

An Investigation into the Use of Computer-based Simulation Games for Learning and Teaching in Business Management Courses

Dr Mark Loon

University of Worcester

(m.loon@worc.ac.uk)

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Abstract

Computer-based simulation games (CSG) are a form of innovation in learning and teaching. CGS are used more pervasively in various ways such as a class activity (formative exercises) and as part of summative assessments (Leemkuil and De Jong, 2012; Zantow et al., 2005). This study investigates the current and potential use of CGS in Worcester Business School's (WBS) Business Management undergraduate programmes. The initial survey of off-the-shelf simulation reveals that there are various categories of simulations, with each offering varying levels of complexity and learning opportunities depending on the field of study. The findings suggest that whilst there is marginal adoption of the use CSG in learning and teaching, there is significant opportunity to increase the use of CSG in enhancing learning and learner achievement, especially in Level 5 modules. The use of CSG is situational and its adoption should be undertaken on a case-by-case basis. WBS can play a major role by creating an environment that encourages and supports the use of CSG as well as other forms of innovative learning and teaching methods. Thus the key recommendation involves providing module teams further support in embedding and integrating CSG into their modules.

Background and Purpose

Worcester Business School (WBS) prides itself in the quality of its teaching and the employability of its graduates. WBS has a number of innovative learning and teaching methods in preparing its students not just for work but also for a meaningful career in business and management. The spirit of innovation in the School means that it continuously seeks new, stimulating and effective methods of learning and teaching.

The development of computer-based simulation games (CSG) over the years has resulted in such systems being more user-friendly, flexible and cost-effective (Evans et al., 2013). The number of off-the-shelf systems, as well as technologies to develop simulation games in-house, has grown thus resulting in the greater variety of choice (Proserpio and Gioia, 2007). This situation presents an opportunity for WBS to explore and investigate the use of CSG in sustaining and further developing excellence in learning and teaching (Salas et al., 2009).

'Simulations' are a model (or simplification) of reality or some natural systems (Proserpio and Gioia, 2007). Students learn by experimenting with changing the input values, the parameters and/or constraints, and consequently observe the change in the output. Pure simulation programs have no specific goals or competitive elements (Leemkuil and De Jong, 2012). Games, in contrast, involve competition (or cooperation) amongst players to attain a goal within the rules and constraints of the game setting (Galvão, et al., 2000). Games involve players making and implementing choices between alternatives with the aim of achieving an objective (Galvão et al., 2000; Vogel et al., 2006).

Whilst simulation games need not be computer-based, this study specifically focuses on CSG as it has a number of advantages that non-computer based systems are not able to match. These advantages include algorithms in the systems enabling complexity (e.g. interaction of variables) to be increased thereby more closely mirroring reality and systems are able to provide real-time feedback to students in terms of how well they are doing (e.g. dashboards) (Doh, 2009; Association for Business Simulation and Experiential Exercises, 2014). The adaptive advice mechanism (e.g. hints provided to learners when they have completed a certain stage to help them with the next) available in some CSG provides learners a level of control over their learning (Leemkuil and De Jong, 2012). The adaptive advice keeps the tasks optimally challenging that maintain the learners' engagement (not too easy that the learner gets bored or too difficult that the learner gives up).

CSG comes in a variety of forms (e.g. web-based) and supports a variety of disciplines (e.g. strategy, change management) (Harvard Business Publishing, 2013). It also varies in terms of complexity (for both students and tutors, in terms of the administrator role). More importantly, although CSG is both a catalyst and vehicle for learning and teaching, it is not a substitute for learning and teaching (Arbaugh, 2008). It must be accompanied with effective instructional design. The context of the use of any CSG takes precedence.

The objectives of this study are to:

1. Identify the current adoption of CSG Business Management modules.

2. Identify the benefits of using CSG and its potential adoption in modules.
3. Conduct an initial survey of CSG products in the market.

Methods

This investigation adopts a 'Mode 2' approach in knowledge creation, which essentially concerns acquiring practical and applied knowledge for practice (Bryman and Bell, 2011). This approach is distinct from 'Mode 1', which generally is associated with academic research that is primarily gained for intellectual purposes. The outcome of this 'Mode 2' investigation is to help inform decision making in WBS in terms of the use and potential use of CSG as a form of innovative learning and teaching method, and the actions that may be required to encourage and support the use of CSG.

Semi-structured interviews were the primary data collection method. The interview guide was directed by the aims of the investigation. The identification of interviewees as part of the sampling design was in part purposive and in part involved snowballing. Interviews were held with:

1. Head of Learning and Teaching in WBS.
2. Business Management Course Leader.
3. Eight module leads.
4. Three external academics who have used CSG in learning and teaching.
5. Three CSG vendors.

