Affect-Based Effects of Simulation Games on Learning

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Abstract

Empirical evidence has demonstrated the benefits of using simulation games in enhancing learning especially in terms of cognitive gains. This is to be expected as the dynamism and non-linearity of simulation games are more cognitively demanding. However, the other effects of simulation games, specifically in terms of learners' emotions, have not been given much attention and are under-investigated. This study aims to demonstrate that simulation games stimulate positive emotions from learners that help to enhance learning. The study finds that the affect-based constructs of *interest*, *engagement* and *appreciation* are positively correlated to *learning*. A stepwise multiple regression analysis shows that a model involving *interest* and *engagement* are significantly associated with *learning*. The emotions of learners should be considered in the development of curriculum, and the delivery of learning and teaching as positive emotions enhances learning.

Introduction

The use of technology in learning and teaching has gained much traction over the years as the cost of technology has declined in parallel with the increase in its ownership and use (Vogel et al., 2006). Technologies such as simulation games help learners gain and retain knowledge as game playing necessitates learners to continuously apply knowledge that has been accumulated (Gros, 2007). The use of technology such as simulation games do help in enhancing learning (Laffey et al., 2003), however the degree of its effectiveness remains equivacoal (Randel et al., 1992, Costabile et al., 2003, Rosas et al., 2003).

The effectiveness of technology and simulation games have generally been evaluated in terms of the cognitive gains made by participants. Whilst this is important, and is potentially the primary aim of learning, there are other processes that contribute to learning that have not been investigated at depth, namely the feelings and emotions that are invoked when using simulation games (Hartley, 2002). There appears to be paucity in literature in terms of empirical evidence that explains the role of feelings and emotions in management education

(Leemkuil and De Jong, 2012, Knight, 2002) as the evaluation of simulation games have generally been anecdotal and descriptive. The role of emotions in learning and teaching is important as it influences cognitive processess such as problem solving (Spering et al., 2005). The interplay amongst cognitive, conative and affective factors, whilst not completely understood, is recognised and is considered to be important (Eysenck, 1994) to learning in the workplace and in improving overall academic performance (Gros, 2007).

Affect-based processes (e.g. interest) have been conjectured to be an antecedent of cognition gains (Chiu et al., 1994) as learners who feel relaxed and are emotionally stable tend to be more receptive, thus enabling them to focus on their learning (Nicol et al., 2003). This study aims to demonstrate a link between affect-based constructs and learning specifically in the context of the use of simulation games in learning and teaching. This study contributes to literature by demonstrating the importance of emotions in learning and the role of simulation in inducing such emotions. In the next section, extant literature is reviewed in regards to the use of simulation games in learning and teaching, and in support of the hypotheses development. The following section outlines the methodology adopted that includes a description of the measurement scale, the sampling design, administrative procedures and the context of the module. The findings are presented next, followed by a discussion concerning the implications of the findings on theory and practice, as well as suggestions for future research.

Literature Review

Virtual Generation

The continuous advancement in computing together with the decline in its cost has enabled technology to be developed and applied in all aspects of life (Arbaugh, 2008, Gros, 2007). Technology is ubiquitous (Martins and Kellermanns, 2004) and has permeated into all areas of learning and education. The use of technology in learning and education is not optional as the present generation of learner in business schools expects to be taught interactively and graphically (Aldrich, 2003). Proserpio and Gioia (2007) indicated that at least one person per household in the U.S. plays PC console-based games. The generation of children growing with high digital literacy are known as the virtual generation (V-Gen) (Gros, 2007, Proserpio and Gioia, 2007). The V-Gen's culture emphasises immediacy, 24/7 information availability and access.

