Proceedings of the NACCQ 2000
Wellington NZ www.naccq.ac.nz

An Argument for the Information Systems Educators' Preferred Model of Internet-based Business Simulations

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ABSTRACT

UCOL staff have documented and observed that Information Systems (IS) students often query the value added to learning the course requirements of highly theoretical accounting or business principle units. A UCOL solution is to use business simulations as a capstone of theory learned or as an on-going experiential exercise during theory delivery. Business simulation selection has been a recent focus for UCOL staff. The purpose of this paper is to explore preferred attributes comprising an Internet business simulation model of IS educators for business simulation selection or specification of design.

A business simulation is based on a high number of variables involved in determining a real market, which allows users to implement corporate strategies. The majority of business management simulations fit two categories. Microworld simulations involve intracompany efficiencies or in-house competitions. Macroworld simulations involve complex systemic problems with horizontal learning across industry by teams or participants, representing different companies, who are competing for market share.

This exploratory study surveyed 24 New Zealand business computing tertiary institutions interviewed two IS lecturers and experimented with business computing students on their preference for macroworld Internet-based simulations. Content analysis for patterns of preference revealed the model requires five interdependent subsets that will aid business simulation selection.

Additionally, the Internet simulation model allows the trainer to set quality learning outcomes and performance scheduled based on the interdependent Internet simulation model sub-sets. The subsets are business simulation design complexity, Internet medium controlled by the trainer, relevant documentation is obvious to the trainer and participant, and user friendly navigation of the simulation. The business simulation selected that ignores these subsets is likely to negatively impact on the student learning outcomes.

Keywords
Internet, business simulation, model.

1. INTRODUCTION

UCOL staff have documented and observed that Information Systems students often query the value added to learning the course requirements of highly theoretical accounting or business principle units (Kelly, *et al.* 1999). A UCOL solution is to use business simulations as a capstone of theory learned or as an on-going experiential exercise during theory delivery. Business simulation selection has been a recent focus for UCOL staff (Toki & Foster, 1999). The purpose of this paper is to identify IS educators' preferred attributes which comprise an

Internet business simulation model for business simulation selection or specification of design.

2. LITERATURE REVIEW

Literature reveals the majority of business management simulations fit two categories, which have been defined here as microworld and macroworld (Kelly, *et.al.*, 1999; Keys, *et al.*, 1996). Microworld simulations involve intracompany efficiencies or in-house competitions, usually custom-designed. Macroworld simulations involve complex systemic problems with horizontal learning across industry by teams or participants, representing different companies, who are competing for market share of products. Either category, if the product is appropriately constructed and delivered, can provide excellent practice fields for participants. Some simulations may provide a capstone for content supplied or a seamless integration of business theory in practice, others as a rapid accumulation of managerial experience. This exploratory study refers to Macroworld simulations.

Business simulations are used extensively in business education, both at academic institutes and in the commercial environment (Burgess, 1990). Problems occur when the business model that is the crucial underpinning of the simulation is not conveyed in documentation or within the simulation itself, to the person running the simulation (Keys, *et al.*, 1996; Neelamkavil, 1987). This has forced many institutions to write their own (Foster, 1999; Toki & Foster, 1999; Cohen, 1998; Burgess, 1990) or practise extreme caution over selection (Toki & Foster, 1999).

The majority of business simulations are run from management companies, who oversee the games and add 'reality' to the situations, as they prefer at the time (Salopek, 1998). Control of simulation elements resides with the management companies, not the IS educator.

Problems for delivery and student learning occur when the business model cannot emulate complex situations. Perry and Preston (1986) have demonstrated that linear programming is not suitable for aggregate decision making. Issues then arise to give a model that is sufficiently complex to emulate real business, with a programming tool and systems design that can achieve that goal (Kippi, 1996; Hermasi, & Graf, 1992). The Internet media using object-oriented programming provides real-time response that meets this goal (Toki & Foster, 1999). However, often the management company owns the simulation and the IS educator must comply with their gaming rules for data submission.

3. BEHAVIOURAL MODEL OF SIMULATIONS

The use of simulation allows the participants to live in the reality of business management by experiencing with no risk the consequences of the adopted strategic and tactical decisions (Salopek, 1998; Keys, *et al.*, 1996; Keys & Wolfe, 1990). In order to bring about improved behavioural, attitudinal and knowledge change, a three state teaching model called the 'Management of Learning Grid' is advanced by Keys (1989, cited in Keys & Wolfe, 1990), based on Kolb's experiential learning model (Lublin, Spoth, & Baker, 1986). It is based on the premise that an effective instructional style requires the balance of three factors content, experience and feedback. These are considered essential to effective learning in simulations.

The 'content' is defined as the dissemination of new ideas, principles or concepts. An opportunity to apply content in an experiential environment is defined as 'experience'. 'Feedback' is defined as the result of actions taken and the relationship between performance at each chronological phase in experience and subsequent result.

