UNIVERSITY OF SOUTHAMPTON

FACULTY OF LAW, ARTS AND SOCIAL SCIENCES

School of Management

To What Extent Can Total Enterprise Simulation be Validated?

by

Andrew Stainton

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ABSTRACT

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TO WHAT EXTENT CAN TOTAL ENTERPRISE SIMULATION BE VALIDATED?

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A Total Enterprise Simulation (TES) is a virtual, gaming representation of the functions of a business and its marketplace. Traditionally, business gaming simulations of this kind have been used as learning tools aimed at developing the business acumen of students. Past research conducted by authors in this field has shown that, although an enjoyable exercise for users, this type of simulation has lacked educational and representational validity. Researchers have found insubstantial evidence of learning effectiveness and there has been simplistic modelling of the real world business environments. Consequently, this research project has investigated the TES learning medium with the aim of establishing the extent to which TES can be validated from both an educational and representational perspective. A multi-case study design has been implemented in which data has been sourced by engaging participants from varied work environments within a TES and subsequently analysing their perspectives. In this way, opinions of postgraduate management students, aerospace executives, executives from Kraft Foods, and executives from QBE Insurance have been compared and assessed. The author has pulled together literature to provide a foundation for simulation designers aiming to develop simulation exercises that are educationally valid. Within the literature review, a taxonomy of simulation has been compiled which the author has used to define the simulation area of focus for this study; business management development simulation - the authors brand of TES. Past validity studies have been inconclusive, and therefore this study has combined the literature on learning, simulation design and research methodology to formulate a methodology for validating TES. This study has applied this methodology to four different case organisations which has contributed to knowledge by yielding evidence strongly supporting the educational and representational validity of TES within this substantive enquiry. Also, there have been contributions to knowledge resulting from this investigation through the development of frameworks: 1) A reference framework for simulation validity; 2) A research methodology framework for simulation validity; and 3) A design objectives framework for simulation validity.

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Abbreviations

TES – Total Enterprise Simulation

FMCG – Fast-moving-consumer goods

Introduction

The author has an active interest in business simulation. For almost twenty years he has been working as a management consultant within a range of industries. Most of his time has been employed within two distinct industries: financial services and fast-moving-consumer goods. More specifically, the author has designed and developed computer systems within Zurich Financial Services, Prudential, Norwich Union, Jardines, Mars, Tesco and Vodafone. The focus of applications has been to help managers make decisions and to improve their understanding of the business environment. For example, during the 90's the author was responsible for a multi-million pound contract to build a national market research computer system for Norwich Union. Related to nurturing business understanding of managers, the author has concentrated upon management development projects and as a consequence has developed a deep knowledge and experience in the building and implementation of business simulation. For example, at Zurich Financial services he used business simulation globally to enable senior managers to practise using a new management information system, and to practise thinking through and implementing strategies. The success from this led to the development of a range of insurance business simulations covering personal life, non-life, and commercial insurance that were used to develop the business acumen of middle managers within the company. Hence, it is from this background that the author embarked upon this research project. The literature revealed that a common view shared amongst academics was that business simulations and total enterprise simulations were lacking in educational and representational validity. The author therefore aimed to use his past experience and knowledge combined with literature on learning, simulation design and research methodology to establish a methodology for validating total enterprise simulation, and to test for educational and representational validity. Vitally, having worked in this area, the author also had opportunity to develop access to case organisations through his personal contacts. This would prove useful in the testing-out of simulations with executives and the eliciting of evidence from appropriate target audiences.

This thesis has the objective of establishing and implementing a methodology for validating total enterprise simulation. This is achieved by exploring literature concerning the work of past researchers on the topic combined with an investigation of

the literature on research methodology, and the use of the author's past experience in simulation design. A methodology is proposed and subsequently tested to address the research question: "To what extent can total enterprise simulation be validated?". Hence, there are four main chapters to this thesis addressing this objective. Chapter 1 examines literature on simulation validity. In section 1, it defines a taxonomy of simulation from which a focus for the investigation could be derived. Subsequently, Section 2 examines how, and the extent to which, business gaming simulation has been validated. From this, it becomes apparent that the measurement of learning derived from simulation has been problematic within the process of validation. Consequently, Section 3 explores learning theory to establish whether such theory might be useful within the process of establishing educational validity of business gaming simulation. The literature on simulation validity also highlights difficulties in the design of simulation. Therefore, Section 4 focuses upon design considerations linked to the educational validity of business gaming simulation.