In addition, desktop research was undertaken in obtaining secondary data for the purpose of triangulation in validating information obtained from the interviews from external sources.

Findings

Current adoption of CSG Business Management modules

CSG is adopted and integrated in two Business Management modules.

Level 5 Accounting Module

The module lead has recently used an audit simulation on a Level 5 module with 25 students. The simulation is developed by University of West of England, and has been a success with positive feedback from students and resulting in high student achievement. The simulation is tightly linked with the formative assessments, which in turn is closely aligned to the summative assessment. In this module, students were given access to simulation from

the start of the module. Lessons learned from the simulation were synthesised in formative activities incorporating the tutors' feedback. This was performed over four distinct stages cumulating into the students' final summative assessment that involved integrating the four phases of formative work into one coherent piece of work.

Level 6 Change Management Module

This module had recently adopted a simulation, Change 'Management: Power and Influence' from Harvard Business Publishing (HBP). The simulation had four scenarios and the students engaged with the simulation during two seminar classes, over two weeks. The first simulation run was positioned as trial run. The second week was dedicated to playing the simulation games as the students engaged with the other three scenarios (the lecture session was replaced with an extended seminar run of three hours). The simulation from HBP was adopted as it was deemed to be comprehensive (in terms of support materials) and theoretically sound (each aspect of the simulation was linked to theory in the support materials). The feedback from the students in module evaluations has been encouraging. A simple content analysis of the free-text section of the module evaluation revealed that there were 36 instances of positive feedback on the simulation compared with three negative (four were ambivalent).

Benefits of using CSG and its potential adoption in modules

There is a general consensus that the use of CSG would be beneficial for learning and teaching to:

1. Reinforce knowledge and application theory.
2. Develop skills.
3. Increase and sustain interest in the subject matter.
4. Increase student satisfaction in modules (e.g. due to increased variety in seminar activities).
5. Increase student engagement in modules (CSG allows students to 'test' themselves in a benign environment).
6. Increase achievement in modules by catering for different learning styles (learning-by-doing for students who are kinaesthetic learners).
7. Develop transferable skills. CSG can be designed as a catalyst for group discussion and debate. Such group interactions may involve the development of leadership, negotiation, conflict resolution skills, as well as problem solving and critical thinking).
8. Improve (potential) National Student Survey (NSS) results for WBS courses (by reflecting some of the points above).

9. Enhance employability upon graduation. Students who are able to 'hit the ground running' further promulgating WBS' reputation and increasing the opportunities for future intakes.
10. Act as a catalyst for research into CSG in Learning and Teaching, and Business Management.

Whilst there is significant opportunity to use CSG in WBS, the interviews revealed that CSG may be better positioned (in terms of extensive use) in Level 5 as a stage of 'practice'. The focus of Level 4 modules is best maintained in developing learners' study skills, whilst Level 6 is primarily concerned with employability skills. The use of CSG in Level 5 helps to bridge the two 'realms' e.g. Level 5 = practical and University study skills, Level 5 = stage for practice, and Level 6 = real-world employability skills.

Nonetheless, CSG should be the preserve of Level 5 as CSG should be implemented if it enhances student learning and achievement in Levels 4 and 6. The following summaries from interviews with two module leads reveal opportunities for the further use of CSG.

Level 4 Marketing and Management Module

Students on this module are given a business scenario (a fictitious company based on real-life examples) to work on in groups. Students are provided with challenges each week based on the objectives, resources and constraints that they have identified in their business scenario. The students' responses are graded and these are provided to the students at the end of each week. The entire process is undertaken manually. These business scenarios are a form of simulation, focussing on theory application and skill building. Support in terms of 'automating' some aspects of the process would be required to further develop this innovative method.

Level 6 Strategic Management Module

The module lead is of the view that CSG may increase the students' enjoyment of the module by making learning more interesting and to accommodate other ways of learning. There is an intention to evaluate a number of simulation products in terms of the 'topics' covered, learning 'value', the cost of the product, potential additional equipment and devices and the difficulty/complexity in 'managing' and administering the game. The evaluation will also consider how best to incorporate the simulation into the curriculum, how it may complement other formative activities/assessments, and support student achievement in the summative assessment.

Initial survey of CSG products in the market.

