12-2013

THE GAME OF INFORMATION SYSTEMS HIGHER EDUCATION

Mark Bruce Freeman

Alison Freeman

THE GAME OF INFORMATION SYSTEMS HIGHER EDUCATION

Mark Bruce Freeman
School of Information Systems and Technology
University of Wollongong, Australia
mfreeman@uow.edu.au

Alison Freeman
School of Information Systems and Technology
University of Wollongong, Australia
afreeman@uow.edu.au

Abstract:

With continual changes in higher education in the field of Information Systems (IS), educators are faced with the question: how can we actively engage each learner in a way that encourages self-direction while developing the ability to independently solve problems? The unique learning characteristics of adult learners must each be considered in the design of learning experiences in higher education environments. Gamification – the use of gaming elements in non-gaming contexts – is one source of opportunities for new and interesting learning experiences. Through discussion of 12 major gaming elements, this paper considers whether gamification can create innovative learning environments for IS higher education. Practical suggestions for the application of gaming elements, as part of a constructivist approach, are also presented.

Keywords: E-learning, Information systems, Learning, Gaming

I. INTRODUCTION

In higher education settings, educators are faced with the same dilemma each session: how best to deliver course materials in a way that will actively engage learners, allow for self-direction and develop learners' abilities to independently solve problems – all while building learners' knowledge of the subject content and meeting the course objectives. This raises many and varied challenges for educators. Given the diversity of issues that must be considered, and the domain-specific nature of some of these considerations, this paper will specifically focus on the unique needs of adult learners in university courses in the Information Systems (IS) space. Practical suggestions for addressing adult learners' needs via constructivist theories of learning will be provided through examples employing gamification. Constructivist theories of learning are concerned with active enquiry, guiding learners and coaching within a learning context that is situated by authentic activities [Kerka, 1997]. This approach has potential to increase learning outcomes and enrich learning experiences. It also allows learners to develop skills in dealing with complex open-ended problems while maintaining a high level of interest in their targeted learning content.

IS academics educate students to become the conduit between business and technology, and equip students with the necessary skills to be adaptable in a world of ever changing technological considerations. Although this goal forms the basis for delivery in most courses taught, *Assessment of Learning* is still essential in most universities to ensure learning outcomes are met. Summative approaches are deemed by some educators to be the only way to evaluate learning; final examinations are typically worth an extremely large percentage of a student's course mark and courses are taught by applying the same methods year-in year-out. Despite this situation, some forward-thinking educators apply *Assessment for Learning* techniques within their courses to facilitate deep learning, and pro-actively modify

courses during delivery to increase learning outcomes. It has been argued that a formative assessment approach aids in increasing learning [Moore, 2005]. This paper argues that changes should be made to higher education assessment, moving away from summative exam assessments and instead relying more heavily on formative approaches that are concerned with *Assessment for Learning*. Specifically, these formative assessments *for* learning should be used to gamify the learning experience for students.

II. ADULT LEARNERS

All too often when teaching IS courses in the university context, there is a focus on teaching pedagogy. This model was originally designed to teach child learners through the transmission of information and skills [Holmes & Abington-Cooper, 2000], and is therefore not heavily relevant to the higher education environment. The focus on pedagogy is seen most prominently when teaching information that needs to be transmitted to learners, commonly delivered through a series of lectures and tutorials – for example, explaining the basics of a programming language or network structure and then asking students to complete the same task repetitively. Educators must re-think this approach – university students are adult learners who will benefit most from learning to solve problems similar to those that they will face in the workplace.

As previously discussed in the literature, it is necessary to apply different methods of learning for adult learners in some circumstances as they have a different set of needs to child learners [Holmes & Abington-Cooper, 2000; Kerka, 2002]. One of the most commonly cited theories of adult learning, popularised by Knowles, is andragogy [see Light et al., 2009; St. Clair, 2002]. The six key principles of andragogy are described in Table 1.

Table 1. Principles of Andragogy

Andragogy principle	**Description**
Self-directedness	An educator has the responsibility to assist an adult learner to move from being dependent on the educator to having self-directed experiences.
Experience	Past experiences of an adult learner can be used as a rich source of material within the learning environment.
Readiness	An adult learner is seeking learning experiences to aid them in coping with real-world problems.
Competence	Through learning experiences, adult learners believe they can achieve increased competence.
Orientation	Material taught in a learning environment requires justification and an explanation of its applicability to life.
Motivation	An adult learner typically has internal motivation for their desire for learning.

There has been considerable critical debate about andragogy theory: some claim it is only relevant to some aspects of adult learning [St. Clair, 2002]; others argue that age should not be used as the only element for determining the teaching approach used and that a continuum of learning practice exists between pedagogy and andragogy [Light et al., 2009]. Knowles [1984] argues that pedagogy has a place within andragogy, drawing a distinction between the two based on underlying assumptions. Pedagogy is concerned with content

planning, while andragogy is about process design [Knowles, 1984]. It has been suggested that an extension of the basic premises of andragogy is required before andragogy can be broadly applied in adult learning [Henschke, 2011]. Despite these on-going debates, it is notable that the six key principles of andragogy align closely with the constructivist approaches, particularly when implemented in conjunction with the basic principles of gamification. This allows learners to control their own learning experiences, delivering the potential to motivate learners and increase overall learning outcomes.

