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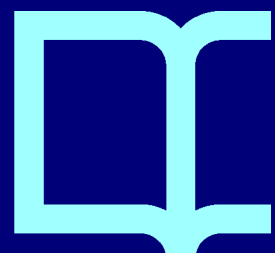
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Student Interactions in Online Discussion Forums: Their Perception on Learning with Business Simulation Games

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Abstract

Digital technology offers new teaching methods with controversial results over learning. They allow students to develop a more active participation in their learning process although it does not always drive to unequivocal better learning outcomes. This study aims to offer additional evidence on the contribution of business simulation games to students' learning outcomes considering student interactions in online discussion forums. We conducted a qualitative research with the online discussion forums of five different courses at bachelor and master levels, which involves 41 students' teams. The final sample was composed of 3,681 messages posted by the students. The results reveal that some generic and specific managerial skills exert a positive influence on learning outcomes. Students mostly highlighted teamwork, decision-making, information processing, reaching agreements, and dealing with uncertainty as the most relevant contributions of the game towards their learning. These results have instructional and pedagogical implications for determining the best way to enhance students' motivation and learning outcomes when using digital technology methods, which involves recommendations that affect their design and monitoring.

Keywords: Student interactions; Online learning; Higher education; Simulations; Computer-mediated communication; Learning outcomes.

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1. Introduction

Digital technology and information and communication technologies (ICT) have provided new methods beneficial for education and professional development (John and Wheeler 2012). These methods have also promoted different types of learning interaction between students and content, students and instructors, and among students themselves (Cheng and Chau 2014), as they are necessary not only to apply the new technology but also in planning and managing how to use it to enhance its contribution towards the achievement of educational objectives and the development of the new competence-based learning models (Cheng and Chau 2014; Noeth and Volkov 2004).

In the specific field of business and administration, business simulation games constitute a well-known example of an e-learning method in management training (Siddiqui *et al.* 2008). The main contribution of this method emerges from the nature of the simulation itself, which improves experiential learning recreating on-the-job situations that avoid real risks, failures, and reprisal; and from the fact of being games which are more motivational and enjoyable for students (Fu *et al.* 2009; Gilgeous and D'Cruz 1996; Jones 2005; Zantow *et al.* 2005). Nevertheless, conflicting voices also have emerged regarding the educational impact of these e-learning methods that question their characteristics drive to unequivocal improved learning results, claiming for more empirical evidence to understand the effectiveness of these methods and their real effects on learning (Connolly *et al.* 2012; Tao *et al.* 2015). Student interactions, their voices and opinions registered through online systems, could be really helpful to enter into this black box of the students' learning process (Kent *et al.* 2016), which is even more relevant in the new scenario where students assume a more autonomous role as builders of their own

knowledge (Hernández *et al.* 2010).

This study seeks to enter into this black box of the learning process of students and offer new empirical evidence on the learning outcomes of students when participating in business simulation games. To do so, a qualitative analysis was conducted through the online discussion forums used by students to interact with each other while participating in business simulation games.

This study aspires to contribute to the open debate on the educational effectiveness of business simulation games based on the students' opinions, to understand the skills fostered by business simulation games and the learning outcomes achieved by the students using these e-learning methods. It also aims to recommend the instructors and teachers how best to administer the games and how their interaction with students should be to solve problems in their learning process in order to enhance their engagement and learning outcomes.

2. Theoretical Framework

2.1 Educational Contribution of Business Simulation Games

Business simulation games are generally considered e-learning methods that improve knowledge and competence, on the basis of several learning theories, such as experiential learning and constructivism (Siewiorek *et al.* 2013), at both the individual and social level (social constructivism) (Kent *et al.* 2016).

Among the benefits of this e-learning method, previous research has underlined the skills that business simulation games allow students to put into practice, mostly generic or transferable skills, like analytical abilities, teamwork, decision-making, leadership, and abilities related to processing information (Fitó *et al.* 2014; 2015; Jensen 2003); as well as specific managerial skills, like the practicing of managerial roles, the establishment of

goals for a company, and the design, planning and implementation of business strategies (Chang *et al.* 2003; Fitó *et al.* 2014; 2015).