Simulation Games

Information technology and the Internet provide various tools and methods as options for instructors to adopt in developing their own blended learning approach to suit their specific contexts. Computer-assisted-instruction (CAI) are programs that augments, teaches or simulates the learning environment (Vogel et al., 2006). 'Simulations' are essentially a model (or simplification) of reality. A simulated model is valuable if it is characterised by *omomorphism*. Omomorphism is the degree of authenticity of the simulation in terms of reflecting reality (Proserpio and Gioia, 2007). In other words, omomorphism is the number of important traits in reality that has been taken into account by the simulation. It is a challenge in balancing the need to simplify reality and maintaining authenticity as over simplification degenerates the face validity of the simulation (Proserpio and Gioia, 2007; Vogel et al., 2006), whilst simulations that are too complex may lose their educational utility. Learners benefit from using simulation through experimentation by changing input values, parameters and constraints of a process, and consequently observing the change in the output. Many pure simulation programmes do not have specific goals or any competitive element to them (Leemkuil and De Jong, 2012).

Games, however, involves some level of competition (or in some cases even cooperation) amongst players to attain a goal (Galvão et al., 2000). Vogel et al. (2006) states that the key characteristics of computer games are i) the game has goals, ii) is interactive and iii) is rewarding (gives feedback). Games involve players making and implementing choices between alternatives. Players are provided 'feedback' with every action / decision with aim of helping players attain their goal (Vogel et al., 2006; Galvão et al., 2000). Games are complex as they are open-ended, which allows for various and multiple strategies to take place. This makes games more cognitively demanding than many other learning and teaching methods.

Simulations and games have converged and the hybrid of the two is becoming more pervasive. Many simulation games are *decision-making* systems that require learners / players to decide amongst a range of options in a contrived environment based on realistic scenarios (Gros, 2007). This artificial environment enables learners to observe the consequences of their decisions through real-time feedback provided by the programme (Siemer and Angelides, 1995). Hybrid simulation games provide the best of both worlds in enhancing the learning experience (Prensky, 2001). According to Gros (2007) there are seven genres of simulation games; action games (that are reaction-based), adventure games (players have to solve a number of test to progress in the game), fighting games (opponent can be controlled by the computer of another player), role-playing games (human players assumes a character/ role), simulations (involving experimentation), sports games

(based on popular sports) and strategy games (that recreate historical or fictional situations to allow players to develop appropriate strategies to achieve a goal). These 'types' of simulation games are not mutually exclusive and commonly overlap and/ or are in combination.

Stimulation from Simulation Games

Evidence suggests that simulation games are effective in developing learners' knowledge and skills, as well as improving attitudes amongst diverse types of learners and across various situations (Evans et al., 2013; Gros, 2007, Vogel et al., 2006). Playing games develops the brain to work more effectively. Literature suggests that the potential of simulations in advancing and increasing the effectiveness of learning is almost unequivocal, however its potency is still underestimated. Simulation games help but the degree of their impact relative to other learning and teaching methods are unknown (Zantow et al., 2005). The effectiveness of simulation games relates to not only the cognitive gains made by learners but also relates to changing attitudes and making learning more interesting and enjoyable (Graham et al., 2013).

Interest

Simulation games, at the very least, mark a departure from the traditional dyadic method of learning and teaching. Its presence and use provides a sense of novelty and this should stimulate interest in learners. The nature of individual simulation games vary greatly (Kiili, 2005) and thus, by the virtue of its heterogeneity, it should provide some sense of novelty and interest irrespective of learners' experience in playing (other) simulation games (Gros, 2007). Learners' interest in learning should be piqued in their curiosity to understand how the simulation game works, and whether it will be fun and if they can learn from it (Proserpio and Gioia, 2007). From the discussion above, the following hypothesis is proposed:

H1: *Interest* in the simulation game will correlate positively to *learning*.

Engagement

Simulation games are characterised by the process of discovery (Proserpio and Gioia, 2007, Wu et al., 2012). New scenarios and / or challenges are revealed to learners on a gradual basis (Proserpio and Gioia, 2007). At times, some simulation games provide new tasks that may be related to the level of achievement of the learner in the previous stage of the game. This gradual process is one of discovery, which keeps learners engaged in anticipation of the new challenges (Leemkuil and De Jong, 2012). In addition, the narratives that are a

common feature / functionality of simulation games also help to keep learners engaged, as it provides learners with new hints on how to do better (Leemkuil and De Jong, 2012). This keeps learners engaged as it appeals to their sense of inquisitiveness in applying the new 'hint' to see if it works. From the discussion above, the following hypothesis is proposed:

H2: *Engagement* in the simulation game will correlate positively to *learning*.