III. ASSESSMENT PRACTICES

Higher education is more than just grades and a testamur; for it to be truly effective, a student must achieve deep learning of their chosen subject matter, and establish a foundation of lifelong learning and the ability to rationalise content in social and workplace settings. It is therefore vital that students receive more than simply a summative result from assessments and exams. An informal review of existing higher education IS courses indicates that the majority of current assessments use a summative approach (for example exams and essays), which limits the applicability of the feedback for learners as they are learning.

Formative assessment is a planned process where the educator uses evidence from learner progression within the learning task to modify teaching methods [Wright & Sandlin, 2009b]. Historically, there has been a tendency for administrators to see formative assessment only as a mechanism for feedback and review rather than as a method of 'engaging students with learning' [Wright & Sandlin, 2009a]. Whilst advocating the application of formative assessment techniques within teaching, it is essential to ensure that the activities used in each assessment are appropriate for the subject matter [Gee, 2012] and to consider students' reactions to the different kinds of assessments given to them [Tisdell, 2008]. From an academic perspective, learning and assessment are closely coupled [Sandlin et al., 2011]. Biggs [2002, cited in Rasmusson & Eklund, 2012] noted that assessment tasks should be used not only to determine what is learnt, but also to inform requirements for future knowledge and skill development, including students' ability to reconstruct or build on the knowledge they have learnt. This is referred to as an Assessment for Learning approach.

Modification to existing assessment practices would allow the integration of formative assessment, making it possible to achieve Assessment for Learning rather than the current widely-used Assessment of Learning. Prior research has identified this as an important factor in improving student learning. This modification requires the use of a triangulation approach within subjects to allow for deeper understanding of learning: the application of group-, peer and self- assessment methods. Each of these components could be facilitated by gaming elements; this concept is explored further below.

Constructivist theories of learning are characterised by three propositions:

- "Understanding is in our interactions with the environment;
- Cognitive conflict or puzzlement is the stimulus for learning and determines the organization and nature of what is learned; and …
- Knowledge evolves through social negotiation and through the evaluation of the viability of individual understandings." [Savery & Duffy, 1995 pp. 135-136]

Constructivist theories are closely tied with the andragogy theory of adult learning, where the learner is considered to be responsible for his/her own learning and to be self-directed [Knowles, Holton & Swanson, 2005; Light et al., 2009]. Constructivist theories of learning are ideal for use with gamified learning experiences as they allow the learner to have control of the learning experience. The use of open problems for which learners must find a potential solution [Hoic-Bozic et al., 2009] has been supported in previous research in the IS higher education space; benefits (including creating value and increased student motivation) of exposing learners to 'near real-life' educational experiences [Lynch et al., 2007] have been

identified. Group based activities are commonly used to engage students as they have been found to encourage students to develop deeper knowledge and problem solving skills [Hauer & Daniels, 2008].

IV. GAMING ELEMENTS AND THE GAMIFICATION OF LEARNING

DEFINING GAMIFICATION

The practice of gamification has recently become popularised in many discrete contexts, including in for-profit organisations, health, marketing and education. Varying levels of acceptance and success have been reported with the use of gaming principles in these varied contexts. Despite the increasingly widespread discussion and application of gamification, and broad agreement on many key aspects of the concept, there is currently no single definition agreed by either practitioners or researchers [Erenli, 2012]. Within the educational context, definitions of gamification vary [Muntean, 2011]. The main area of agreement is the importance of embedding the gaming characteristics in the context of learning [Erenli, 2012].

Based on a review of the literature, Deterding et al. [2011] proposed the following definition of gamification: "Gamification is the use of game design elements in non-game contexts". This definition can be applied to the concept of gamification in learning contexts due to its general nature. However, it does not assist in: identifying elements of gaming that can be applied to gamify interactions or experiences; selecting elements that are useful for learning; or guiding educators as they gamify learning experiences.

GAMING ELEMENTS

The first challenge facing educators is understanding the opportunities offered by gamification; this requires an understanding of gaming elements, their purpose and their outcomes. There are a number of elements that are commonly incorporated into games to engage players. Various lists of these elements have been developed by researchers [Garris et al., 2002]. Twelve of the more commonly cited and popular gaming elements are described in Table 2.

Table 2. Gaming Elements

Gaming element	Description
A system	All games can be understood from the perspective of a system. A game is the interplay of a group of predefined elements of interaction [Salen & Zimmerman, 2004].
Abstractions of concepts and reality	For a game to function effectively, it must be established at a level that represents an abstraction of society; mundane concepts are removed to increase player engagement [Garris et al., 2002; Kapp, 2012b; Muntean, 2011].
Goals	A player will either achieve or not achieve each goal within a game. During a game, a player receives feedback about progress towards a goal. Well-structured goals can be achieved using scaffolded player experiences that include sub-goals. Achievement of the ultimate goal within a game means that the interaction with the game is finished [Garris et al., 2002; Kapp, 2012b; Muntean, 2011; Salen & Zimmerman, 2004].

