assessment and evaluation form the perspective of the repertory grid method (RGM), which is a significant deviation from current research. Bober (2010) outlined a very useful taxonomy comprising 23 learning elements of digital games, which might prove useful when rationalizing the Ver 2.0.

Extending the FUNIFICATION Model to Version 2.0. The previously described Kiili's (2005) experiential gaming model for GBL, Bennet *et al.* (2015) KMb model, along with the previous fun definitions and models provide an opportunity to propose the Jorge and Sutton FUNIFICATION Model 2.0 for GBL (see Tables II and III). The model is framed within the context of the RGM. Hemmecke and Stary (2004) connected the externalization of tacit knowledge to repertory grids.

The RGM is a tool for comparing construct data about an object, event, or situation over a maximal/minimal range of bi-polar evaluation criteria (Fransella *et al.*, 2004). Explanations and interpretations of the comparison data can potentially yield insight and an understanding of the relationships associated with the different criteria in the RGM. The RGM is based upon personal construct theory and a philosophical perspective of constructive alternativism (Kelly, 1955). The RGM technique facilitates the exploration of structure and content (networks of meaning) of personal constructs.

Kelly (1969, p. 293) defined the concept of these criteria:

> A construct is like a reference axis, a basic dimension of appraisal, often unverbalized, frequently unsymbolized, and occasionally unsignified in any manner except by the elemental processes it governs. Behaviourally it can be regarded as an open channel of movement, and the system of constructs provides each man with his own personal network of action pathways, serving both to limit his movements and to open up to him passages of freedom which otherwise would be psychologically nonexistent.

1.0 Conditions of flow	*Description*
1.1 Tasks are clearly defined	Task to be completed is understood
1.2 Feedback is provided	About what succeeds and what fails is immediate and unambiguous
1.3 Concentration is focused	Distraction does not distance someone from being engaged in the task
1.4 Goal is attainable	Goal challenges the individual, but is not beyond him/her
2.0 Characteristics of flow	*Description*
2.1 Sense of control	Discernable cause-effect relationship between decisions, actions, to outcomes
2.2 Loss of self-consciousness	The individual is totally immersed in the task, without reference to oneself
2.3 Sense of time transformed	Disappearing sense of time – time may pass quickly, without notice

Table II.
Csikszentmihalyi's conditions and characteristics of flow

Source: Adapted from Murphy *et al.* (2013)

Table III.
Jorge and Sutton FUNIFICATION Model 2.0 constructs for game-based learning

	Construct	Construct pole	Contrast pole	Definition	Authors	Weighting
1	Physio-pleasures	Intense physio-pleasures	Shallow physio-pleasures	Human pleasures associated with sensory organs: touch, olfactory, taste, sight, hearing	Tiger (1992), Jordan (1999, 2000)	w%
2	Socio-pleasures	Intense socio-pleasures	Shallow socio-pleasures	Social interaction, social identify, rank, status, title, self-image, brand, any pleasurable relationship between the subject, other subjects, and society	Tiger (1992), Jordan (1999, 2000)	
3	Psycho-pleasures	Intense psycho-pleasures	Shallow psycho-pleasures	Outcomes form an activity that provide emotional satisfaction, high-quality usability engineering, software interface ease-of-use	Tiger (1992), Jordan (1999, 2000)	
4	Ideo-pleasures	Intense ideo-pleasures	Shallow ideo-pleasures	Individual values associated with the aesthetic of an object or event, such as an appreciation of the design of a functional object or the aesthetic impact of an art piece	Tiger (1992), Jordan (1999, 2000)	
5	Visceral design	High emotional design	Shallow emotional design	The appearance, aesthetic, and attractiveness of objects, i.e., people, places, and things	Norman (July, 2002, 2005)	x%
6	Behavioral design	High interactivity design	Dearth of activity design	Utility of the form vs function of an object or event, i.e., ease-of-use, challenging to the subject	Norman (July, 2002, 2005)	
7	Reflective design	Deep reflective design	Deficient reflective design	Personal rationalization, sensemaking, and conceptualization with an object or event, i.e., personal brand, self-image, self-confidence	Norman (July, 2002, 2005)	
8	Conditions of flow: clear tasks	Explicit tasking	Confusing and contradictory tasking	People understand the task they must complete	Murphy *et al.* (2013)	y%
9	Conditions of flow: feedback	Well-formulated and relevant feedback	Shallow or non-existent feedback	People receive clear and immediate feedback showing what succeeds and what fails	Murphy *et al.* (2013)	
10	Conditions of flow: concentration/focus	Stimulating attentiveness	Highly distractive or boring interaction	People are not distracted and can fully attend to the task	Murphy *et al.* (2013)	
11	Conditions of flow: an attainable, balanced goal	Attainable goal	Virtually impossible goal	Goal is challenging and within their abilities to complete	Murphy *et al.* (2013)	