The categorisation of simulation game products may be viewed from the perspective of comprehensiveness in terms of theoretical underpinning. From this perspective, a three – level hierarchy has been identified; global, second tier and ‘game games’. Global simulation games are simulation games that can be played on demand, and have sound and explicit theoretical underpinnings. Second tier simulation games also have sound but narrower theoretical underpinnings (e.g. sources), whilst the ‘game games’ usually have a narrower scope for learning. Examples of simulation games in each tier are as follows:

1. Global simulations
 - a. Harvard Business Publishing (<http://hbsp.harvard.edu/list/simulations>)
 - Entrepreneurship (one simulation), Finance (three simulations), Marketing (two simulations), Operations and Service Management (five simulations), Organisation Behaviour (two simulations) and Strategy (two simulations).
 - b. The EIS Simulation: The Change, IT Innovation and People Management Challenge (<http://www.calt.insead.edu/eis/>).
2. Second Tier simulations
 - a. Simventure (<http://simventure.co.uk/index.php>).
 - b. Marketplace (<http://www.marketplace-simulation.com/>).
 - c. Goventure (<http://www.goventureanybusiness.com/>).
 - d. The Enterprise Game (by PixelLearning - <http://www.pixelearning.com/services-the-enterprise-game.shtml>).
 - e. Stock Market Challenge (<http://www.stockmarketchallenge.co.uk/>).
 - f. Pearson’s Strategy Simulation.
3. ‘Game Games’ simulations
 - a. Beer Game (e.g. <http://www.beergame.org/>).
 - b. Lemonade game (<http://www.lemonadegame.com/>).

The level of technology in each simulation seems to vary - however the assessment of technology is beyond the scope of this report.

Recommendations and Conclusion

The use of CSG in modules appears to be feasible. Currently, the type and level of integration of CSG within modules is varied, if present at all (though appropriately as such). There is potential to further explore the use of CSG within other modules, in terms of off-the-

shelf products or developing customised solutions in support of current learning and teaching activities that are problem-based and involving role-playing with real-time feedback mechanisms (Mariais et al., 2012).

CSG may be used in a self-contained manner in terms of specific topics within a module, in a limited number of seminars as an activity, or be used more extensively throughout a module. CSG may also be used as part of summative assessments. Lessons learned by students from CSG may be used as a point of reference in their assessment (e.g. reflection essays). The level of integration and use in the summative assessment depends on a number of factors such as field of study and the transparency of the algorithms in the simulation (for the 'right answer').

Whilst the piecemeal approach may be appropriate as each module is unique, there is an opportunity to explore the possibility of integrating aspects of the use of CSG at a School/Institute level. This may involve a community of practice to share best practice and/or mechanism to coordinate the use of CSG. For example, the period for use of license may be beyond the module's life in an academic year and may be used in other postgraduate modules, or modules that have a different set of students.

Level 5 modules in the Business Management course group are recommended to be targeted in the implementation of CSG because of its potential to have the biggest impact in terms of student learning, which is achievement. In addition, students at this level would have acquired the necessary requisite knowledge from Level 4 and thus CSG would be an effective tool for students to apply their knowledge and to hone their skills. In other words, Level 5 could be a 'stage for practice' for students prior to progression to Level 6. The introduction and use of CSG at Level 4 provides an innovative differentiation in terms of learning and teaching methods from other Universities. In addition, the experience with CSG may provide students with a more positive stimulating learning experience to take with them throughout their course of study.

In terms of the next steps, a stage-gate approach is proposed - the proceeding stage commences only if the preceding stage is a satisfactory outcome:

1. Design stage:

Undertake an in-depth discussion and evaluation of the use of CSG and/ or development support mechanisms in modules adopting a problem-based and/ or role playing approach to

learning and teaching. Provide assistance in the potential redesign of some aspects of a module that may incorporate a CSG.

2. Implementation stage:

This stage involve the details of the implementation including matters such as lecture/seminar arrangements and how this may be managed from the administrator perspective of the CSG, working with vendors in configuring CSG to the needs of the module as much as possible, classrooms and corresponding facilities and working with other administrative units in support of CSG.

The above is consistent with bottom-approach adopted that views CSG as a vehicle of learning. CSG should be evaluated in terms of its appropriateness within the context of the field of study and other contextual factors (e.g. student numbers) (Gros, 2007).

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Biography

Mark Loon is a Senior Lecturer in Worcester Business School. His research areas include innovation and design, systems thinking, problem solving, leadership, learning, and personality. He teaches human resource management and change management. Prior to joining academia, Mark was a management consultant and had worked with firms such as Ernst & Young, Cap Gemini and KPMG. As an independent management consultant and business analyst, Mark has worked for companies such as QBE, AMP and Morgan Stanley. His public sector clients include the Prime Minister's Department of Malaysia, the Ministry of Finance of Indonesia, and the New South Wales State Government.