Having explored simulation validity literature in Chapter 1, research methodology literature is subsequently explored in Chapter 2. Learning from both chapters is combined in order to formulate a research methodology for this investigation – to validate total enterprise simulation. The research question is developed in section 2.1which is addressed through a set of theoretical propositions covering validity issues such as design factors influencing validity, business understanding derived by participants, and the "real-world" relevance of this business understanding for participants. Section 2.2 provides justification for the paradigm stance adopted by this research, describing the epistemology and ontology in terms of the basis upon which knowledge was gathered and how knowledge developed. Subsequently, and building further upon previous topics, section 2.3 formulates the research strategy and methods that were implemented within this investigation. Validity, reliability, simulation design and validation processes, and design of research instruments are addressed. Given that the research instruments yield data to be analysed, section 2.4 describes qualitative and quantitative methods used for data analysis. Finally, in section 2.5 the research schedule is presented.

In Chapter 3 evidence is used to assess the theoretical propositions associated with the research question. In Section 1, internal educational validity is addressed in terms of understanding derived from the simulation in areas such as market developments, financial impacts, projects and team effectiveness. In Section 2, external educational validity explores whether the simulation has influenced business understanding related

to real-world business environments. Topics such a strategic management, marketing management, financial management, project management, leadership and teamwork are considered. Representational validity is also addressed. Finally, Section 3 assesses design factors that might enhance the validity of TES.

Overall conclusions are drawn in Chapter 4 which provides a summary of the investigation's aims, directions and achievements. Contributions made to existing knowledge from this project are described. Areas for potential further research associated with this investigation are proposed. Finally, limitations of this research are suggested. Hence, in this way, this thesis is structured to investigate the research question in a logical and sequential order.

Chapter 1: A Literature Review - Simulation and its Validity

This literature review consists of four main sections that are illustrated in figure 1: Structure of literature review, and are now explained.

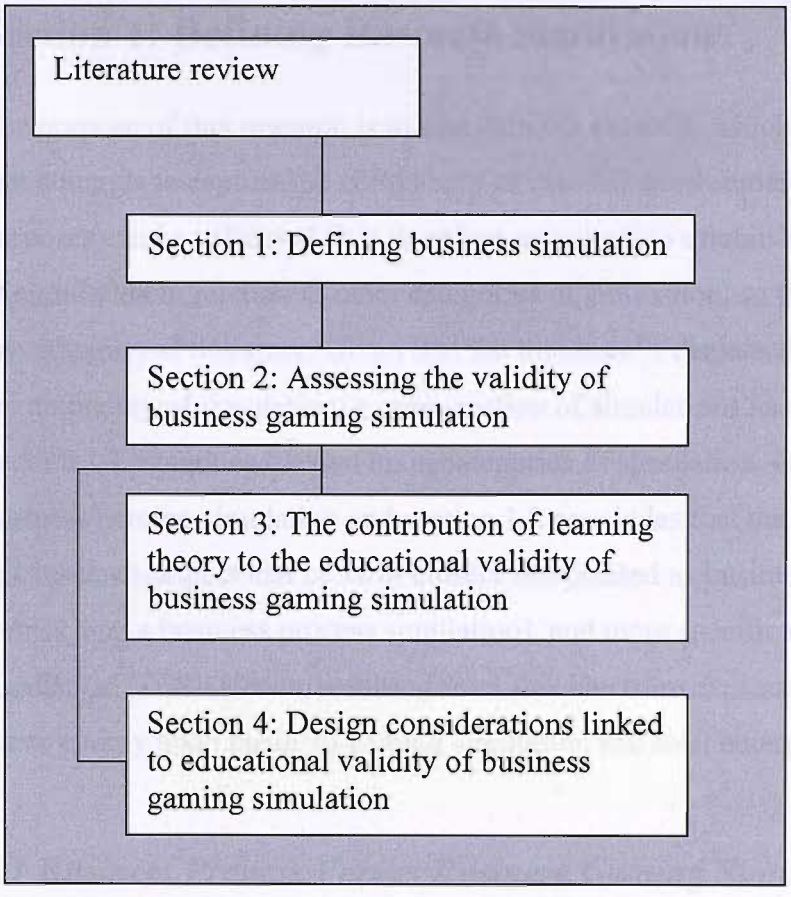
The first section - Defining Business Simulation - explores the different kinds of simulation and seeks to find an established taxonomy for the category of simulation that is the subject of focus for this research project - Total Enterprise Simulation (TES). The purpose and design of simulation is investigated. It is deduced that this investigation should focus upon a discipline of simulation referred to as Business Gaming Simulation and more specifically, a sub-category termed Total Enterprise Simulation.