Appreciation

Simulation games are effective in changing learners' attitudes towards learning, especially towards complex fields of study such as strategic management (Johnson et al., 2011). The dynamic capabilities of simulation games allows the presentation of complicated and complex scenarios, and as well as the efficient computation of inputs by learners (Tsuchiya, 1998). The dynamism of simulation games demonstrates and emphasises the non-linearity of reality, which helps learners to appreciate and value the complexity of a subject field (Funke, 2001). Such new found respect for the field is argued to heighten learning. From the discussion above, the following hypothesis is proposed:

H3: *Appreciation* will correlate positively to *learning*.

Methodology

The study involved final year undergraduate learners following a two-semester (24 teaching weeks) module on strategic management at a UK university. The module was delivered through a blended learning system, involving weekly lectures (for 169 learners) a series of weekly seminars (15-20 learners per class), supported through a module dedicated university virtual learning environment (VLE) site, plus a proprietary strategic business simulation, accessed through the online support site of a popular international text book. The delivery was executed in three stages: strategic analysis and positioning; strategic options and methods; implementation of strategy (strategy as-practice).

Participants

Data was obtained from 169 undergraduate learners taking the module. The mean average age of the participants was 22.0 years (SD = 2.9). Seventy six learners started their undergraduate programme at the university at entry level (i.e. Year 1 of three years), seven at Year 2 and 73 at Year 3. Thirteen participants did not respond to the survey.

Measures

The measurement scales were developed for this research. One item was developed for each of the constructs: the simulation made the module more interesting, the simulation made me appreciate the complexity of business strategies, the simulation made me more engaged in the module and the simulation enhanced my overall learning in this module. A five-point Likert scale (i.e. 1 = strongly disagree, 2 = disagree, 3 = not sure, 4 = agree, and 5 = strongly agree) was used with all the items.

Procedure

The anonymous survey questionnaire was distributed to the learners towards the end of a class in the second semester. The learners completed and returned the survey questionnaire in a number of collection boxes placed within the classrooms.

Findings

SPSS 19 was used to conduct a one-tailed Pearson correlation for the simulation-enhanced learning model. The product-moment correlation is the most appropriate method of analysis. *Interest* is positively correlated with learning ($r = .32$, $p < .001$). Hypothesis one is therefore supported. *Engagement* is positively correlated with learning ($r = .35$, $p < .001$). Hypothesis two is therefore supported. *Appreciation* is positively correlated with learning ($r = .34$, $p < .001$). Hypothesis three is therefore supported. The results are shown in Table I below.

TABLE 1

Means, standard deviation (SD) and correlations for the measured variables

	Mean (SD)	1	2	3
1. Learning through the simulation game	3.9 (0.8)			
2. Interest	4.3 (0.8)	0.32**		
3. Engagement	4.0 (0.8)	0.35**	0.72**	
4. Appreciation	4.2 (0.8)	0.34**	0.51*	0.63**

Notes: *$p < .05$, **$p < .01$, ***$p < .001$

To further understand the association amongst the independent variables with the dependent variable, a stepwise multiple regression analysis was performed. This analysis was undertaken to evaluate which independent variables was a better 'predictor' of learning in relation to the other independent variables. When there are multiple independent variables present the multiple regression method is used to assess which individual independent variable or a combination of independent variables (i.e. model) are a better 'fit' (or in other

words 'stronger in association') with the dependent variable. The 'stepwise' method is used as it progressively builds the models by including and removing variables to and from the model in building the best 'fit' model. The stepwise multiple regression analysis revealed two models that significantly explained simulation-enhanced learning. Model 1 contained only *interest* (R^2 = .23, p < .001), whilst Model 2 had both *interest* and *engagement* (R^2 = .26, p < .001). The result of this analysis is presented in Table 2.