However, several conflicting voices have also emerged with regard to the educational effectiveness of business simulation games. These criticisms underline that there is not an unequivocal link between the use of these methods and learning results; it depends on how this tool is used by students and teachers (Lonn *et al.* 2011). Regarding students, they could be more focused on the recreational and technological aspects of the game than on its learning dimension (Gros-Salvat 2009), which is a problem that emerges when they perceive a lack of transparency about the contribution of these games to their learning (Connolly *et al.* 2012; Tobias and Fletcher 2012). Besides, students may perceive the game as being unrealistic or not based on the real world (Siewiorek *et al.* 2013), which will negatively affect their engagement and motivation (Eseryel *et al.* 2014).

Other challenges relating to teachers and instructors role in a scenario dominated by digital technologies and ICT has dramatically changed (Worley and Tesdell 2009). The teaching-centred paradigm has been overcome, and a new model emerges centred in students as builders of their own learning (Romero *et al.* 2013). This scenario has modified the traditional role of teachers as transmitters of contents into a new one where they act as facilitator, collaborator, advisor, moderator, and coach in the teaching-learning process (Hernández *et al.* 2010). In the specific case of business simulations games, these changes are translated into a situation where instructors and teachers could influence and improve the students' learning results intervening to help students in the understanding of technology and the logic of the game, and correcting potential students' attitudinal problems (Hernández *et al.* 2010; Pando-Garcia *et al.* 2016; Schellens *et al.* 2007). Nevertheless, among these changes, it is also important to highlight the loss of instructors' views and opinions as the only indicator of students' learning achievements (Cheng and

Chau 2014; Kent *et al.* 2016).

In the new educational paradigm, the evaluation of students' achievement has been also transformed (Kent *et al.* 2016), and players' opinions and feedback extracted from student interactions have become a powerful source for determining the success of business simulation games in contributing to students' learning outcomes (Pando-Garcia *et al.* 2016).

2.2 Student Interactivity and Learning Outcomes

According to Kent *et al.* 2016 "social constructivism perceives knowledge as constructed between people by a social process of interacting". Interaction can be described as two-way communication among two or more people within a learning context (Gilbert and Moore 1998). The relationship that exists between interactivity and learning outcomes depends on the nature of the interactivity, which involves not only communication but also other complex activities developed by learners, such as engaging, reflecting, questioning, answering, elaborating, discussing, problem-solving, constructing, and analysing among others (Liaw and Huang 2000). As long as interactivity allows students to engage in all these activities, it contributes to knowledge construction (Schellens *et al.* 2007*)*, and hence learning from the interactive exchange of information and the development of relatedness among pieces of information (Kent *et al.* 2016).

Student interactions based on digital technology and ICT can be divided into two main categories: content interaction and social interaction (Northrup 2001), the latter including learner-instructor interactions and learner-learner interactions (Moore and Kearsley 1996). Learner-instructor interactions allow instructors to act as coaches, counsellors, and supporters in the students' learning process (Lonn *et al.* 2011) and provide instructors with useful information for the assessment of the students' learning

achievements. Learner-learner interactions, on the contrary, do not necessarily involve instructors because students seem more interested in interaction with companions than with instructors (Xie *et al.* 2001), so they normally do not take part in the discussions among students and even may be unaware that such interaction occurs or of its consequences in terms of the students' learning. Furthermore, this interaction is mostly neglected in the evaluation of the knowledge construction and learning of students and is not taken into account for effects on instructional and pedagogical issues.

Learner-learner interactivity is rarely evaluated or considered as a learning evaluation metric (Kent *et al.* 2016). Its use, if any, is restricted to reporting on students' task completion or to tracking students at risk of dropping out (Gašević *et al.* 2015). Therefore, it is not used for assessing the learning process itself, the progress of the learners' understanding, their ability to relate information and to build on existing knowledge, and the contribution of the business simulation game to their expectations and satisfaction regarding their learning (Reich 2015).