Subsequently, as indicated in figure 1, in the second section past research specifically related to the validity of business gaming simulation is reviewed to ascertain the extent to which simulation has been validated and methods employed. It is shown that validity has been assessed based upon its strength as an educational tool and the accuracy with which a phenomenon can be modelled. It is concluded that there is a paucity of supportive evidence concerning both the educational effectiveness of this medium, and the degree to which business gaming simulation is able to represent real-world phenomena. Also, it is established that past investigations have been hampered through difficulties in measuring learning, and design.

Consequently, shown through the link in figure 1, in order to progress the investigation into learning effectiveness of total enterprise simulation, the third section explores learning theory and applies relevant learning concepts to the business gaming simulation context. As a result, some approaches are identified that may help facilitate and measure learning and hence contribute to educational validity of TES.

Likewise, as shown in figure 1, learning effectiveness is influenced by the simulation design. Therefore, the fourth section examines design considerations when building a business gaming simulation that aims for validity. The role of the facilitator, the appropriate level of complexity and the project management of design and development are addressed.

Figure 1: Structure of literature review



Section 1: Defining Business Simulation

The purpose of this research is to ascertain the extent to which a business simulation that attempts to capture the complexity of real-life environments for business learning purposes can be validated. It is therefore necessary to establish a definition for this type of simulation in relation to other categories of simulation, so that there is a focus to the investigation of literature. Given that the literature is dispersed and vague concerning the taxonomy of simulation, a cross-section of simulations has therefore been explored. Section 1.1 examines the two main categories of simulation - business process Versus business gaming simulation and section 1.2 concludes that the simulations used within this research project can be most closely categorised as business gaming simulations (rather than a business process simulation), and more specifically total enterprise simulation (TES). Hence, resulting from this literature exploration, subsequent topics focus mainly upon business gaming simulation and total enterprise simulation.

1.1 Business Process Versus Business Gaming Simulation

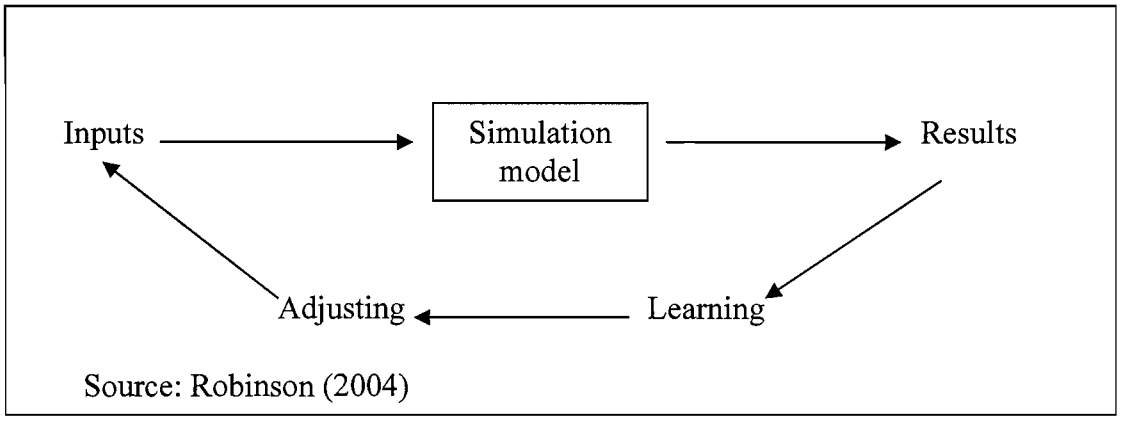
Unfortunately - and causing confusion - the term "simulation" has different meanings depending upon the desired goals and perceptions of the user. Within the field of simulation there appears to be two major disciplines. The first category consists of simulations used in Management Science or Operational Research, principally as "what-if" tools to explore the effects on a system resulting from events occurring over time (Oakshott, 1997). The second category might be described as educational simulations, mainly aimed at developing personal skills and understanding (Elgood, 1993; Saunders, 1995). In this chapter, the former shall be referred to as business process simulation and the latter as business gaming simulation. There is, however, overlap between these genres of simulation. For some, a business process simulation could be used to develop skills and understanding, and for others a business gaming simulation might show effects occurring over time.

1.1.1 Business Process Simulation

Within the world of management science and operational research, simulation tools for "what-if" analysis are often programmed on computers either using established techniques such as discrete event simulation or on a more open-ended basis within the discipline of System Dynamics.

From a Management Science perspective, Oakshott (1997:121) defines a process simulation as a model that mimics how an actual system responds to events that are taking place over time; providing a dynamic representation. Oakshott (1997) explains that such a model can be used to conduct experiments aimed at understanding the behaviour of the system and to evaluate various strategies that could be used when operating the system. For example, within Operational Research discrete-event simulation is widely used. The system to be modelled is represented by the progressive movement from one discrete event to another - such as arrivals and departures within a queue. Computers are useful for this kind of simulation because the status of many events must be monitored. This is achieved through established stochastic approaches in which samples are taken from probability distributions based upon computer generated random numbers (Oakshott, 1997: 123). Hence, as Robinson (2004) represents in figure 2, simulations within Operational Research are often used to perform "what-if" type experiments in which the inputs to the model are changed and learning is achieved by examining the resulting outputs (p.53).