(*continued*)

Table III.

	Construct	Construct pole	Contrast pole	Definition	Authors	Weighting
12	Characteristics of flow: control	Explicit causation and consequence	Random causation and consequence	People believe their actions have direct impact on tasks and that they can influence the outcome	Murphy *et al.* (2013)	
13	Characteristics of flow: diminished awareness of self	Total immersion	Lacking involvement	Complete focus on the task leaves little room for self-consciousness or doubt. Often described as becoming a part of the activity	Murphy *et al.* (2013)	
14	Characteristics of flow: altered sense of time	Timelessness	Brief or short-lived	Perception of time is distorted. Seconds can feel like minutes, minutes like hours. Yet, time also passes by quickly, unnoticed	Murphy *et al.* (2013)	
15	Easy fun	Play stimulates creativity of player	Play lacks or diminishes creativity of player	Associated with awe, creativity, curiosity, exploration, fantasy, surprise, or wonder, e.g., Myst™	Lazzaro (2004)	z%
16	Hard fun	Creates increased proficiency and mastery of skills	Lame skills engagement	Associated with mastering a skill or competency through increasingly challenging quests or game journeys, e.g., EI Games	Lazzaro (2004)	
17	Serious fun	Emotionally charged engagement	Promotes boredom	Associated with an altered state of reality, where the subject is relaxed, but sharply focused and are immersed within an emotional experience, e.g., Candy Crush Saga™	Lazzaro (2004)	
18	Social fun	Team/tribal-based play	Solo play	Founded upon the interaction of multiple subjects that cooperate, collaborate, or communicate on a particular topic, theme, or event, e.g., World of Warcraft™	Lazzaro (2004)	
19	Gamification: mechanics	Logical, well-formulated spectrum of rules	Arbitrary, artificial restrictions to play	Laws, rules or sets of rules that enable or restrict player action by creating a cause-effect relationship. Levels, badges, points, scores, and/or leaderboards	Kapp *et al.* (2014)	a%
20	Gamification: aesthetics	Seamless user experience	User hostile environment	Look and feel of the interface	Kapp *et al.* (2014)	
21	Gamification: game thinking	Pragmatic skills and competencies development	Outrageous conjecturing	Conversion of an everyday experience that encompasses elements of competition, cooperation, exploration, and storytelling	Kapp *et al.* (2014)	
22	Gamification: engagement	Engaged player	Disengaged player	Involve the player in the gaming process	Kapp *et al.* (2014)	

(*continued*)

Table III.