TABLE 2

Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.481	.231	.226	.714
2	.512	.262	.253	.702

Table 3 shows the beta, or standardised, coefficient and the significance of the score. Model 1, which only contains the *interest* variable, shows a beta coefficient of .48, whilst Model 2, which contains the *interest* and *engagement* variables, have beta coefficient of .37 and .21 respectively. Model 2, with both *interest* and *engagement* variables combined, are a better fit with the dependent variable of learning with *simulations*.

TABLE 3

Stepwise multiple regression analysis on learning outcomes

Variable	Model 1				Model 2			
	B	SE B	β	t	B	SE B	β	t
Model 1:								
Interest	.46	.07	.48***	6.79				
Model 2								
Interest					.36	.08	.37***	4.47
Engagement					.20	.08	.21*	2.52

Notes: *p < .05, **p < .01, ***p< .001

Discussion and Conclusion

The findings suggest a reinforcing virtuous cycle of interest-engagement-learning. The simulation games acts as a catalyst and vehicle for learning. The positive correlation between *interest*, *engagement* and *appreciation* with learning is expected as learning that is

generally enjoyable tends to result is enhanced learning. The following discussion rationalises the findings.

Learners who find a curriculum interesting tend to be motivated in learning more. The novelty of the simulation game as a novel device and method of learning gains the learners attention as well as stimulating their curiosity (Leemkuil and De Jong, 2012). The problem-based learning aspect of the simulation games helps to enhance learners' attentiveness (Kolb and Kolb, 2005) and this consequently maintains the learners' interest in the module as a whole. The real-time feedback provided by the simulation game facilitates learners' experience of 'seeing' the impact of their decisions (Leemkuil and De Jong, 2012).This potentially is another factor that reinforces and further heightens the learners' interest and motivation in the module. It is plausible that the interest and enjoyment that the learners derive from the simulation game have shaped and influenced the learners' active participation and engagement with the subsequent parts of the simulation game, as well as the other aspects of the module (Zantow et al., 2005).

Engagement in the simulation game is a form of immersion (Vogel et al., 2006). Learners were given an elaborate vignette of an organisation's situation that gives the simulation game 'character and personality'. As the simulation game was played over six weeks, this allowed learners to be truly absorbed in the game. The interactivity aspect, which involve learners choosing or defining parameters of simulation games, are the real attraction of such systems that maintain the engagement of the learners (Randel et al., 1992). In addition, the availability to adaptive advice also helps players in the discovery and learning process. Adaptive advice occurs only when certain conditions are met e.g. when the learner has reached a certain stage (Leemkuil and De Jong, 2012). The adaptive advice supports learning and engagement by providing limited but timely information to learners in helping them make the right decisions. The learners six week engagement with the simulation may have also helped learners to appreciate the complexity of the subject field. The variety of scenarios and decisions suggest to learners the intricacy of strategic management, which in turns shapes the learners attitude towards the field of study.

Appreciation for the complexity of the field of study is a construct that overlaps with both affective and cognitive domains. *Appreciate* is affective as it concerns attitudes but it is also cognitive as the appreciation for something means to be cognisant of its value i.e. to have some evaluation (Lohman, 2005). Vogel et al. (2006) asserted that simulation games produce positive attitudes toward the subject field. This assertion has some basis as they found in a study that the use of simulations is associated with higher cognitive gains and

better attitudes (appreciation) towards the field of study (Gros, 2007). *Appreciation* is primarily based on the decision making aspect of the simulation game. Learners may have learned to appreciate how senior managers have to make strategic decisions based on incomplete information, a continuously changing external environment and the counter-actions of competitors. For example, Leemkuil and De Jong (2012) argued that learning operations management using games is more effective than the traditional mode as learners have to develop effective decision making capabilities to address the complex and dynamic challenges presented to them in the simulation.