Rules	A game requires a set of predefined rules. These can be operational, foundational, implicit (behavioural) or instructional [Kapp, 2012b; Salen & Zimmerman, 2004].
Engagement (conflict, competition or cooperation)	A game embodies a contest with the system or with other players [Deterding, 2011; Kapp, 2012b; Muntean, 2011; Salen & Zimmerman, 2004]. Often engagement is linked to Malone and Lepper's 'Taxonomy of Intrinsic Motivations' under the category of interpersonal motivations as: cooperation, competition and recognition [Malone & Lepper, 1987].
Reward structures	A game can include sub-goals that build towards the achievement of the ultimate goal within the game. Achievement of these sub-goals can result in player rewards delivered through internal/individual, intrinsic or extrinsic means [Kapp, 2012b; Muntean, 2011]. Often reward structures are linked to Malone and Lepper's 'Taxonomy of Intrinsic Motivations' under the category of individual motivations as: challenge, curiosity, control and fantasy [Malone & Lepper, 1987].
Progression, levels	A player has the ability to progress through game levels, reflecting the achievement of sub-goals [Kapp, 2012b; Muntean, 2011].
Storytelling	A compelling game has an element of storytelling. The story is typically embedded in the flow of the game; the player participates in the story within the gaming context [Kapp, 2012a, 2012b].
Curve of interest	A game must be engaging, maintaining a curve of interest for the player. This is usually achieved through sub-goals. A game should incorporate peaks and troughs to engage the player and to establishment and maintain interest [Kapp, 2012a, 2012b].
Investment	Through engagement with a game, a player becomes invested in the experience and thus continues to play the game to achieve the created goals [Kapp, 2012b; Knewton, 2012; Muntean, 2011].
Fulfilment	A player can achieve a sense of fulfilment through engagement in a controlled setting that provides the opportunity to take chances [Kapp, 2012a].
Replay, do-over or infinite play	A game allows a player to re-do activities in another attempt to achieve objectives if unsuccessful the first time. This is an advantage over real world experiences [Kapp, 2012b].

CONNECTING WITH LEARNERS

From this broader list of gaming elements presented above, it is necessary to identify the characteristics of gamification that are accepted as being relevant to education. Despite significant discussion about the topic in practice and in the media, there is currently a lack of literature specifying agreed characteristics for gamification in the context of learning.

Even assuming that gamification is applicable and valuable to some IS learning environments, it is important to critically analyse its usage in different learning contexts. It is likely that different gaming elements will be required to match the needs of varied learning environments and specified learning outcomes [Kapp, 2012b]. This paper describes how

some of these gaming elements have the ability to be used to gamify adult learning environments, and IS higher education learning specifically.

The use of games for learning is not new, with three types of games identified for reaching educational goals in a more engaging way: classic edu-tech or edutainment games, games developed by students themselves and gamified courses [Klopfer et al., 2009; Muntean, 2011]. Edu-tech games are generally classified as 'serious games', which are games "for training… characterized by their specificity and applicability for particular work-related purposes" [Klopfer et al., 2009 p. 20]. While some authors include the element of 'fun' in their definition of serious games, others imply simply that these are 'games' because they are not reality, and therefore they provide the benefits of a game environment (e.g. the ability to fail without real consequences). Serious games are popular in industries such as health and the military. Serious games are distinctly different from gamified courses and the gamification of learning, which employs elements of games to learning experiences. Klopfer et al. [2009] provides a list of ways games can be integrated into an educational environment, described through various types of systems. While Klopfer et al. present principles for learning game design, they do not specify the characteristics of gamification that justify its applicability to the classroom. An example of the application of a serious game in IS higher education is the SAP simulation game developed at HEC Montréal for teaching enterprise resource planning concepts to students [Léger, 2006]. However, this approach is not appropriate in most higher education settings due to the content being taught.

Given that the percentage of Internet users who engage in social gaming is continually increasing, with an estimated 118.5 million social gamers in the US and UK in 2011 alone, and that it is estimated that over 70% of Global 2000 organisations will have at least one gamified application by 2014 [Gartner, 2011], the impact of games and gamification will be significant. A clear understanding of the concept of gamification is therefore essential for educators as they seek to connect more closely with learners and provide them with learning experiences that are consistent with their future careers as well as their current interests. What is important to understand is that the use of individual gaming elements, as described in this paper, is different to playing an actual game (e.g. serious game) as part of the learning.