Figure 2: The what-if nature of simulation



Source: Robinson (2004)

From figure 2, there is a simulation model which is a computerised, mathematical representation of the environment being modelled. Numerical decisions are made by a decision maker which provide "inputs" to the model. The model processes these inputs to produce numerical "results" or outputs – in tabular or graphical form. Through

analysis, the decision maker can learn about outcomes relative to inputs, adjusting inputs to further assess the resulting outcomes. In this way, understanding of the environment being modelled may be enhanced.

Similarly, process simulations are also created within the field of System Dynamics; another Management Science discipline. Coyle (1972) defines System Dynamics as the analysis of problems that involve issues occurring over time, within a system, to assess effects upon the system of shocks which are imposed by the outside world (p.2). As Coyle (1972) explains, models can be built of the system based upon decision rules and its behaviour can be tested to aid decisions concerning how to improve behaviour of the system. For example, Bakken, Gould and Kim (1994) describe a management flight simulator based on system dynamics as providing a learning laboratory that helps managers to leverage their knowledge by playing through simulated years, reflecting on actions and hence modifying mental models by continually repeating the process and making comparisons (p.247). Hence, in accordance with Robinson (2004), the simulation is allowing "what-if" scenarios to be assessed and compared, often through the building of complex computer programs with which a user interacts with the goal of identifying the possible consequences of actions.

1.1.2 Business Gaming Simulation

The second category of simulation is business gaming simulation used as an educational medium. The features of business gaming simulation are therefore described in this section. These are sometimes also referred to as business games or business simulations. Users can participate in the simulation either through a board game, a computer program or through role play. The simulation may be more likened to a competitive game than a representation of events over time. As a role play, it might be an open-ended exercise. Alternatively, it could take the form of a dynamic case study (used for teaching rather than research) in which the user interacts with the "case" as it develops over time in response to the user's actions. Developing organisational skills is a common outcome from this type of simulation – such as communication and teamwork. Business gaming simulations are often presented as interactive exercises involving individuals working in teams to achieve goals, often based around the improvement of company performance. Business gaming simulations may attempt to model the whole of a business – TES – or parts of the business – functional simulation. Alternatively, they

might be defined as behavioural in which there is role play within a scenario or even a crisis. This section will describe these aspects in more detail.

Faria and Wellington (2004) note that since the boom in computer technology of the early 1960's, business simulation games have been used widely for business education; particularly within management, strategy and marketing disciplines. However, categorisation of simulation within this area is vague.
According to Wolfe and Crookall (1998):

'The educational simulation/gaming field has been unable to create a generally accepted typology, let alone taxonomy, of the nature of simulation/gaming.
This is unfortunate because the basis of any science is its ability to discriminate and classify phenomena within its purview, based on underlying theory and precepts' (p.8).

1.1.2.1 Gaming Simulation: A Game or a Simulation

Conflicting characteristics of a game and a simulation mean that a gaming simulation might be more of a game than a simulation, or conversely, more of a simulation than a game. Whilst a game is a contrived exercise bounded by rules, a simulation is a more open-ended representation of the real world. Therefore, by definition, a gaming simulation cannot be a good representation of reality because it has game rules and boundaries that make it less realistic, detracting from the realism of the simulation. Saunders (1995) defines a simulation game as comprising elements of both a simulation and a game. For Saunders (1995), simulation represents some of the critical features of reality, and a game is a contest bounded by rules and decided by skill or luck. Hence, a simulation game only models those critical features of reality which involve rules, strategies and tactics (p.13). Other authors - Jacques (1995:22), Klabbers (1999:19), Leigh(2001:26) – also suggest that a game involves rules and competition, and describe simulation as a representation of reality – reinforcing the notion that a gaming simulation might be more of a game than a simulation. Leigh (2001:26) describes simulation as being more open-ended, focusing on real-life behaviour and processes. For her, this means that the structure can be more uncertain relative to a game which has pre-determined outcomes. Klabbers (1999) explains that the terms games, simulation and simulator are used interchangeably (p.18). For example, Jacques (1995) regards both simulations and games as representing a situation that is contrived rather than real,

with clearly defined boundaries and rules which enable participants to experiment in a safe environment (p.26). Hence, there appears to be confusion concerning the extent to which a gaming simulation represents reality or is in fact a more abstract game, modelled on reality and with boundaries and rules.