This gap makes it hard to know about learning outcomes in terms of interactivity (Song and McNary 2011). There are some previous studies that have looked for a correlation between participation in asynchronous discussions and marks or classroom performance and achievements (Kent *et al.* 2016). However, this approach has two problems: firstly, the lack of consensus about whether or not this relationship actually exists (Song and McNary 2011; Picciano 2002); and secondly, the excessive focus on quantitative indicators when analysing interactivity, such as posting frequency, the number of logins or the number of posts read (Schellens *et al.* 2007*)*. This approach offers only a partial view of the students' learning in terms of interactivity, which should be complemented by other indicators of quality, centred on the content of students' discussions, to really appreciate the learning construction favoured by peer-led discussion

as an essential component in blended and online learning environments (Lonn *et al.* 2011; Ozkan and Koseler 2009).

This study seeks to provide new insights into the contribution of business games to students' learning outcomes, by considering the interactivity among learners. We analyse the content of their online discussion forums, where without the presence or intervention of instructors, it is possible to gain a better and less biased source of information to capture the students' points of view regarding the skills that better contribute to their learning achievements, satisfaction, and the fulfilment of expectations while participating in business simulation games.

3. Methodology

3.1 Data Collection

This study used a qualitative analysis on the online discussion forums used by students participating in business simulation games administered in several management courses, three at bachelor's degree and two at master's degree level, at the Universitat Oberta de Catalunya[1], during the academic years 2011-2012 and 2012-2013.

A total of 182 students participated in the five courses, with 12, 10, 5, 6, and 8 teams in each one. Each team was composed of an average of 4.4 students.

Table 1 summarises the demographic profile of the students. The participants were mostly men, 62.61%, while 37.39% were female. Their mean age was 36 years old, with slightly more than 50% between 31 and 40 years old, and more than 20% between 41 and 50 years old. Most of the students, nearly 90%, did not have any previous experience with business games.

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[1] The Universitat Oberta de Catalunya (Open University of Catalonia, UOC) is an innovative university based in Catalonia and open to the world through e-learning and the Internet offering online courses in Arts and Humanities, Economics and Business, Health Sciences, Information and Communication Sciences, Computer Science, Law and Political Science, and Psychology and Education Sciences.

INSERT TABLE 1

The students' interaction in the online discussion forums of the five courses represented a total number of 7,172 messages or posts. Given the high number of messages registered in the forums of each course, we decided to analyse only the communications of the team having highest number of messages in each course, which meant analysing a total of 3,681 messages. In the next table (Table 2), we can see the main figures for each course.

INSERT TABLE 2

3.2 The Game

All the students had the same instructor and also played the same business simulator game, Cesim Global Challenge (www.cesim.com). This strategic game simulates an international mobile telecommunications company, and its focus is centred on strategic management, international business, global operations, and business policy, integrating different functional areas. The game was administered online in the five courses. Participation in the business simulation game was a full course at both levels, bachelor and master, and was a non-compulsory subject worth 6 ECTS credits (European Credit Transfer System).

3.3 Coding of the messages

We analysed the students' online forums looking for information that would show any kind of relationship between the skills acquired by students participating in the games and their learning outcomes.

The skills were coded as those identified in previous research on business simulations games, which could be classified into generic and specific managerial skills (Chang *et al.* 2003; Fitó *et al.* 2014; 2015; Jensen 2003).