The business simulations provide an 'experience' for participants to provide 'feedback' to their group and the administrator/facilitator of the training exercise. Referring to the Management of Learning Grid provides the IS educator a framework to identify the appropriate stages of intervention in student groups to aid student learning or performance. Comments follow from interviewed IS educators. A negative statement: 'I have to meet the time frames of the company managing the game. This doesn't always suit my students.. they change their decisions.' A positive statement: 'I (game administrator) decide how long to run the sim, at what daily or weekly rate, and how much emphasis should be placed on the sim within my course.'

The overall benefit of consistency, control and interactivity allows components of training to be added to address other nuances e.g. leadership and managing group dynamics. With careful management, simulations can teach a mental model (Senge, 1990) especially when practising a behaviour that involves decision making or a routine sequence of actions. The facilitator of the game can control the message to aid learning of discrete skills (Salopek, 1998).

A learning organisation can benefit from the compressed learning time inherent in business simulations. For instance, a large number of students can be grouped at geographically diverse locations. Students acting as managers have the freedom to fail, without the threat of bankruptcy, when applying strategic knowledge in the business simulation.

Simulations are used for student learning (team dynamics, strategic decision making, commercial pricing, quality management...) participant's performance (return on investment...), or as an assessment. The context for simulation use needs careful objective setting by the IS educator (Keys *et al.*, 1990). For instance, one should not assume a performance outcome of a highly profitable group necessarily reflects a high learning outcome; other reasons such as cracking the game's formula may exist.

4. INFORMATION SYSTEMS ISSUES WITH BUSINESS SIMULATIONS

The complex experiential learning environment of management simulation gaming poses several unique information systems problems. An examination of current business simulations available revealed the following issues.

4.1 Complexity

In many simulations reviewed, the actions of one company do not have a significant reaction on other companies. Nor do the actions of one turn compound into other turns. Participants who are endeavouring to operate 'real world' often find themselves pondering why their results were not as they expected. This highlights just some of the decisions software engineers have made when pondering the complexity balance. They have got a working product, but it lacks realism in an area that can detract from the intended learning experience. In the past few years object-oriented software tools have become readily available to developers for creating and analysing computer models of critical business systems and situations. However, this software requires business managers and courseware developers to create customised business simulations. It is rare that the game facilitator has the development skills to create the simulation (Salopek, 1998).

Internet as the medium to deliver the business simulation was preferred over paperbased, CD-Rom or DOS driven simulations. The respondents' reasons referred to the Internet as the most appropriate and common medium for in-class or on-line learning.

These issues formed the basis for the research question.

5. RESEARCH QUESTION

The primary research question is 'what is the tertiary educators' preferred Internet business simulation model to facilitate computing students' learning? The result of this exploratory research is to provide a model for the IS educator on attributes for business simulation selection or specification of design.

5.1 Research Method

There are four parts to the research. First, a search of relevant literature was undertaken to identify attributes of business simulations and to develop a theoretical foundation for the study.

Second, questionnaires were administered to the computing sections of the 24 New Zealand polytechnics. The response rate was 66 percent. The analysis of data aided the compilation of a model. This model was tested against willing survey respondents and modified where appropriate.

Third, based on the developed theoretical framework, a focused interview was conducted with two tertiary IS educators, who use business simulations to deliver accounting or business.

Fourth, an experiment comparing a paper based linear simulation to an Intranet/Internet non-linear simulation was tested on a population of 100 Bachelor of Applied Information System UCOL students. Thirty-one sets of valid data was collected and analysed.

The following model results from the research findings.

6. THE INTERNET SIMULATION MODEL

Having examined the issues associated with existing business simulations, the aim of this research was to create and test a business simulation model that eliminates or minimises these issues, namely one that:

- Is complex in its design calculations
- Is Internet/Intranet based
- Provides clear documentation for administrators and participants
- Is user-friendly to operate

- A learning and performance schedule may be easily set by the trainer

The importance of selecting an Internet business simulation that can meet a trainer's delivery needs is dependent on the quality of the stated sub-sets. IS educators contributed to the content analysis that aided the development of the Internet Simulation Model.

6.1 Business Simulation Design is Complex

This study has consistently revealed that business simulations require a simulation that uses a high number of variables to emulate the business world. Content analysis (see Table 1) and model critique by IS educators provided the minimum quality factors acceptable.

Table 1: Categories assigned to business simulation design

Scenario design is documented for the trainer

1.1 Weightings for external and internal factors of the design of the business model are stated.
1.2 Scenario can be designed by the trainer for:
1.2.1 Team conditions
1.2.2 Duration
1.2.3 Selecting level
Initial team market share stated
Decision making complexity
1.2.4 Trainer able to select relevant weightings

IS educators stated suitably complex business simulation details of 'what if' scenarios, price sensitivity and quality of product is indicative of non-linear programming supporting the computer application.

6.2 Internet Medium is Controlled by the Trainer

The IS educators in this study expect to be able to design or include simulation features using the Internet to set the scene and control the pace of the simulation. Results have revealed a significant preference, 75%, of business simulation trainers do not want an external body to control the pace of the simulation. Survey and interview respondants stated this lack of control may force changes to results and subsequent time management planning; and may effect the group dynamics and leadership objectives.