The argument of the use of simulation games in learning and teaching is persuasive. Clearly, the use of simulation games can only be effective in enhancing learning if it reinforces / supports the key curriculum. This underscores an important point relating to the need for task and technology to be compatible as posited by the Task-Technology Fit theorem (Goodhue and Thompson, 1995). Identifying the right simulation game is important as well as developing effective instructional designs to highlight the key 'take home' lessons to learners (Wu et al., 2012). The ease of use of the simulation game is also critical as the Technology Acceptance Model asserts that technology acceptance is dependent on the technology's ease of use and perceived utility (Venkatesh and Davis, 2000). Understanding the users' perspective is critical in the implementation and use of any technology in learning and education. The use of technology must be attractive to learners and also practical to instructors (Vogel et al., 2006). Instructors, who may well be already overworked, need technology that helps rather than burdens them.

In terms of decision making simulation games, these games provide learners with hands-on experience and opportunities to *make decisions* in a safe environment, and thus allowing learners to experiment and learn from experience, albeit in a contrived environment (Zantow et al., 2005). The use of simulation games may soon become 'table stakes' in learning and teaching as simulation games provide a real opportunity to take advantage of V-Gen's learning style that prefers realistic situations (Proserpio and Gioia, 2007). The answer to the question of whether simulation games enhance learning is more straightforward and categorical as simulation games do enhance learning but the question in regards to *how* and *why* is more multifaceted.

Implication for Theory and Practice

The findings in this study demonstrate how learning theories should be revisited and potentially revised to accommodate the role of affect-based constructs. Most learning theories are focused on the cognitive aspects, however, as this study has demonstrated,

learning theories must be balanced in consideration of the cognitive, conative and affective aspects of learning. Robust learning theories may also facilitate the commitment to life-long-learning by understanding how learning helps change attitudes in addition to helping learners gain cognitively. Another implication for theory is in regards to the structure of affect-based constructs in predicting learning specifically in regards to the primacy of the constructs i.e. which comes first and is the most important.

In term of practice, simulation games provide powerful learning context (Shaffer et al., 2005). Vogel et al. (2006) argued that whilst evidence seems to be positively consistent that learners using simulations tend to outperform those learning in traditional environments, it does so in varying degrees ranging from mere knowledge retention / memorisation to skill development. Thus it is important to provide effective instructional design to support the use of the simulation game to ensure that the learning derived from simulation games are fully maximised.

In addition, the use of simulation games should be encouraged in teaching younger learners. The virtual generation follows the verbal and visual generation of learners. As each generation of learners emerge, trainers and educationalist must look for new methods to commensurate with new and emerging learning styles. (Proserpio and Gioia, 2007). Proserpio and Gioia (2007) state that V-Gen's early exposure to surfing and playing games on the internet have shaped and moulded their abilities according to the digital environment. There are conjectures that V-Gen learners generally lack the ability to memorise as information is readily accessible on the Internet, but they have better problem solving abilities (compared to previous generations at the same age) (Proserpio and Gioia, 2007). It is also argued that it would not be surprising that some V-Gen learners expect, and perhaps even demand, interactive and playful learning environments (Proserpio and Gioia, 2007).

However, the conundrum is that these new learners are 'digital natives' who have grown up with the technology already in place, whilst the instructors are 'digital immigrants', who who generally merely witnessed the technological revolution (Garrison and Vaughan, 2008). Technology, nonetheless, has advanced to a level that involves minimal effort to operate and administer (Daspit and D'Souza, 2012). Technologies at present are both attractive to learners and practical to educators. Educational instructors of V-Gen learners should design learning in the context of a conducive social setting, emphasise active involvement from the learners and focus learning activities on problem-solving (Alavi et al., 1995). Technologies such as digital games shape and, in turn, are shaped by V-Gen learners' expectation. Digital

games are user-centred and provides challenging environments that enhances engagement (Gros, 2007).