The learning outcomes were structured according to the dimensions highlighted by two expert instructors of business simulations games. The dimensions included were as follows. Firstly, the learning objectives which consider the achievement of skills and knowledge previously defined by the instructor in the teaching plan of the subject, such as the understanding of the roles and functions of top managers in the decision-making process, the integration of different functional areas, and processing information and data to guide decision-making. Secondly, the learning process itself which comprises the different tasks and functions developed by students while participating in the game that allows them to attain skills and knowledge. Thirdly, the students' expectations which refer to their previous ideas towards what the game was going to offer them, not in terms of learning, already included in the learning objectives, but in terms of joy, motivation, or other targets not directly learning-related. And finally, the value perceived, and experienced (regarding satisfaction or dissatisfaction) by students while playing in terms of their learning experience.

The reliability of these dimensions was checked by a focus group composed of 14 master students participating in the same business simulation game at Rovira i Virgili University during the academic year 2011-2012.

4. Data analysis

In order to obtain a more in-depth understanding of the most relevant dimensions of students' learning and skills acquired while participating in business simulation games, we conducted a qualitative analysis of the online discussion forums that were held among students while they were playing.

We conducted a qualitative analysis of the messages in the students' online forums through what Glaser and Strauss (1967) called a comparison analysis. We organised data

into codes that identify the most frequent categories of skills and learning outcomes that later came up as topics in students' conversations while they were playing and were registered in the online forums. NVivo software was used to codify all qualitative data.

It is important to note that the contribution of the game to the learning outcomes of students is not only related to the achievement of a high degree of values, expectations, and satisfaction, on the contrary, it also refers to a low degree of values, problems, and bad experiences suffered during the game, as far as they also imply an effort to overcome these situations while practicing and learning.

Table 3 shows some quotes from the students about the skills they practised more during the game and which also made a great contribution to their learning outcomes, even if the experiences associated with practising were not valuable or satisfactory.

INSERT TABLE 3

In Table 3, we can observe that the most relevant categories related to the students' learning outcomes are those of generic skills, such as information processing, decision-making, teamwork, dealing with uncertainty, or reaching agreements. There are also comments about some specific managerial skills, like reaching the goals of a company, dealing with competition, or processing financial information as a specific form of processing data in general. However, the frequency and relevance of these latter topics in the students' online forums was lower. Even if in the decision-making process the students have a certain strategic goal in their minds, this information does not frequently appear in their communication pattern. It seems that they apply a more short-term approach, just deciding for each round, considering competitors and their financial situation from the previous round, but without any clear long-term planning or goals.

The generic skills, however, were more clearly observed in the students' discussions, as shown in previous research (Fitó *et al.* 2014; Fu *et al.* 2009). Our analysis

also allowed us to appreciate the relationship of these skills with different dimensions of learning outcomes. In the case of teamwork, for example, we could observe comments regarding how the teamwork was organised, achievements regarding working in teams, the overcoming of previous expectations about the contribution of the game to teamwork as well as some bad experiences and problems related to working with others. It is important to highlight the role of socialisation in creating a positive atmosphere while playing and emphasise that both good and bad experiences with teamwork were talked about. Good experiences implied a good division of work, contributions by all or most of the members of the team, closeness in their relationship, etc., and they were independent of the results achieved in the game. Bad experiences normally related to big differences in students' levels of involvement in and dedication to the game, communication problems, or not valuing the contribution of others.

The skill related to dealing with uncertainty was also emphasised by students who normally expressed their doubts regarding the best options even agreeing that no such thing existed. Some of the dimensions of the learning outcomes were related to their comments, for example, solutions for dealing with uncertainty or statements about overcoming it, comments about how uncertainty made the game more difficult than expected, and even anger at not being in control of some of the game's parameters. The necessity to play in these uncertain scenarios contributed to the sharing of opinions, not imposing a certain viewpoint, looking for agreement, more collaborative attitudes, delegating and trusting in others, etc.

Most of the messages were related to information processing and decision-making because the practising of these skills constitutes the main focus of this type of games. We found comments regarding the students' decisions about different functional areas and how they processed information and data to decide on these matters as part of the learning

process. We also found examples where the success of the decisions made and the way in which information was related were the main learning objectives accomplished. In this regard, the most relevant expectations were winning and the opportunity to act as top managers; we also observed many comments showing dissatisfaction because decisions were not working out as the students expected.