1.1.2.2 A "Dynamic Case Study"

A gaming simulation could be likened to a dynamic case study used for teaching purposes because, as is the case with a case study, there is a scenario with problems and issues to contemplate. However, the additional factor is that the scenario is not static but changes and responds to the decisions of the user. Hely and Jarvis (1995) believe that simulation provides business management students with a degree of realism that is not possible with the more static case study approach to teaching. They explain that case studies require students to analyse a situation and propose hypothetical recommendations without discovering the impact of their decisions on the organisation. By contrast, through feedback, computer simulation enables the effects of decisions on the organisation to be analysed in areas such as finance; staff morale; the market place; competitor results and others (p. 74).

1.1.2.3 An Opportunity for Learning

A range of possible learning outcomes from business simulations and games have been suggested. Saunders (1995:14 –16) proposes that these exercises encourage participants to work through a variety of decisions in a risk-free environment, and hence enhance skills and understanding. Elgood (1993:5) proposes that decision-making may improve through the discovery of results associated with decisions and adds that skills learnt and experiences can be transferred back to the business environment. These exercises provide a broad picture of the organisation by enabling participants to recognise how the components fit together. Some business simulations and games are intended to improve behavioural skills such as communication, listening, relationship building, co-operation, and teamwork (Elgood, 1993: 8-10; Faria, 2001). Wolfe (1997) (and Faria and Wellington (2004)) postulate that business gaming simulation is an effective tool for learning strategic management and marketing.

1.1.2.4 An Opportunity to Practise and Experience Management

Business gaming may provide the opportunity to practise and experience management in a manner that might improve management capabilities back in the workplace. Saunders (1995) defines common themes within business game and simulation exercises: focussed objectives, commercial profit, intense activity, professional roles, and efficiency. The goal of the exercise might be profit generation such that there is a need for participants to identify, assess and select a range of tactics and strategies that might achieve specific objectives. Participants assume entrepreneurial roles within the organisational functions - such as marketing, publicity or production - and make varied decisions covering issues such as pricing, storage and distribution, advertising and others. Assuming professional roles provides the opportunity to expand horizons by assigning particular responsibilities or duties necessitating the examination of a situation from a different perspective. Intense activity develops amongst participants due to a need to make decisions for simulated time periods (may be monthly or quarterly decision periods), at the end of which decisions are collected and outcomes determined. Other contributors can be competition between teams, random crises such as workforce strikes, or contentious issues leading to discussion and argument. In fact, enthusiasm may be so great that organisers may find it difficult to finish because participants become so involved. Regarding efficiency, individuals may become more efficient in the workplace as a result of contending with issues encountered during the exercise; although no evidence is provided to support this supposition. Hence, by assuming responsibility for simulated companies, participants might be provided with the opportunity to develop their business skills in an interactive and absorbing fashion (Saunders, 1995).

1.1.2.5 Types of Business Gaming Simulation

Several types of simulation have been proposed within the business gaming simulation area: TES, functional, behavioural and crisis. Goosen, Jensen and Wells (2001) define Total Enterprise Simulation (TES) as a 'descriptive and mathematical model of the general activities associated with operating a company in its totality' (p.23). For them, a valid model will operate in a fashion that is similar to the real-world business by producing results or outputs in response to management actions that are comparable to those expected within the real world. They define TES as comprising three broad

aspects: the making of decisions or inputs by users, the processing of decisions or activities by the model, and the generating of financial statements and operating results or outputs. They explain that the purpose of such a model might be to enable users to improve business decision-making skills by understanding the consequences of actions. Another category of business gaming simulation is the functional simulation (Goosen et al, 2001). TES differs from functional simulations in that functional simulations emphasise decisions in one functional area whereas TES covers many disciplines simultaneously; such as marketing, production and finance (Goosen et al, 2001). Summers (2004) provides a description of behavioural simulation - a genre of gaming simulation that is gaining in popularity. This experiential exercise requires participants to act out or role-play a situation, either relating to business or to other environments. He believes that learning objectives may over-lap with TES - such as leadership, teamwork, sales, negotiation, ethics, understanding different cultures – however, this type of simulation is based upon a story line with goals and progresses as a set of decision trees; contrasting with the mathematical decision-making models of TES. Summers (2004) describes behavioural simulation as usually comprising computer-controlled characters participating within the goal-driven story and such that the learner must strive to achieve the goal by conversing with these characters – making the simulation heavily dependent upon audio, graphical animation and video. Summers (2004) explains that the learner interacts with the simulation by selecting answers to multiple-choice questions, which in turn determines the computer response and enables the user to move to the next section in the decision tree. The behavioural simulation may also incorporate an 'agent'; an object that influences the multiple choice questions through its own artificial intelligence (Summers, 2004). Hence, behavioural simulation immerses participants within a performance or a show that has pre-determined story lines, and contrasts with the TES approach where developments occur based upon user interactions with a mathematical business model.

