

Teaching Introductory Management Using A Computer Simulation Game

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ABSTRACT: *The teaching of management at both undergraduate and postgraduate level using simulation games has grown throughout the world. There is now a wide range of commercially available games and also a number of Higher Education Institutions have developed their own. In order for students to learn about business and management through computer simulation it is not always necessary for the game to be complex. This paper describes the development, use and evaluation of a business simulation game. The simulation game was used with first year students to develop both computing and information management skills, and a better understanding of the dynamics of business decision making. It also highlights the nature of the interrelationships between the various functions of a business and also the business's interaction with its external environment. The simulation described was developed in order to provide an engaging and integrating learning experience for students. The evaluation of the students learning outcomes seemed to indicate that the simulation game provided deeper learning than might have been expected from conventional approaches.*

Keywords: *Simulation games, gaming, computer information systems, pedagogy.*

INTRODUCTION TO USING COMPUTER-BASED BUSINESS SIMULATION GAMES

Over the past forty years, the number of games and breadth of their application has grown. This has stemmed from the expansion of business teaching and developments in computing technology. Although there are a range of well-established pedagogic simulations on the market which emphasise business strategy, (see Keys 1997 for a review) these may be too complex for use with students studying introductory business. Developing an 'in-house' business simulation game with a lower level of complexity could allow a higher level of learning for introductory business students.

First year students at the University of Plymouth Business School study a range of core compulsory modules covering such areas as marketing, human resource management, economics, accounting and quantitative methods. However, the Business School has a strong belief that all of its graduates should be capable of working within a modern, computerised business environment. Therefore it also runs a compulsory core module in Computing Information Systems (CIS) for its major business programmes.

The key challenge facing staff teaching the first year CIS modules is to provide a learning experience that all students will find engaging and useful for their future studies and careers, even though their main interests lie outside computing in such diverse areas as marketing, personnel, finance and even perfumery. The educational and work experiences of students participating in the course are wide ranging, and accommodating students with varying levels of knowledge and ability is an important consideration. However, the most fundamental issue is to provide a course which achieves its own objectives whilst also reflecting the wide range of preferred specialisms of participating students.

This paper describes the development, use and evaluation of a business simulation game. The problems of developing business knowledge and information skills with first year business students are raised. The use of a bespoke computer-based simulation as a pedagogic aide is described, along with the lessons learnt from using this particular learning platform.

THE CONTEXT FOR USING COMPUTER-BASED BUSINESS SIMULATION GAMES

Research conducted with employers by Plymouth University (Ethos, 1995) has shown that employers wish to see a range of different skills in the graduates it employs. In addition to the possession of embedded basic core disciplines (providing an understanding of technical detail) and the ability to flexibly transfer skills rooted in specific knowledge, a number of generic transferable skills were also identified. These included interpersonal, presentational, communication, leadership and teamwork skills. Rated most important however were IT skills. This finding is reflected in the recent Dearing Report, which states:

“... changes [in information technology] have important implications for higher education. They affect the types of skills which students will have when they enter higher education, their expectations of the facilities and learning modes open to them and the types of skills and intellectual attributes which those leaving higher education will need to have if they are to operate successfully in the modern world. For example, the development of high-level skills in handling the large volumes of complex information which can be made available by communications technology will be one of the tasks of undergraduate programmes”.

Dearing Report, 1998

Whilst the challenge to develop transferable skills is pertinent to all disciplines, it is particularly so in business related programmes which are, by their nature, expected to deliver rounded and vocationally well equipped graduates. Furthermore, research indicates that even amongst the smallest of firms, the use of information technology is widespread and increasing (McClure and Blackburn, 1997). It is therefore regarded as critical that all Business School graduates are proficient in the use of common business applications and understand their role in aiding business decision making.