By analysing the voices of students in the online discussion forums, we could also detect the most relevant obstacles to students' learning, which were basically related to demotivation caused by not understanding how the game worked, the consequences of their decisions, not knowing how to improve their financial results and performance, and problems related to students' availability and the time dedicated to playing, which finally led to teamwork dysfunction.

Finally, the students also expressed their emotions and attitudes towards the game, sharing these feelings with their partners, and shared personal information that did not contribute to the learning outcomes but which contributed to the teamwork atmosphere. A few quotes, by way of example:

"Enjoy the holidays" (*Team C*)

"Today is my birthday, I couldn't come early" […] "It would be great to share a piece of cake together" […] "I can make professional cakes, although it is not my job" (*Team C*)

"Merry Christmas" (*Team D*)

"Congratulations on the work done" (*Team A*)

"We are ready! Now for the first position!" (*Team B*)

They also sometimes acted to empower the simulation, making the learning scenario more real, as in the following quotes:

"The CEO is exiting now" (*Team E*), or "I am deciding to buy shares of our

company)" (*Team E*), or "I hope we win, my future depends on it" (*Team E*).

5. Discussion and conclusions

The main objective of this paper was to analyse the contribution of business simulation games in students' learning outcomes, determining which skills better enhance learning. To do so, we conducted a qualitative study through the analysis of the online discussion forums of business simulation games.

5.1 The Contribution of Business Simulation Game to Learning Results

The findings confirm that, from the students' perspectives, the most relevant skills affecting their learning outcomes were generic ones, such as information processing, decision-making, teamwork, dealing with uncertainty, and reaching agreements. Some specific managerial skills, like reaching a company's goals, dealing with competition, or processing financial information, also appeared in the students' discussions, but not as frequently, as previous research mentioned (Fitó *et al.* 2015).

This result is in line with the contributions of previous research, mostly centred on identifying the improvement of certain generic skills as a relevant benefit of business simulation games (Fitó *et al.* 2014; Jensen 2003). However, our findings go a step further. While previous research mostly confirmed the improvement of generic skills when participating in business simulations games, our study underlined the link between these generic skills and students' learning outcomes, in terms of learning objectives and learning process, and students' expectation and satisfaction, making a relevant contribution to the effectiveness of this method for learning purposes.

From the analysis of the online discussion forums among students, instructors can obtain better knowledge, more useful and less biased data, and richer perspectives, which

complement the information that they receive from students using other methods. Sometimes it is the only way to know exactly what is happening within the work teams, especially if the game is administered online. Instructors can detect what their students are having trouble understanding how the game works, which concepts are missing, and which problems they are encountering. Using this information, instructors can mediate in teamwork and motivate students as they face uncertainty and risks. As a matter of fact, sometimes online communication is the only way to deal with problems related to low levels of student engagement or motivation. Skills that students are not developing properly can also be identified. Therefore, this information can be very useful in improving the new roles of teachers and instructors in the digital era.

5.2 Recommendations and Limitations

Once the students' voices were heard, the main obstacles to their learning were detected, which were basically related to the following topics: first, demotivation of students caused by not understanding the consequences of their decisions, not understanding the calculations conducted by the game, and poor performance of the simulated company; second, problems with using and understanding the game software, especially at the beginning; and third, problems related to the students' availability and the time dedicated to playing, which finally led to problems within the teams, among the partners.

Taking into account these obstacles, we are able to propose some practical recommendations that affect the design and monitoring of the courses. These recommendations seek to improve students' engagement and offer solutions to solve the most relevant problems detected in their learning process.

Regarding how to deal with students' demotivation due to difficulties with the game and how to improve forecasts related to decisions, instructors should offer additional

support to students in dealing with uncertainty and risks. This support could take the form of decision-making techniques for uncertain situations, mathematical tools for estimations and predictions, lessons about the inclusion and consideration of different scenarios, etc. Furthermore, although students integrate and apply their previous knowledge to management when participating in the game, it would be advisable to achieve higher levels of reflection about what specific type of knowledge they are applying, and that the application of managerial concepts and theories will be part of the students' marks and grades.