Borodzicz (2004) explains how simulation can help understand how to act within crises situations. For Borodzicz (2004), these might be situations where decision makers are required to operate in environments characterised by a complete lack of information (such as the 9/11 disaster), or to rapidly instigate new emergency policies and procedures within an organisation in response to a crisis event. Similarities shared with behavioural simulation are that individuals are required to play out certain roles within developing situations. Congruent to the outcomes of other simulation categories,

Borodzicz (2004) highlights communication and negotiation skills as major learning objectives within crisis management simulations.

1.2 Conclusion for section 1 – Defining Business Gaming Simulation

In summary, it is apparent within this chapter that there is no clearly established taxonomy of simulation genres (Wolfe and Crookall, 1998). Simulation is seen to be the representation of a real-world dynamic environment over time (Oakshott,1997; Jacques, 1995; Klabbers, 1999; Leigh, 2001). Within Management Science, the purpose of such a model is often to assess the effects on a system caused by changes to inputs occurring over time (Oakshott, 1997; Robinson, 2004; Coyle, 1972). On the other hand, in the educational world, business gaming simulation is mainly used to enhance personal skills and understanding (Saunders, 1995; Elgood, 1993). However, there may be cases in Management Science – such as a management flight simulator (Bakken, Gould and Kim, 1994)- where the objective is also learning about the simulated environment, and likewise in education – such as a TES - where the impact of directions is important (Goosen et al, 2001). Business gaming simulation is seen to offer a more dynamic approach to learning than case studies (Hely and Jarvis, 1995), and encourages learning through experimentation and practise (Elgood, 1993). Business gaming simulation often has objectives connected to profit creation, requires participants to take on roles and generates much enthusiasm amongst participants (Saunders, 1995). TES is a category of business gaming simulation which aims to holistically model the operations of the organisation (Goosen et al, 2001). However, there is confusion concerning the definition of simulation within the gaming field (Jacques, 1995; Klabbers, 1999; Leigh, 2001). It is unclear whether a business simulation is a game with rules and boundaries or a more open-ended, unconstrained representation of reality. In the authors opinion, business simulation tend to be the former. Categories of simulation within the gaming area – TES, functional, behavioural, and crisis – adopt different teaching approaches (Borodzicz, 2004; Goosen et al, 2001; Summers, 2004) but appear to share some common learning objectives based around behavioural skills and decision-making. However, the mathematical modelling behind TES may also drive the focus of activity towards the assessment of the implications of decisions (Goosen et al, 2001); and the "story" orientation of behavioural and crisis simulations may lead to greater role-play within situations (Summers, 2004).

In conclusion, the author has compiled two summary tables. Table 1: Business Process Simulation versus Business Gaming Simulation, outlines the major differences between business process and business gaming simulation. Table 2: Types of Business Gaming Simulation, compares Total Enterprise Simulation with Behavioural Simulation. These tables are generalisations based upon the author's experience and the learning derived from this literature research – from authors described above such as Bakken, Gould and Kim (1994), Borodzicz (2004), Coyle (1972), Elgood (1993), Goosen et al (2001), Hely and Jarvis (1995), Jacques (1995), Klabbers (1999), Leigh (2001), Oakshott (1997), Robinson (2004), Saunders (1995), Summers (2004). As shown, the author has defined the simulation within this investigation as Business Management Development Simulation given that it shares features of all these simulation categories – illustrated by the bold items. Even so, TES and business gaming simulation provide the closest match within existing literature. However, there is the possibility that TES adopts a more simplistic "game" approach when compared to the category of business simulation that is the focus of interest for the author of this thesis. More specifically, these types of simulations traditionally do not represent the real-world business environments in as much detail. There is the implication that the objective is to "play the business game" rather than to develop management abilities. Hence, the author has chosen to classify his type of business simulation as Business Management Development Simulation so that the name conforms to the objective - As explained, the author has specialised in designing and implementing competitive business simulations that aim to model the complexity of real-life business environments for use as a tool for business learning.