Kapp [2012b] noted the importance of defining the basis of gamification (i.e. the 'game') in the context in which the game is 'played'. It is therefore essential to consider the context in which gamification is applied in educational contexts. Kapp [2012b] defined a game in a learning context as "a system in which players engage in an abstract challenge, defined by rules, interactivity, and feedback, that results in a quantifiable outcome often eliciting an emotional reaction" [p. 7] and hence defined gamification as "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems." [p. 10]. Within the education context, learning is usually associated with work while games are associated with fun [Gee, 2005]. One important feature of gamification of learning experiences is that they can influence a learner's behaviour [Hamari & Koivisto, 2013]. This has the potential to increase learning outcomes. In IS learning environments this may entail the use of a simulation of a business process that is 'played' by the learners.

From the elements of effective games it is clear that the *goals* of the *system* needs to be developed so that the player (who is now also the learner) can progress through the *levels* and is engaged with the content (their *curve of interest*) so that *fulfilment* enables learning outcomes to occur. For a learner, *progression* is of importance as they can visually see their success during the learning experience. The division of learning content into chunks, and the recording of progress based on these chunks, allows a learner to maintain an awareness of their progress [Muntean, 2011]. The *investment* that a learner puts into the gamified learning experience allows a sense of accomplishment, a feeling of pride in their work, achievement of learning outcomes and recognition of achievements. Activities attempted and completed by a learner can be recorded through the use of a profile with associated points. This has a strong link to the game terminology of points or the element of *reward structures*. Points

information (a *reward structure*) can be displayed publicly within the game, published on a leaderboard or published through a list of top scores. This encourages a focus on positive results [Muntean, 2011] and in turn increased learning outcomes.

Prior research has argued that activities, topics and courses can be divided into the smallest chunks of coherent content, based on cascading information theory [Muntean, 2011]. Learners can absorb this content at a high level, or have the ability to navigate more deeply to discover more. A learner being awarded points for the learning tasks in that chunk of content demonstrates the achievement of learning outcomes embedded in each chunk of content. The completion of learning activities allows the learner to build skills and/or knowledge. The completion of evaluation activities allows the learner to demonstrate their acquired skills and/or knowledge. Both learning activities and assessment activities can be used to assign rewards to the learner [Muntean, 2011]. An understanding of prior research on gamifying traditional learning and elearning experiences can be used as a grounding for gamifying approaches to learning in higher education environments.

As identified in the elements of *engagement* and *reward structures* above, a player's motivation can be both individual and interpersonal (as described in Malone and Lepper's [1987] 'Taxonomy of Intrinsic Motivations'). By understanding the cognitive reasons for a player choosing to engage with a gaming experience, these influential elements can be further evaluated and then introduced into learning experiences, thereby creating environments where a learner is playing to learn.

It is envisaged that, through gamification, adult learners will be able to satisfy their intrinsic learning needs as outlined in Knowles' principles of andragogy [Knowles, 1984]. This would result in a more engaging learning experience [Deterding, 2011] as motivational affordances are accommodated for; through this, increased learning outcomes will occur.

V. ANDRAGOGY AND GAMIFICATION

Practical application of our understanding of adult learning is essential to make a positive improvement to a learner's experience. This section provides some suggestions that can be applied in your classroom to assist in the development of effective strategies. Understanding that adult learners are self-directed, have experience and competence and a readiness to learn enables greater flexibility in the learning experience. Through a comprehensive *rewards structure* built into the learning experience, adults can engage and learn in a truly gamified environment. This can be achieved in a number of ways once the principles of andragogy and the elements of games are clearly understood. This process is not about turning the learning environment into one big game; however, it is about purposefully employing gaming elements in the learning environment.

The educator needs to act as a facilitator rather than a teacher or lecturer. By placing responsibility for learning in the control of the learner [Brown, 2001], learning becomes a *self-directed* experience. In a gamified learning environment, this can be achieved through the design of the *system*. The *goals* (or learning objectives) need to be somewhat fuzzy; there are no exact answers because the purpose is the development of higher order learning skills where answers are only shades of grey. The facilitator in this gamified experience needs to establish the *rules* of play. The traditional process of sharing the lesson objectives with the learners [Hayes, 2006] can involve providing these rules to all learners.

Understanding the learners' world and using the entire class group as a resource of different experiences [Hayes, 2006; Imel, 2000] is an important component of this type of learning experience. Try asking each learner to use examples from his or her current workplace as evidence of the concepts being discussed in class, and then encourage other students to discuss how that issue or problem would be rectified in their workplace. The concept of *storytelling* is used here to gamify this learning experience. These interactions will also establish greater orientation about the reasons for each learner's participation in the course.

Employing role-play in an IS learning environment to deal with conflict is an example of the *engagement* element being applied, and has the potential to increase learning outcomes. This could be a role-play between an end-user and systems analyst negotiating the requirements of a system and what is technically feasible. This also demonstrates respect for learners' opinions and knowledge, treating them as a partner in the education process.

Adult learners have a readiness to learn and intrinsic motivations for obtaining new knowledge. Utilisation of the gaming element of *fulfilment* in the learning environment can challenge learners and lead to better learning outcomes. Fulfilment can occur by encouraging learner interaction [Hayes, 2006] or showing the benefits of *cooperation* as a method for engagement.