To solve problems related to not understanding the game software, the interaction between learners and instructors should be fostered, especially at the beginning, with the latter having a more proactive role in this interaction. This could include, for example, videos that online students could view to know more about how the game works before playing or meetings during the first practice rounds through the use of synchronous communication techniques to handle students' doubts on this matter.

With regard to teamwork, we consider it necessary to work harder on this skill. One possible option would be to create specific forums comprising members of different teams to share good and bad experiences form their work teams, for offering and receiving advice. The instructor should also be more proactive in detecting possible problems, not just waiting for students to complain, but monitoring the teamwork from the very beginning, whether it is working or not. Also, it would be advisable to work harder on the teams' composition, trying to obtain groups in which the members complement each other and share the same level of expectation, involvement and availability for participation in the game.

Nevertheless, this study has some limitations of which an important one is the homogeneous profile of students in terms of their lack of exposure to previous

experiential learning. Attaining more data from students having different cultural and educational contexts could contribute to improving our understanding of the influence of skills on learning outcomes considering students with heterogeneous profiles and also could provide instructors with clues for detecting flaws in the use of the game and their possible solutions.

References

Chang, J., Lee, M., Ng, K.L. & Moon, K.L. (2003). Business simulation games: The Hong Kong experience. *Simulation & Gaming*, 34(3), 367-376.

Cheng, G. & Chau, J. (2014). Exploring the relationship between learning styles, online participation, learning achievement and course satisfaction: An empirical study of a blended learning course. *British Journal of Educational Technology*, 47, 257–278.

Connolly, T.M., Boyle, E.A., MacArthur, E., Hainey, T. & Boyle, J.M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education*, 59, 661-686.

Eseryel, D., Law, V., Ifenthaler, D., Ge, X. & Miller, R. (2014). An investigation of the interrelationships between motivation, engagement and complex problem solving in game-based learning. *Educational Technology & Society*, 17(1), 42-53.

Fitó-Bertrán, A., Hernández-Lara, A.B. & Serradell-López, E. (2014). Comparing student competences in a face-to-face and online business game. *Computers in Human Behavior,* 30, 452-459.

Fitó-Bertrán, A., Hernández-Lara, A.B. & Serradell-López, E. (2015). The effect of competences on learning results: An educational experience with a business simulator. *Computers in Human Behavior,* 51, 910-914.

Fu, F.L., Su, R.C. & Yu, S.C. (2009). EGameFlow: a scale to measure learners' enjoyment of e-learning games. *Computers & Education*, 52(1), 101-112.

Gašević,, D., Dawson, S. & Siemens, G. (2015). Let's not forget: Learning analytics are about learning. *TechTrends*, 59(1), 64-71. http://dx.doi.org/10.1007/s11528-014-0822-x

Gilbert, L. & Moore, D.R. (1998). Building interactivity into web courses: Tools for social and instructional interaction. *Educational Technology*, 38(3), 29-35.

Gilgeous, V. & D'Cruz, M. (1996). A study of business & management games. *Management Development Review*, 9(1), 32-39.

Glaser, B.G. & Strauss, A.L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago, IL: Aldine.

Gros-Salvat, B. (2009). Certezas e interrogantes acerca del uso de los videojuegos para el aprendizaje. *Comunicación*, 1(7), 251-264.

Hernández, A.B., Gorjup, M.T. & Cascón, R. (2010). The role of the instructor in business games: a comparison of face-to-face and online instruction. *International Journal of Training and Development*, 14(3), 169-179.

Jensen, K.O. (2003). Business games as strategic team-learning environments in telecommunications. *BT Technology Journal*, 21(2), 133-144.

John, P. & Wheeler, S. (2012). *The digital classroom: Harnessing technology for the future of learning and teaching*. New York, NY: Routledge.