Limitations and Future Research

The research method of this study is mono-source as all of the data collected were from self-reports by learners. Future research may involve collection of data from other sources such as official learner achievement data in assessing learners' actual learning attainments. The measure of learning is limited as it was based on single items. Future research should develop a more robust measure of the variables in creating a more comprehensive inventory in the measurement of the constructs to increase its validity.

Another limitation of this study is that it is cross-sectional. This limitation may be addressed by undertaking longitudinal study in assessing the long term effects of the use of simulation games in learning and teaching. In addition, control variables may be used in future research to 'control' the variables of *learning*, *interest*, *engagement* and *appreciation* so as to establish that its presence is due to the simulation and not any other extraneous factors. Lastly, qualitative studies may help to discover why and how affect-based constructs and instructional design promote learning.

Acknowledgement

References

Alavi, M., Wheeler, B. C. & Valacich, J. S. (1995) Using IT to reengineer business education: An exploratory investigation of collaborative telelearning, *MIS Quarterly,* 19**,** pp. 293–312.

Aldrich, C. (2003) *Simulations and the Future of Learning: An Innovative (and Perhaps Revolution-ary) Approach to e-Learning,* San Fancisco, CA., Pfeiffer.

Arbaugh, J. B. (2008) Introduction: Blended Learning: Research and Practice, *Academy of Management Learning & Education,* 7**,** pp. 130–131.

Chiu, C., Hong, Y. & Dweck, C. S. (1994) Toward an integrative model of personality and intelligence: A general framework and some preliminary steps. *In:* Sternberg, R. J. & Ruzgis, P. (eds.) *Personality and Intelligence.* Cambridge: Cambridge University Press.

Costabile, M. F., De Angeli, A., Roselli, T., Lanzilotti, R. & Plantamura, P. (2003) Evaluating the educational impact of a tutoring hypermedia for children, *Information Technology in Childhood Education Annual,* 2003**,** pp. 289-308.

Daspit, J. J. & D'Souza, D. E. (2012) Using the community of inquiry framework to introduce wiki environments in blended-learning pedagogies: Evidence From a business capstone course, *Academy oí Management Learning & Education,* 11**,** pp. 666-683.

Evans, J., Kerridge, C. & Loon, M. (2013) Campus based students' perspectives on strategic management simulation: A contextual study, *World Journal of Social Sciences,* 3**,** pp. 12–24.

Eysenck, H. (1994) Personality and intelligence: Psychometric and experimental approaches. *In:* Sternberg, R. J. A. R., P. (ed.) *Personality and Intelligence.* Cambridge: Cambridge University Press.

Funke, J. (2001) Dynamic systems as tools for analysing human judgement, *Thinking & Reasoning,* 7**,** pp. 69-89.

Galvão, J. R., Martins, P. G. & Gomes, M. R. (2000) Modeling reality with simulation games for a cooperative learning. In: *Proceedings of the 32nd conference on Winter simulation, 2000.* Society for Computer Simulation International, pp. 1692-1698.

Garrison, D. R. & Vaughan, N. D. (2008) *Blended Learning in Higher Education: Framework, Principles, and Guidelines,* USA: John Wiley & Sons.

Goodhue, D. L. & Thompson, R. L. (1995) Task-technology fit and individual performance. *MIS Quarterly,* 19**,** pp. 213–236.

Graham, C. R., Henrie, C. R. & Gibbons, A. S. (2013) Developing models and theory for blended learning research. *In:* Picciano, A. G., Dziuban, C. D. & Graham, C. R. (eds.) *Blended Learning: Research Perspectives.* Chicago: Routledge.

Gros, B. (2007) Digital games in education: The design of game-based learning, *Journal of Research on Technology in Education,* 40**,** pp. 23-38.

Hartley, J. (2002) Studying for the future, *Journal of Further and Higher Education,* 26**,** pp. 207-227.

Johnson, G., Whittington, R. & Scholes, K. (2011) *Exploring Strategy: Text and Cases,* Harlow, Essex, Financial Times Prentice Hall.