One element of gaming is *abstractions of concepts and reality,* meaning that to engage the player the scope of the overall *system* is reduced to a manageable element. Focus can then be given to the game's *goals*. Thus the educator needs to consider the practical implications of the materials selected for use [Hayes, 2006]. The depth of the learning materials can have an adverse relationship with learning outcomes. While limiting content to a manageable scope (e.g. focusing on one element of the overall situation) ensures learners are not overwhelmed, it is important to deliver learning within a context [Imel, 2000]. Learners need to be able to construct their own meaning from their own personal experiences. This is rooted in the constructivist approach to learning. This can be implemented using a skill-based approach, for example an IS learner who demonstrates competency using a particular software application is awarded a virtual badge for their success.

VI. ASSESSMENT OF ADULT LEARNING

A key component of teaching adult learners is assessing the effectiveness of the teaching and learning interactions. This is best undertaken through the exploration of ill-defined problems [Gallagher, 1997] to challenge and *engage* learners. Despite their popularity in IS courses in universities, it has been argued that the use of multiple-choice style assessments does not favour adult learners for a variety of reasons and should be avoided [Hay et al., 2010]. Multiple-choice questions are also of little value for assessment with adult learners. Instead, assessments should be experiential learning activities that play a key role in the learning process [Kolb & Kolb, 2005; Kolb, 1984; Kolb et al., 2000]. A well-structured *system* can allow learning and assessment to occur simultaneously. However, the implementation of such requires that both educators and students understand the benefits afforded by this approach.

Adult learners should be challenged to demonstrate their understanding of a given problem and present a logical solution within the defined context (i.e. the *rules*) [Gallagher, 1997]. One practical application of this approach is for students to address an IS problem for a small local business; when implemented, students worked with the business to identify a number of different ways to solve an existing problem. This experience was positive for all involved – it created an authentic learning experience with an ill defined problem (*storytelling*), provided feasible solutions for the business (*fulfilment* for both learners and the business) and allowed community outreach (*engagement*) to occur. In IS learning environments, the use of a scenario or case-study for students to engage with is a good example of *storytelling* for a gamified learning environment. These techniques can be enhanced through other gaming elements.

A focus on the learner's ability to problem solve, ideally using feedback (*goals, curve of interest*), the importance of being self-directed (facilitated by the *system*), and the need to continually develop confidence and communication/negotiation skills (creating *investment* which leads to *progression*). Each of these elements contributes to improved learning outcomes for adults, and also ties closely to andragogy (a commonly cited theory of adult learning, as explained above).

By embracing the learning community concept (*engagement*) and acting as a facilitator – both within the classroom and online – the IS educator can facilitate a positive relationship between all educators and students involved in the learning experience. This is essential for providing an environment that fosters adult learning. Learners that have spent time in the workplace would have both positive and negative examples of situations that could be explored as a class (*storytelling* and *investment*). To gamify these, students could act out the situation and other learners could develop methods to improve the situation (full *engagement* as a class).

For changes to the designated assessment approach within IS courses to be effective, educators (particularly those who have traditionally focused on using summative assessment) must be involved in the process of change. While previous research has noted resistance to change in the higher education space [Blin & Munro, 2008], explanation of the benefits of the new approach and a resulting ability for IS educators to embrace such an approach can negate this resistance, as each educator assumes the role of a change agent [Kenny, 2009]. Learners can be engaged through demonstration of the skills that they could develop as a result of full participation in the assessment task, a clearly specified relationship between the task and subject objectives and graduate qualities, and understanding the value placed on these skills by employers [Barrie, 2004; Harwood, 2008]. To maximise the effectiveness of these methods of learner engagement, the role of educators must shift from lecturer to learning facilitator [Collins & Blot, 2003], placing responsibility for learning in the control of the student.

Group-work based assessment has been shown to provide students with motivational, social and cognitive benefits whilst increasing learning outcomes. Other benefits include increased problem solving skills and enhanced ability to deal with group dynamics including conflict and inter-group problems [Hammar Chiriac, 2008]. If groups are left on their own without instruction they can be unfocused [Dennis et al., 2008] and can have unresolved conflict [Lubna & Collins, 2005]. *Rules* can be embedded in the *system* to provide structure and scaffolding. The issue of a 'free-rider' in group tasks has previously been identified in the literature [Maiden & Perry, 2011] – use of a *system* can automatically record contributions to minimise such problems. If these problems are not rectified then students could lose motivation on the project (overcome using *investment*) and not achieve the desired learning outcomes. When groups develop these problems, conflict arises – the nature of this group conflict is distinctly different to the conflict embedded in traditional gaming environments for the purpose of *engagement*, such as online first person shooter games (e.g. conflict in 'Call of Duty' against the opposition). Group conflict must be dealt with within the rules of the system. With defined *reward structures*, learners understand the benefits of engagement through cooperation with their team members; this could be highlighted by a group being able to *progress* through the assessment (*levels*) if they are working as a cohesive unit.