	Construct	Construct pole	Contrast pole	Definition	Authors	Weighting
23	Gamification: motivating action	Positive behavior modification	Lacking any call to action	Energize and provide direction, purpose, or meaning to behavior or actions	Kapp *et al.* (2014)	
24	Gamification: promoting learning	Learning is promoted	Learning in trivialized	Apply educational psychology to activities and tasks by assigning points, providing corrective feedback, and encouraging collaboration to educate the player	Kapp *et al.* (2014)	
25	Gamification: problem solving	Solvable problems	Insurmountable problems	Encourage the best actions in each player on solving the problem or achieving the quest	Kapp *et al.* (2014)	
26	Experiential learning cycle: concrete experience	Builds upon a personal point of view associated with a circumstance	Minimal grounding in the real world	Feeling a new experience of situation is encountered, or a reinterpretation of existing experience. Learning from specific experiences and relating to people. Sensitive to other's feelings	Kolb and Kolb (2012)	b%
27	Experiential learning cycle: reflective observation	Invokes a sensemaking cycle in the mind of the player	Lacks significant introspection for the player	Watching of the new experience. Of particular importance are any inconsistencies between experience and understanding. Observing before making a judgment by viewing the environment from different perspectives. Looking for the meaning of things	Kolb and Kolb (2012)	
28	Experiential learning cycle: abstract conceptualization	Abstraction and critical analysis results in new knowledge	"same old […] same old"	Thinking: reflection gives rise to a new idea, or a modification of an existing abstract concept. Logical analysis of ideas and acting on intellectual understanding of a situation	Kolb and Kolb (2012)	
29	Experiential learning cycle: active experimentation	Active discovery and exploration of new ideas	Backwater of trite or dead ideas	Doing the learner applies new ideas to the world around them to see what results. Ability to get things done by influencing people and events through action. Includes risk-taking	Kolb and Kolb (2012)	

Kelly was a psychologist who studied how individuals categorize and interact with people they know in terms of a repertory of dimensions (or constructs) that are important to that individual, personalized, and founded upon previous interaction with other people. The technique has extended by numerous researchers to explore the individual experiences, perceptions, or knowledge of any set of artifacts or situations.

Using the RGM (Fransella *et al.*, 2004), constructs were created that could be described by a range of Likert values (where "1" demonstrates a high affinity to a construct, while "5" represents a high contrast to the opposite of the construct). RGM consists of four steps: choice of elements, construct elicitation, rating, and analysis. Rating a construct represents the relationships between an array of game stages (1–n) and the constructs. A weighting factor was appended to the construct line to assess priority areas when evaluating a game (see Tables II and III).

Most games are designed and compartmentalized into multiple stages. Thus, each stage may contain different values for each of the constructs. The RGM has been occasionally used as a tool to collect and organize the knowledge related to learning outcomes (Chu *et al.*, 2010). The goal of using such a model would be to ask numerous evaluators to assess different games and determine – through a suite of qualitative measures – a quantifiable range of numbers that would represent a FUNIFICATION Factor. The FUNIFICATION Factor could be used to identify games that are significant and valuable for learning. Moreover, the FUNIFICATION Factor could also be integrated to the KMb process and knowledge flows model (Bennet *et al.*, 2015) to determine a KMb quotient related to Kresearch, Kpractice, and Kaction. This application will appear in a subsequent paper (Table IV).

Future directions

The potential outcomes from a model using the RGM would be a metric to assess which games contribute to organizational KMb, especially when the authors attempt to determine the impact of serious games, simulations, and game-based immersive learning environments on organizational performance management. Evidently, a FUNIFICATION Model that synthesizes numerous evaluation models for GBL could be used as a KMb strategy to engage individuals to change behavior in relationship to organizational strategies and goals, as well as increase engagement and retention within the learning environment.

Of course, when one reviews the FUNIFICATION Model 2.0, one can see some opportunities for rationalization and reformulation of the constructs. The authors' future research goals will attempt to integrate the FUNIFICATION Model 2.1 – (after rationalization and revisions) – with the KMb process and knowledge flows model to assess specific serious games and simulations used in workplace training and education activities. This research will be undertaken to refine and further enhance the model. Moreover, McCrindle Research (2012) and McCrindle and Wolfinger (2010) postulated a very useful breakdown of the significant characteristics that differentiate generations of workers. Additional study of workplace generations and GBL is also warranted.

Remember, games must be fun to be played. One of our most critical challenges in bringing useful and valuable serious games and simulations to the workplace and HE is the need to build fun into the educational process. Our FUNIFICATION Model 2.0 (see Tables II and III) provides the foundation for further study of an assessment tool that could prove very beneficial as a means to rate serious games and simulations, thus providing a quantitative/qualitative measure – the FUNIFICATION Factor – where up to now a highly subjective process based strictly upon personal opinion has been the only means available.