6.3 Relevant Documentation is Obvious to the Trainer & Participants

When selecting a business simulation the supporting documentation needs to be relevant for the trainer and participants. Content analysis (see Table 2)

and model critique by IS educators provided the minimum quality factors expected in documentation.

Table 2: Categories of documentation

2 External Factors documented and categorised :

2.1 Economic cycle
2.1.1 NZ CPI
2.1.2 NZGDP
2.1.3 Interest rate
2.1.4 International exchange rates
2.2 Seasonal cycle
2.3 Regional cycle
2.4 Product life cycle
2.5 Replacement product
2.6 Industry setting
3 Internal Factors documented and categorised:
3.1 Price sensitivity
3.1.1 Selling and promotion
3.2 Market sensitivity
3.2.1 Purchase source and price
3.3 Quality sensitivity
3.4 Production
3.5 Storage & Transport
3.5.1 Warehouse size/capacity/leasing cost
3.5.2 Vehicle maintenance (depreciation)
3.5.3 Outsource /courier
3.6 Capital investment
3.6.1 Dividends and interest
3.7 Tax
3.7.1 NZ GST payment or refund
3.8 Term loans
3.9 Bank overdrafts and interest charged
3.10 Bankruptcy possibilities
3.11 HR
3.12 Information systems (IS)and administration
3.12.1 Equipment
3.12.2 IS development
3.12.3 Impact of new technology
3.13 Initial Statement of financial performance and Financial Position
3.14 Initial Cash Flow Statement
3.15 Initial Market share
3.15.1 What allocation is made?
3.16 Merger/Take-over possibilities

The trainers' required minimum explanations on scenario set up. The participants required simulation context and rules. A New Zealand business context was preferred.

6.4 User friendly navigation of the Internet simulation

From this study the following identified features (see Table 3) collectively aid user friendly navigation of a business simulation. IS educators' needed to check documentation or trial the business simulation when selecting a business simulation for these features.

Table 3: Internet User friendly features, in order of preference

Access rights to simulation by trainer

Limited access rights to simulation by participants
Unified simulation environment
Graphic visualisation
Integrated online help
Keystroke error prevention
Built-in analysis of variance
Window commands applicable
Calculator mode
Automatic spacing
Cursor prompting
Interruptible / swaps between applications
Error messaging

6.5 Trainer may set learning outcomes and performance schedule

Provided all the previous subsets of the Internet Simulation Model are met the trainer has a quality product to build an intense learning experience for participants on managerial decision making. The experiment showed with poor stock purchasing decisions with the paper-based simulation. This lack of quality indicated that if subsets of the model are missing elements then there is a likely impact on learning or performance.

This study revealed a skill set of learning outcomes that was commonly delivered by IS educators (see Table 4).

Table 4: Skills sets gained from using business simulations

Business Strategy

Capacity Planning
Competitive Dynamics
Forecasting
Human Resources
Information Systems
Marketing Dynamics
Manufacturing Processes
Product Development
Product Lifecycle
Project Management
Sales & Marketing
Financial Accounting
Technology Management
Teamwork and leadership skills

7. CONCLUSIONS

7.1 Evaluation of research assumptions

This research has revealed the benefits of using a business simulation to IS educators who may set a schedule for business computing students to:

- learn and improve their management capacity in the business functional areas (marketing, finance, production...),
- learn and improve their strategic management capacity,
- improve their teamwork capacity, and leadership skills,
- improve the "quality" of the corporate decisions they make,

in a virtual business world, where risks have consequences. Business simulations provide a learn-by-doing environment, which is far removed from the theoretical classroom.

The trainer may set quality learning outcomes and performance schedule based on the interdependent Internet simulation model sub-sets that are: business simulation design complexity, Internet medium is controlled by the trainer, relevant documentation is obvious to the trainer and participants, user friendly navigation of the simulation. The lack of factors contributing to these sub-sets is likely to negatively impact on the learning outcomes. It is unclear what the impact of the IS educator's intervention during participants' decision-making aids or inhibits learning.

The Internet simulation model provides the design complexity, relevant documentation and technical robustness identified in other underachieving simulations; and takes business simulations into the age of other industry simulators. This model provides the complexity of different levels, and requires the simulation to be adaptive to the delivery environment. It identifies preferred factors that will aid the selection of an ideal Internet business simulation for trainers of business computing students.

7.2 Future research plans

The production of the Internet simulation model has raised areas where more research is required.

The highly structured survey did not allow an opinion to be provided on scenario loading, or object-oriented programming of an Internet simulation. Data could not be collected to agree or disagree with Slopek's (1998) statement that it is rare that the game facilitator has the development skills to create the simulation.

The use of simulations as a learning tool, participant's performance and an assessment tool are separate issues requiring further investigation. This involves identifying at what stage during the Management Learning Grid should the facilitator intervene in business simulation teams decision-making to aid these separate tools.

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