The rapid feedback provided by gamified interactions can inform fairer, more factual peer-assessment and enables learners to self-assess more objectively and ultimately improve learning outcomes. Both peer- and self-assessment are concerned with allowing students to assume some responsibility in making judgements about their learning, a key element in Andragogy. Both approaches are extremely useful in achieving learning outcomes [Yankelovich, 2006], and allow students to develop their own metacognitive competences related to their learning process [Warschauer, 2003]. Peer-assessment techniques within group assessment reflect a more democratic approach to assessment mark determination [Erstad et al., 2007] through "the involvement of students in making judgements of their learning" [Tyner, 1998 p. 16] and also encourage students to engage in discussion about the processes of learning. Peer-assessment also has the ability to reduce the issue of 'free-riding' in group-work, an issue previously discussed as a limitation of group-work [Nixon, 1999]. By introducing peer sessions into the classroom, students are also able to get formative feedback at a very rapid pace. This technique could be particularly appropriate for programming subjects taught within IS courses. Engaging in self-assessment assists students to better understand their own strengths and weaknesses and to set realistic goals

[Alfred, 2002]. It encourages active participation and is integral to a learner-centred approach [Alfred, 2002]. One of the objectives of using group-based assessment within IS courses is building employability in students, including the ability to work effectively as part of a team. Therefore, assessing the group process via peer- and self-assessment is a vital skill that educators must assist IS students to develop.

Through the use of a gamified process of peer-assessment in which other learners allocate the rewards specified in the assessment's *reward structures*, greater learner *fulfilment* can be achieved. Peer ownership of the application of the *reward structures* within a learning experience means that learners are required to assume a greater sense of *involvement* in their own learning. A group of learners could use a ranking structure to order the group effort and quality of each member's submission; this ranking could then be used in the determination of actual marks for each member's contribution to a group assessment.

Self-assessment (or critical reflection) is an important skill for IS students to develop, and is identified as one the generic skills required for typical employment options for business/systems analysts. These roles require professionals to review IS requirements and establish system structures that meet the needs of a business. Hence, the ability to identify appropriate *goals* for a system is essential; this is one skill that can be directly developed in a gamified learning environment. Learners progressing to software development careers will be required to identify requirements for each iteration of a software product (*progression*/*levels* of the application).

One other significant area in which formative assessment has the potential to enable greater learning outcomes is through the provision of lifelong learning skills, which are particularly important for IS learners due to constant changes in technology. The delivery of feedback through *reward structures* (e.g. points or the achievement of sub-goals) draws learners' attention to their learning process, hence building metacognitive skills that can then be applied to all areas of their life. *Abstractions* provide the opportunity for learners to master both skills and knowledge in a controlled, *rules*-based context; the feedback provided through the game highlights the complexity of the learning experience for learners and hence the various outcomes achieved (*fulfilment*). When it comes to developing new practices within IS courses, educators must consider learners' needs beyond their time of enrolment in the formal course.

The scenarios, explanations and examples above demonstrate that many gaming elements can be applied to the delivery of higher education in the IS discipline. It is important to note that, while technology *can* be used to facilitate any such implementation, it is *not* an essential component. Many of these suggestions can also be applied to higher education learning environments more generally.

VII. FINAL REMARKS

With rapid advancements in IS higher education, the question that needs to be addressed by educators is: how can we actively engage each learner in a way that encourages self-direction while developing the ability to independently solve problems? While serious games have been used in some contexts where the content being taught was adaptable to traditional style games and/or simulations, most higher education content does not allow such an approach. This paper has identified that the application of gamification can enhance a learner's experience; more active engagement can be achieved and greater learning outcomes are therefore obtainable. Based on 12 identified gaming elements, this paper has considered the relevance and appropriateness of the gamification of higher education learning experiences in the IS discipline through the context of andragogy. All gaming elements have the ability to be applied in a way that positively contributes to learners' experiences and learning outcomes. Given that technology is not an essential component of the gamification of any learning experience, it is likely that many of the suggested

applications of gaming elements could also be successfully applied in other higher education disciplines.

LIST OF REFERENCES

Alfred, M. V. (2002). "The promise of sociocultural theory in democratizing adult education". *New Directions for Adult and Continuing Education,* (2002)96, pp. 3-14.

Barrie, S. C. (2004). "A research-based approach to generic graduate attributes policy". *Higher Education Research & Development,* (23)3, pp. 261-275.

Blin, F., & Munro, M. (2008). "Why hasn't technology disrupted academics' teaching practices? Understanding resistance to change through the lens of activity theory". *Computers & Education,* (50)2, pp. 475-490.

Brown, B. L. (2001). "Group Effectiveness in the Classroom and Workplace". *ERIC/ACVE,* (Practice Application Breif No. 15).

Collins, J., & Blot, R. (2003). *Literacy and Literacies*: Cambridge University Press.