Jones, H.C. (2005). Lifelong learning in the European Union: Whither the Lisbon strategy?. *European Journal of Education*, 40(3), 247-260.

Kent, C., Laslo, E. & Rafaeli, S. (2016). Interactivity in online discussions and learning outcomes. *Computers & Education*, 97, 116-128. http://dx.doi.org/10.1016/j.compedu.2016.03.002

Liaw, S. & Huang, H. (2000). Enhancing interactivity in web-based instruction: A review of the literature. *Educational Technology*, 40(3), 41-45.

Lonn, S., Teasley, S.D. & Krumm, A.E. (2011). Who needs to do what where? Using learning management systems on residential vs. commuter campuses. *Computers & Education*, 56(3), 686-694. http://dx.doi.org/10.1016/j.compedu.2010.10.006

Moore, M.G. & Kearsley, G. (1996). *Distance education: A systems view*. Belmont, CA: Wadsworth Publishing Company.

Noeth, R.J. & Volkov, B.B. (2004). *Evaluating the effectiveness of technology in our schools. ACT policy report*. Washington, DC: ACT.

Northrup, P. (2001). A framework for designing interactivity into web-based instruction. *Educational Technology*, 41(2), 31-39.

Ozkan, S. & Koseler, R. (2009). Multi-dimensional students' evaluation of e-learning systems in a higher education context: An empirical investigation. *Computers & Education*, 53(4), 1285-1296. http://dx.doi.org/10.1016/j.compedu.2009.06.011

Pando-Garcia, J., Periañez-Cañadillas, I. & Charterina, J. (2016). Business simulation games with and without supervision: An analysis based on the TAM model. *Journal of Business Research*, 69 (5),1731-1736. http://dx.doi.org/10.2016/j.jbusres.2015.10.046.

Picciano, A.G. (2002). Beyond student perceptions: Issues of interaction, presence, and performance in an online course. *Journal of Asynchronous Learning Network, 6*(1), 21-40.

Reich, B.J. (2015). Rebooting MOOC Research. *Science, 347*(6217), 34-35. DOI: 10.1126/science.1261627.

Romero, C., López, M. I., Luna, J. M., & Ventura, S. (2013). Predicting students' final performance from participation in on-line discussion forums. *Computers & Education*, 68, 458-472.

Schellens, T., Van Keer, H., Valcke, M. & De Wever, B. (2007). Learning in asynchronous discussion groups: A multilevel approach to study the influece of student, group and task characteristics. *Behaviour & Information Technology*, 26(1), 55-71.

Siddiqui, A., Khan, M. & Akhtar, S. (2008). Supply chain simulator: a scenario-based educational tool to enhance student learning. *Computers & Education, 51*(1), 252-261.

Siewiorek, A., Gegenfurtner, A., Lainema, T., Saarinen, E. & Lehtinen, E. (2013). The effects of computer-simulation game training on participants' opinions on leadership styles. *British Journal of Educational Technology*, 44(6), 1012-1035.

Song, L. & McNary, S.W. (2011). Understanding students' online interaction: analysis of discussion board posting. *Journal of Interactive Online Learning, 10*(1), 1-14.

Tao, Y.H., Yeh, C.R. & Hung, K.C. (2015). Validating the learning cycle models of business simulation games via student perceived gains in skills and knowledge. *Educational Technology & Society*, 18(1), 77-90.

Tobias, S. & Fletcher, J.D. (2012). Reflections on a review of trends in serious gaming. *Review of Education Research*, 82, 233-237.

Worley, W.L. & Tesdell, L.S. (2009). Instructor time and effort in online and face-to-face teaching: lessons learned. *IEEE Transactions on Professional Communication,* 52, 138-151.

Xie, X., Lin, F. & Zhang, T. (2001). Comparison between on- and off-campus behaviour and adaptability in online learning: A case from China. *Behaviour & Information Technology, 20*(4), 281-291.

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