THE PROBLEM OF TEACHING BASIC BUSINESS PRINCIPLES AND INFORMATION SKILLS

A number of challenges exist in teaching computing modules to business students. First, as already suggested, the ultimate aim of many Business School students is to specialise in such areas as marketing and personnel. Therefore computing falls outside their main area of interest. Second, and of increasing significance, is that growing numbers of students entering the first year already have some experience in using computer applications. Many therefore perceive that they ‘already know computing’, despite the fact that their experience is often limited to a little word processing, some basic spreadsheet work and the use of the internet. In reality, only a small number have very high level skills. A failure amongst students to recognise their own limitations in the use of computer applications within business scenarios is for some reflected in disappointing assessment grades. A further group of students are those who still have practically no experience in using computer applications, although this is a small and shrinking minority. Thus the range of abilities within a typical cohort is wide.

The main challenges arising from the nature of students being taught are to provide a module that:

- emphasises the real world integration of computer systems in to the various functions of business (finance, marketing, operations, personnel) which represent the main areas of interest for students
- accommodates students with varying levels of knowledge and ability
- provides a thorough and in-depth understanding of the use of specific computer applications and the development of business focused systems
- helps students appreciate the holistic nature of the business, and the idea that co-operation between inter-dependent system actors can give rise to synergy benefits.

USING A COMPUTER-BASED BUSINESS SIMULATION AS THE SOLUTION

The CIS module being evaluated in this study utilises an interactive computer-based business simulation game designed within the Faculty called ‘Aromatherapy Candles’. It is an event driven game. The concept of the game was based around the decision making process in a candle manufacturing business. A manual paper based exercise was initially developed. Although the game worked relatively well in this form it was rather cumbersome to manage. To overcome this constraint, the game was translated into a computerised form.

Originally the code was written using basic programming. A further development involved re-writing the code in a Visual Basic format and transferring the program onto an Excel spreadsheet platform.

In its various forms, the business simulation game has aimed to help students to develop IT skills and their basic understanding of the role of information systems in businesses. Through this group centred game, IT skills are augmented in the context of a variety of management roles and situations that are closely linked to the students' main areas of interest. In each group, students take on the role of either sales manager, production manager, accountant or managing director (strategist) of a firm producing aromatherapy candles. These four roles represent the major functions of the business. The external business environment consists of customers and suppliers of the business. For effective decision making to occur the students will have to develop information systems which operate both between the various business functions and also extend to external environment.

Following a single introductory lecture and with the help of specially written guided learning materials (Mangles, 1998), each has to develop a computer-based information system to support their decision-making and assist them in the week-to-week running of their company. An e-mail system is used as the primary means of communication between 'managers'.

The simulation is run in a large computer lab generally with 36 students and one lecturer. As the simulation is completely automated, the role of the lecturer is that of facilitator and trouble-shooter when, for example, technical problems arise. In each 2 hour session, between 1 and 4 simulated playing weeks are run. The simulation is generally run across 6 teaching sessions. The real time duration of each playing week can be decreased (using a computer password) as students gain in confidence and experience. During each playing week, orders are generated by the aromatherapy candles computer system (referred to the *Umpire System* as it also records all the decisions made by each company) and placed with the student companies. The sales manager then makes a quote for each order via the Umpire System. This then informs the sales manager which quotes have been accepted. Where quotes are accepted, the company has to produce the necessary candles and deliver them on time, also producing a full set of accounts (using a computer application) for each week.

A number of parameter constraints exist in the simulation that the company must work within. For example, production constraints relating to the amount of melting and setting possible within the candle factory exist. Production managers are required to develop a computer based stock control system to enable them to plan production, manage inventory and provide information inputs to other managers. Meanwhile the sales manager has to develop a sales monitoring system, the accountant an average cost system and the general manager an overall design for the company's information system. All must be developed using appropriate software.

Students are also expected to use the computer systems to analyse data generated in the areas of production, sales and finance using appropriate statistical or graphical techniques. A variety of problems and 'hazards' are also presented to the groups throughout the game. Again, these constraints and problems are related to the students' main areas of interest. For instance, a strike occurs during one week of the simulation and needs to be responded to (of interest to personnel students) whilst in another, a market research report is presented to the firm for interpretation (of interest to marketing students).

At the end of the simulation, students produce a group report reflecting on their work, outlining the computer-based systems they have developed and showing their analysis of data. They are also required to give a presentation using a software application commonly used for computer based business presentations.