Dennis, A. R., Garfield, M., & Reinicke, B. (2008). *Towards an Integrative Model of Group Development*. Sprouts: Working Papers on Information Systems, (8:3). Indiana University, USA. Retrieved from http://sprouts.aisnet.org/8-3

Deterding, S. (2011). *Situated motivational affordances of game elements: A conceptual model*. Paper presented at the CHI, Vancouver, BC, Canada

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September 28-30, 2011). *From game design elements to gamefulness: defining "gamification".* Paper presented at the MindTrek'11, Tampere, Finland.

Erenli, K. (2012, 26-28 Sept. 2012). *The impact of gamification: a recommendation of scenarios for education.* Paper presented at the Interactive Collaborative Learning (ICL), 2012 15th International Conference on.

Erstad, O., Gilje, Ø., & de Lange, T. (2007). "Re-mixing multimodal resources: multiliteracies and digital production in Norwegian media education". *Learning, Media and Technology,* (32)2, pp. 183-198.

Gallagher, S. A. (1997). "Problem-based learning: Where did it come from, what does it do, and where is it going?". *Journal for the Education of the Gifted,* (20)4, pp. 332-362.

Garris, R., Ahlers, R., & Driskell, J. E. (2002). "Games, motivation, and learning: A research and practice model". *Simulation & Gaming,* (33)4, pp. 441-467.

Gartner. (2011). "Gartner Predicts Over 70 Percent of Global 2000 Organisations Will Have at Least One Gamified Application by 2014. Analysts Discuss the Future of Gamification at Gartner Portals, Content and Collaboration Summit, March 12-14, 2012 in Orlando, Florida [press release]", http://www.gartner.com/newsroom/id/1844115 (current Retrieved 12 February, 2012).

Gee, J. P. (2005). "Learning by Design: good video games as learning machines". *E-Learning and Digital Media,* (2)1, pp. 5-12.

Gee, J. P. (2012). *Social linguistics and literacies: ideology in discourses*. Abingdon, Oxon: Routledge.

Hamari, J., & Koivisto, J. (2013). *Social motivations to use gamification: an empirical study of gamifying exercise*. Paper presented at the European Conference on Information Systems, Utrecht, Netherlands

Hammar Chiriac, E. (2008). "A scheme for understanding group processes in problem-based learning". *Higher Education,* (55)5, pp. 505-518.

Harwood, A. (2008). " Life Transitions: Overseas study, work and career for young Singaporeans". *The International Journal of Pacific Studies,* (4)1, pp. 1-19.

Hauer, A., & Daniels, M. (2008). *A Learning Theory Perspective on Running Open Ended Group Projects (OEGPs)*. Paper presented at the Proceedings of the Tenth Australasian Computing Education Conference (ACE2008), Wollongong, Australia

Hay, D. B., Tan, P. L., & Whaites, E. (2010). "Non- traditional learners in higher education: comparison of a traditional MCQ examination with concept mapping to assess learning in a dental radiological science course". *Assessment & Evaluation in Higher Education,* (35)5, pp. 577-595.

Hayes, A. (2006). *Teaching adults*. New York: Continuum.

Henschke, J. A. (2011). "Considerations Regarding the Future of Andragogy". *Adult Learning,* (22)1, pp. 34-37.

Hoic-Bozic, N., Mornar, V., & Boticki, I. (2009). "A Blended Learning Approach to Course Design and Implementation". *IEEE Transactions on Education,* (52)1, pp. 19-30.

Holmes, G., & Abington-Cooper, M. (2000). "Pedagogy vs. Andragogy: A False Dichotomy?". *The Journal of Technology Studies,* (26)2, pp. online.

Imel, S. (2000). "Contextual Learning in Adult Education". *ERIC/ACVE,* (Practics Application Breif No. 12).

Kapp, K. (2012a). "Games, Gamification, and the quest for learner engagement". *T + D,* (66)6, pp. 8, 64-68.

Kapp, K. (2012b). *The gamification of learning and instruction: game-based methods and strategies for training and education*. San Francisco, CA: John Wiley & Sons.

Kenny, J. (2009). "Work-based research in a large organisation: the transformation from change agent to researcher". *Research in Post-Compulsory Education,* (14)4, pp. 369-385.

Kerka, S. (1997). "Constructivism, Workplace Learning, and Vocational Education". *ERIC/ACVE,* (181).

Kerka, S. (2002). "Teaching Adults: Is It Different?". *ERIC/ACVE,* (Myths and Realities No. 21).

Klopfer, E., Osterweil, S., & Salen, K. (2009). Moving Learning Games Forward: The Education Arcade, Massachusetts Institute of Technology.

Knewton. (2012). "The Gamification of Education Infographic", http://www.knewton.com/gamification-education/ (current Retrieved 12 February, 2012).

Knowles, M. S. (1984). *Andragogy in action*. San Francisco: Jossey-Bass.

Kolb, A. Y., & Kolb, D. A. (2005). "Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education". *Academy of Management Learning & Education,* (4)2, pp. 193-212.