In table 1 below, bold items correspond to the author's defined category of business simulation – Business Management Development Simulation. The table illustrates that Business Management Development Simulation shares the objectives of Business Gaming Simulation and the technical considerations of Business Process Simulation. Therefore, in terms of purpose, it fits more with Business Gaming Simulation. More specifically from table 1, Business Management Development Simulation sits within the discipline of management development and education and is used to apply and develop personal business skills. It is based upon social scenarios interpreted by the designer of the exercise which aim to model a business environment. It is a decision-making tool representing real-world events over time from which users aim to develop greater personal competence based upon experiences derived from the exercise. The "results"

from the exercise are insignificant; what matters is whether the experience was useful for the user. The simulation runs on one or more computers because computer programmes are needed to model the complex business environment. Decision making is open and flexible in that there is a broad range of areas that can be considered; although constrained by the parameters of the exercise. Decision making is proactive as well as reactive, strategic, competitive, involves the interactions of people, and is time dependent such that there is an iterative cycle of separate decision periods followed by analysis periods. The business model will have pre-defined boundaries, and represent a specific business management environment. As in the "real-world", there will be some predictability for business results but also outcomes from the model will develop dynamically influenced by decisions made, luck and uncertainty.

In table 2, Business Management Development Simulation is compared to Total Enterprise Simulation and Behavioural Simulation, and the similarities are shown as bold items. It can be seen that, although Business Management Development Simulation has a high degree of role play and shares some objectives with Behavioural Simulation, it fits more closely with Total Enterprise Simulation. In detail from table 2, Business Management Development Simulation is a comprehensive, mathematical computer model providing a holistic, representation of a real-world business environment. There is role play as part of the management responsibilities assumed by participants within the exercise. Story lines will be shaped as an outcome from the exercise based upon interactions that develop dynamically. The proposed learning objective is to develop participant skills in decision making, business and behavioural respects. There are detailed business decisions that span across all business functions concerning key business drivers. Participants manage companies that compete against each other, and achieve business results for their companies that are shown in management reports. A range of management reports assist with business management thinking – market research, financial statements, management accounting, and an interactive tutor within the computer interface. The focus is upon representing a real-life business environment through a high level of social interaction combined with a dynamic, mathematical model of the competitive consumer marketplace, the supply chain and the organisational infrastructure.

In the light of similarities shown, the remaining sections of this literature review will therefore mainly concentrate upon past studies and contributions to the assessment of the validity of Business Gaming Simulation, and TES; given that this category of simulation is most similar to Business Management Development Simulation.