Table IV.
Jorge and Sutton FUNIFICATION Model 2.0 repertory grid for game-based learning (sample)

	Construct	Construct pole	Serious game/ simulation Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage n	Weight	Contrast pole
1	Physio-pleasures	Intense physio-pleasures	1	1	2	3	4	5	w%	Shallow physio-pleasures
2	Socio-pleasures	Intense socio-pleasures	1	2	3	4	5	1		Shallow socio-pleasures
3	Psycho-pleasures	Intense psycho-pleasures	2	3	4	5	1	1		Shallow psycho-pleasures
4	Ideo-pleasures	Intense ideo-pleasures	1	1	2	3	4	5		Shallow ideo-pleasures
5	Visceral design	High emotional design	3	4	5	1	1	2	x%	Shallow emotional design
6	Behavioral design	High interactivity design	4	5	1	1	2	3		Dearth of activity design
7	Reflective design	Deep reflective design	5	1	1	2	3	4		Deficient reflective design
8	Conditions of flow: clear tasks	Explicit tasking	1	1	2	3	4	5	y%	Confusing and contradictory tasking
9	Conditions of flow: feedback	Well-formulated and relevant feedback	1	2	3	4	5	1		Shallow or non-existent feedback
10	Conditions of flow: concentration/ focus	Stimulating attentiveness	2	3	4	5	1	1		Highly distractive or boring interaction
11	Conditions of flow: an attainable, balanced goal	Attainable goal	1	1	2	3	4	5		Virtually impossible goal
12	Characteristics of flow: control	Explicit causation and consequence	3	4	5	1	1	2		Random causation and consequence
13	Characteristics of flow: diminished awareness of self	Total immersion	4	5	1	1	2	3		Lacking involvement
14	Characteristics of flow: altered sense of time	Timelessness	5	1	1	2	3	4		Brief or short-lived
15	Easy fun	Play stimulates creativity of player	1	1	2	3	4	5	z%	Play lacks or diminishes creativity of player
16	Hard fun	Creates increased proficiency and mastery of skills	1	2	3	4	5	1		Lame skills engagement
17	Serious fun	Emotionally charged engagement	2	3	4	5	1	1		Promotes boredom
18	Social fun	Team/tribal-based play	1	1	2	3	4	5		Solo play
19	Gamification: mechanics	Logical, well-formulated spectrum of rules	3	4	5	1	1	2	a%	Arbitrary, artificial restrictions to play
20	Gamification: aesthetics	Seamless user experience	4	5	1	1	2	3		User hostile environment

(*continued*)

Table IV.

	Construct	Construct pole	Serious game/ simulation Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage n	Weight	Contrast pole
21	Gamification: game thinking	Pragmatic skills and competencies development	5	1	1	2	3	4		Outrageous conjecturing
22	Gamification: engagement	Engaged player	1	1	2	3	4	5		Disengaged player
23	Gamification: motivating action	Positive behavior modification	1	2	3	4	5	1		Lacking any call to action
24	Gamification: promoting learning	Learning is promoted	2	3	4	5	1	1		Learning in trivialized
25	Gamification: problem solving	Solvable problems	1	1	2	3	4	5		Insurmountable problems
26	Experiential learning cycle: concrete experience	Builds upon a personal point of view associated with a circumstance	3	4	5	1	1	2	b%	Minimal grounding in the real world
27	Experiential learning cycle: reflective observation	Invokes a sensemaking cycle in the mind of the player	4	5	1	1	2	3		Lacks significant introspection for the player
28	Experiential learning cycle: abstract conceptualization	Abstraction and critical analysis results in new knowledge	5	1	1	2	3	4		"same old […] same old"
29	Experiential learning cycle: active experimentation	Active discovery and exploration of new ideas	2	3	4	5	1	1		Backwater of trite or dead ideas
		Repertory grid sub-totals	70	71	76	81	81	85		
	Repertory grid total	464								

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