Kolb, D. A. (1984). *Experiential Learning: experience as the source of learning and development*. New Jersey: Prentice-Hall

Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (2000). Experiential learning theory: Previous research and new directions. In R. J. Sternberg & L. F. Zhang (Eds.), *Perspectives on thinking, learning, and cognitive styles* (pp. 227-247). NJ: Lawrence Erlbaum

Léger, P.-M. (2006). "Using a simulation game approach to teach ERP concepts". *Journal of Information Systems Education,* (17)4, pp. 441-447.

Light, G., Cox, R., & Calkins, S. (2009). *Learning and Teaching in Higher Education: The Reflective Professional* (2nd ed.). Thousand Oaks, California: Sage.

Lubna, S. A., & Collins, P. (2005). *Engaging our overseas graduate IT coursework community: Developing communication and critical thinking skills*. Paper presented at the ascilite 2005: Balance, Fidelity, Mobility: maintaining the momentum?, Brisbane

Lynch, K., Heinze, A., & Scott, E. (2007). "Information Technology Team Projects in Higher Education: An International Viewpoint". *Journal of Information Technology Education,* (6)Annual, pp. 181-198.

Maiden, B., & Perry, B. (2011). "Dealing with free-riders in assessed group work: results from a study at a UK university", [Article]. *Assessment & Evaluation in Higher Education,* (36)4, pp. 451-464.

Malone, T. W., & Lepper, M. (1987). Making learning fun: A Taxonomy of Intrinsic Motivation for Learning. In R. E. Snow & M. J. Farr (Eds.), *Aptitude learning, and instruction* (Vol. 3). London: Lawrence Erlbaum Associates Publishers.

Moore, M. R. (2005). "Multiliteracies for a Digital Age". *Professional Communication, IEEE Transactions on,* (48)4, pp. 427-429.

Muntean, C. (2011). *Raising engagement in e-learning through gamification.* Paper presented at the The 6th International Conference on Virtual Learning ICVL 2011, University of Bucharest and "Babeş-Bolyai" University of Cluj-Napoca.

Nixon, H. (1999). "Towards a (Cyber)pedagogy for Multimedia Multiliteracies". *Teaching Education,* (10)2, pp. 87-102.

Rasmusson, M., & Eklund, M. (2012). ""It's easier to read on the Internet—you just click on what you want to read…"". *Education and Information Technologies*, pp. 1-19.

Salen, K., & Zimmerman, E. (2004). *Rules of Play - Game Design Fundamentals*. Cambridge, Massachusetts The MIT Press.

Sandlin, J. A., Wright, R. R., & Clark, C. (2011). "Reexamining Theories of Adult Learning and Adult Development Through the Lenses of Public Pedagogy". *Adult Education Quarterly*.

Savery, J. R., & Duffy, T. M. (1995). "Problem Based Learning: An instructional model and its constructivist framework". *Educational Technology,* (35)5, pp. 31-38.

St. Clair, R. (2002). "Andragogy Revisited: Theory for the 21st Century?". *ERIC/ACVE,* (Myths and Realities No.19).

Tisdell, E. J. (2008). "Critical Media Literacy and Transformative Learning Drawing on Pop Culture and Entertainment Media in Teaching for Diversity in Adult Higher Education". *Journal of Transformative Education,* (6)1, pp. 48-67.

Tyner, K. (1998). *Literacy in a digital world: teaching and learning in the age of information*. Mahwah, NJ: Lawrence Erlbaum.

Warschauer, M. (2003). "Dissecting the "Digital Divide": A Case Study in Egypt". *The Information Society: An International Journal,* (19)4, pp. 297-304.

Wright, R. R., & Sandlin, J. A. (2009a). "Cult TV, Hip Hop, Shape-Shifters, and Vampire Slayers". *Adult Education Quarterly,* (59)2, pp. 118-141.

Wright, R. R., & Sandlin, J. A. (2009b). "Popular culture, public pedagogy and perspective transformation: The Avengers and adult learning in living rooms". *International Journal of Lifelong Education,* (28)4, pp. 533-551.

Yankelovich, D. (2006). "Higher Education in 2015". *Education Digest,* (71)5, pp. 43-53.

ABOUT THE AUTHORS

Mark Bruce Freeman is a lecturer in the Faculty of Engineering and Information Sciences within the School of Information Systems and Technology. He is also responsible for Industry and Community Engagement for his school. His primary research areas are human-computer interaction (particularly mobile systems) and learning technologies where he has published his work in journals and at a number of international information systems conferences. Other research areas include community informatics and social networking technologies. Mark was awarded his PhD in 2008. His doctoral research examined the relationship between human-computer interaction and online systems.

Alison Freeman is an Honorary Fellow in the School of Information Systems and Technology at the University of Wollongong, Australia. She received a PhD from the University of Wollongong, where her doctoral research examined information systems policy issues in relation to community informatics. Her primary research areas are information systems, community informatics and e-learning. Alison has published her research in journals and at international conferences.