The anticipated outcome of the module is that students develop both specific software skills (using e-mail, spreadsheet/data analysis, word processing and graphical/ presentational applications) in an applied business context and that they develop a range of more generic skills. These include team working and the identification, analysis, interpretation and effective presentation of relevant data. Students should also develop an understanding of the integrative role of information systems within organisations, in particular gaining practical insights in to how the different functions within a business (which may or may not be a particular student's main area of interest) relate to one another.

EVALUATION OF THE COMPUTER-BASED BUSINESS SIMULATION AS A PEDAGOGIC TOOL

The module described has been evaluated using funding from the University of Plymouth's Educational Development Service made available to investigate innovative approaches to teaching and learning within the University, particularly in the areas of technology and flexible learning. The main aim of the evaluation was to explore student's perceptions of the usefulness of the business simulation in terms of their learning experiences.

Method for Eliciting Student Opinion

Six 'focus group' interviews were conducted with students that had completed the business simulation. Focus groups consisted of four students who had worked together as a team during the module. Each focus group was conducted using a semi-structured format (Robson, 1993). Using this approach, an interview question guide is used, establishing the direction and scope of discourse whilst allowing a degree of flexibility to be maintained in the interactions between researcher and focus group interviewees. Questions asked related to their experiences and preconceptions of educational simulations, the success of the simulation in achieving the learning objectives of the module, the advantages and disadvantages of the learning approach and how the simulation could be improved (a copy of the guide is provided in Appendix A).

In order to elicit honest responses from all participants, it was felt necessary to ensure that there was a relaxed and open atmosphere during focus group sessions. To facilitate this, refreshments were provided in a non-hostile setting and focus groups were led by staff not directly involved in the teaching of the students in the group. Also, efforts were made to include all students in the discussion by asking each participant an 'ice-breaker' question at the start of the session. All focus group sessions were tape recorded and fully transcribed.

Results of the Student Focus Groups

An analysis of focus group transcripts shows that a small number of students had some limited prior experience of simulation based learning in areas such as politics and accounting, though in all cases simulations were run over short time periods. There was general consensus amongst the students with regard to their preconceptions of simulations. They felt that simulations are fun and a welcome change to more traditional lecture based teaching. After their introductory lecture, many students did however feel that they had been overloaded with information and were awaiting their first simulation session with some trepidation. Indeed, experience of running the sessions made it apparent that students' immediate concerns over operational aspects of the game did act to obscure its underlying objectives for a number of students during the initial weeks of the simulation. However, given that a key aim of the exercise was to provide students with practical experience in managing, analysing and acting upon large quantities of information, this was seen as an important aspect of the learning experience. Indeed, although all students were fully briefed on the objectives of the module during the introductory lecture, focus group responses show that for many students, the objectives of the simulation only really became clear during the latter part of the exercise as students began to reflect upon their experiences. Similarly, for most of the simulation, the learning that occurred did so at a subconscious level. In other words learning occurred as a result of their practical work as students considered how computer applications might be utilised to enhance the quality of their decision making and the performance of their business. The following quotes typify comments made by students:

"at the beginning it was all very confusing and we didn't have a clue what was going on. It was a gradual process. In the end it was very, very successful. It just took time"

"it gets you involved instead of just turning up and sitting there passively...it really makes you get on with it and look at what you're doing and I think it makes you progress more than lectures do. I take more in when I do things in practice, in lectures I sort of sit there and go to sleep!"

"I liked the way I picked up so many things without realising – because if you think 'I've got to learn this' you just tend to block out things, but if you're doing it yourself you don't realise that you're learning. You learn more"

These responses in part reflect Everett's (1989) model of learning. He suggests that the higher the level of participation in learning, the more participants remember. Students tend to remember more when learning and experience occur through actual performance, simulating actual performance, participation in a task, viewing demonstration of a task and use of visual and audio material. The more active the student is, the more likely the retention of knowledge or skills.