Kiili, K., (2005) Digital game-based learning: Towards an experiential gaming model, *The Internet and Higher Education,* Vol. 8(1)**,** pp. 13-24.

Knight, P. T. (2002) *Being a Teacher in Higher Education,* Buckingham, UK: Open University Press.

Kolb, A. Y. & Kolb, D. A. (2005) Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning & Education,* 4**,** pp. 193-212.

Laffey, J. M., Espinosa, L., Moore, J. & Lodree, A. (2003) Supporting learning and behavior of at-risk young children: Computers in urban education, *Journal of Research on Technology in Education,* 35**,** pp. 423-440.

Leemkuil, H. & De Jong, T. (2012) Adaptive advice in learning with a computer-based knowledge management simulation game, *Academy oí Management Learning & Education,* 11**,** pp. 653-665.

Lohman, D. (2005) Reasoning abilities. *In:* Sternberg, R., and Pretz, J. E. (ed.) *Cognition and Intelligence: Identifying the Mechanisms of the Mind.* Cambridge: Cambridge University Press.

Martins, L. L. & Kellermanns, F. W. (2004) A model of business school students' acceptance of a web-based course management system, *Academy of Management Learning & Education,* 3**,** pp. 7–26.

Nicol, D. J., Minty, I. & Sinclair, C. (2003) The social dimensions of online learning, *Innovations in Education and Teaching International,* 40**,** pp. 270-280.

Prensky, M. (2001) *Digital Game-Based lLearning,* New York, NY, McGraw-Hill.

Prosperio, L. & Gioia, D. D. (2007) Teaching the virtual generation, *Academy of Management Learning & Education,* 6**,** pp. 69–80.

Randel, J. M., Morris, B. A., Wetzel, C. D. & Whitehill, B. V. (1992) The effectiveness of games for educational purposes: A review of recent research, *Simulation & Gaming,* 23**,** pp. 261-276.

Rosas, R., Nussbaum, M., Cumsille, P., Marianov, V., Correa, M., Flores, P., Grau, V., Lagos, F. L., Ximena, L. V., Rodriguez, P. & Salinas, M. (2003) Beyond Nintendo: Design and assessment of educational video games for first and second grade students, *Computers & Education,* 40**,** pp. 71-95.

Shaffer, D. W., Squire, K., Halverson, R. & Gee. J. P. (2005) Video games and the future of learning, *Phi Delta Kappan,* 87**,** pp. 104-111.

Siemer, J. & Angelides, M. C. (1995) Evaluating intelligent tutoring with gaming-simulations. In *Proceedings of the 27th conference on Winter simulation, 1995.* IEEE Computer Society, pp. 1376-1383.

Spering, M., Wagener, D. & Funke, J. (2005) The role of emotions in complex problem-solving, *Cognition and Emotion,* 19**,** pp. 1252 - 1261.

Tsuchiya, S. (1998) Simulation/gaming as an essential enabler of organizational change, *Simulation & Gaming,* 29**,** pp. 400-408.

Venkatesh, V. & Davis, F. D. (2000) A theoretical extension of the technology acceptance model: Four longitudinal field studies, *Management Science,* 46**,** pp. 186–204.

Vogel, J. J., Vogel, D. S., Cannon-Bowers, J., Bowers, C. A., Muse, K. & Wright, M. (2006) Computer gaming and interactive simulations for learning: A meta-analysis, *Journal of Educational Computing Research,* 34**,** pp. 229-243.

Wu, W. H., Hsiao, H. C., Wu, P. L., Lin, C. H. & Huang, S. H. (2012) Investigating the learning-theory foundations of game-based learning: A meta-analysis, *Journal of Computer Assisted Learning,* 28**,** pp. 265-279.

Zantow, K., Knowlton, D. S. & Sharp, D. C. (2005) More than fun and games: Reconsidering the virtues of strategic management simulations, *Academy of Management Learning & Education,* 4**,** pp. 451–458.

Biography

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