It was also clear from the focus groups that most learning occurred either subconsciously (particularly in the case of specific software skills) or upon reflection. This reflective learning in some cases did not occur until students began to prepare their reports and presentations. However, given that this learning was firmly embedded in their own practical experience, students' understanding of issues and concepts relating to organisational information systems was in most cases clearer and deeper than might otherwise have been expected:

“I learnt more doing the presentation than sitting there each week. [I learnt when] preparing the slides and the overheads. When you’re doing something you don’t really think about it, you just do it automatically, but when you look back ... you think why you did it”

The provision of an effective mechanism for reflection is clearly critical to the success of this business simulation. Without this, the learning experience is incomplete. In the case of a minority of students, this mechanism was not effectively used and this was reflected in lower grades and a less positive attitude towards the game. Frequently, it was those groups whose businesses did less well financially that found it difficult to reflect positively upon their learning experiences. A critical lesson for staff is to underline the fact that the game is not a competition and that the financial performance of individual companies has no bearing on a group’s ability to do well in the module.

A further set of distractions for some students were the technical hiccups that arose on occasions during the simulation, mostly relating to the operation of e-mail. Such technical failures, whilst teaching students valuable lessons about the vulnerabilities of computer systems, did have a de-motivating effect. The need for fallback activities when systems fail is an important short-term lesson, whilst over the longer term the need to enhance the robustness of systems under conditions of heavy usage is apparent.

CONCLUSION TO THE USE OF THE COMPUTER-BASED BUSINESS SIMULATION

In conclusion, findings from focus group interviews with students show that the module is broadly successful in achieving its aims, although some areas for future development are highlighted. Evidence suggests that the way that students develop an understanding of concepts relating to business information systems through the course is different to conventional modes of learning. In particular, a range of technical and analytical skills are developed through hands-on, activity focused practical experience. Less tangible knowledge based competencies are meanwhile developed upon reflection, towards the end of the module. The experiential nature of the work undertaken leads to deeper learning. Equally as important, the game does engage the attention of the majority of students, whatever their main subject interest. This is because the course encourages them to conceptualise the business as a system, where each ‘business function’ (whether it be marketing, finance, production or personnel) is inter-related. Thus the individual student is able to identify more clearly the role of his or her particular area of interest within the business as a whole, generating enthusiasm and interest.

KEY LESSONS LEARNED

- Simulations can provide an effective way of introducing experiential learning into the classroom. Learning does not occur in the same way as in the lecture theatre and is often subconscious or only recognised upon reflection.
- Due to its experiential nature, learning is often deeper than might be expected if conventional approaches were adopted. As it is different, it is also perceived to be more fun by students.
- For desired learning outcomes to be achieved, mechanisms for students to reflect upon their experiences must be put in place. It is also important to reinforce the overall purpose of the module to avoid students losing sight of their own objectives as they become involved in the operational aspects of the simulation.
- Simulations can provide a means of integrating subject matter into the mainstream of students’ interests, providing an engaging learning experience that adopts an holistic approach.
- Using technology as a means of facilitating learning can result in increased levels of vulnerability to disruption as a result of technical failures. Adequate measures should be taken to avoid such failures and particular attention should be paid to developing contingency plans in case failures occur.

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APPENDIX A
ATC GAMING SIMULATION
FOCUS GROUP QUESTION PLAN

Structure of the Group

Groups containing four first year business studies or business information systems students were selected randomly from a 'Computer Information Systems' module at Plymouth Business School. They were invited to participate in a structured group discussion.

Ice-breaker

What did you do before you came to university and why did you decide to study business?

Familiarity with Business Games

What games or simulations, if any have you played in your education?

If so, tell us about your experiences ?

Preconceptions about Business Games

Think back to the start of the module, what was your view about learning from games as compared to conventional lectures?

Objective Achievement

- After the initial talk what were your feelings about the game?
- What did you see as the main objective of the game (learning objectives of module)?
- At what stage of the game did the objectives become clear?
- How successful was the game in meeting those objectives?
- At what stage during the game were these objectives achieved (click point)?

Learning Experience

- What did you learn about the role of information in a business?
- In what ways was the game good at making you think about how to use information in a business?
- What were the limitations of the game in exploring the role of information?
- Are the issues raised in the game relevant to the real world of business?
- Having played the game in what ways are computer simulation games better for learning than structured lectures?
- In what ways was it worse?
- What do you think about using information technology as a vehicle for learning?
- What do students need to do to learn from the game?
- In what others ways might learning be enhanced in the context of the game?