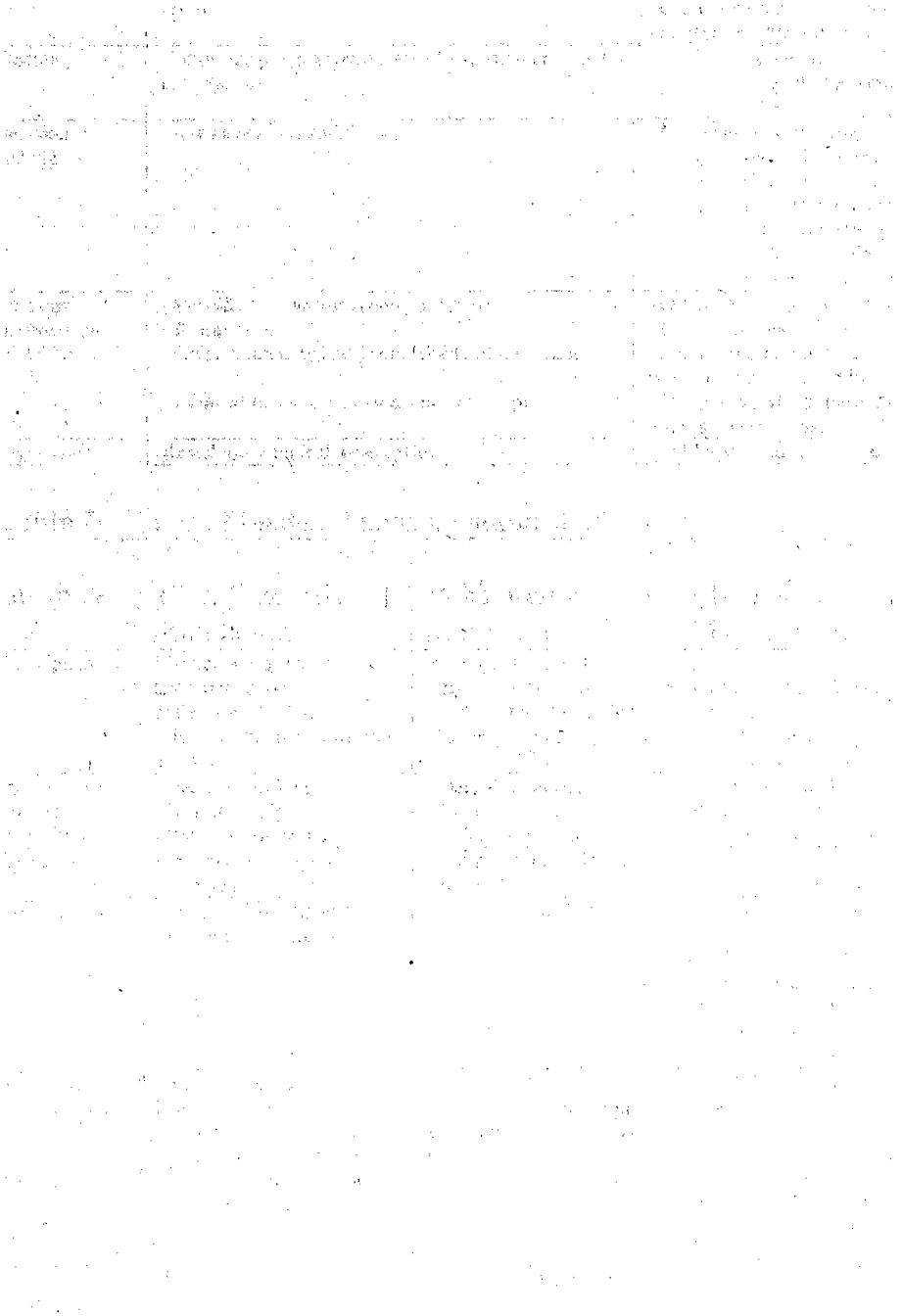


Table 1: Business process simulation versus business gaming simulation

Attribute	Business Process Simulation	Business Gaming Simulation
Management discipline:	Management Science, Operation Research	**Management Development and Education**
Used for:	"What-if" and business projections	**Applying and developing personal business skills**
Based upon:	- Programming techniques e.g. Discrete Event Simulation. - System Dynamics e.g. decision rules	**Social scenarios interpreted by the designer of the exercise**
Modelling Objective:	**To model a business environment**	**To model a business environment**
Nature:	**Decision-making tool representing real-world events over time**	- Often regarded as a game - Can represent events over time that relate to the real world
Output:	Informed business decisions based upon quantified results	**Greater personal competence based upon experiences derived from the exercise. "Results" of the exercise insignificant**
Medium:	**Computer programmes needed to model complex environment**	- Board game - Computer programme - Role play
Decision making:	More closed and constrained	**More open and flexible.** - **Often both proactive and reactive** - **Often strategic** - **Can be competitive** - **Often involves people interaction** - **Time dependent broken into "decision periods" and "analysis periods".**
Business environment modelled:	**- Specific to a business environment** **- Boundaries** - Greater certainty and predictability of outcomes - Detailed focus on a business process or processes	- Often more abstract representation - Boundaries and rules **- Some predictability. Develops more dynamically but can be influenced by luck and uncertainty** **- More general e.g. modelling business function, TES, scenario, crisis**
Algorithms:	**Based upon logical assumptions**	Based upon logical assumptions and rules

Table 2: Types of business gaming simulation

Attribute	Total Enterprise Simulation	Behavioural Simulation	Business Management Development Simulation
Description:	**Mathematical model of a holistic business environment**. Often delivered through **computer medium**.	Participants act out or **role play** a situation based upon a pre-determined story line. Can be computer controlled.	Comprehensive, mathematical computer model providing a holistic representation of a real-world business environment. Role play around management responsibilities is intrinsic and developing story lines are an outcome.
Proposed Learning Objective:	**- Decision making** **- Business skills** **- Behavioural skills**	**- Decision making** **- Business skills** **- Behavioural skills**	- Decision making - Business skills - Behavioural skills
Decisions:	**Span across all business functions**	Multiple choice relative to story line	Detailed business decisions across all business functions concerning key business drivers
Results:	**- Financial statements** **- Operations reports**	- Next stage of story line	Management reports to assist business thinking processes - Extensive market research reports - Performance analysis through financial statements and management accounting reports - Interactive tutor within computer interface of simulation to assist business thinking
Business Environment:	Can be a game based on luck and rules or a **simulated representation of a business environment**	Can be a game based on luck and rules or **a simulated representation of a business environment**	Focuses upon representing the real-life business environment.
Algorithm:	**Mathematical model of a business**	Decision tree relative to story line	Dynamic mathematical model of the competitive consumer market place, the supply chain, and the organisational infrastructure within a real-life business environment.
Level of social interaction during exercise:	Often low	Can be **very high**	Very high

Bold items highlight characteristics shared by Business Management Development Simulation
Source: Complied by author based upon Bakken, Gould and Kim (1994), Borodzicz (2004), Coyle (1972), Elgood (1993), Goosen et al (2001), Hely and Jarvis (1995), Jacques (1995), Klabbers (1999), Leigh (2001), Oakshott (1997), Robinson (2004), Saunders (1995), Summers (2004)

Section 2: Assessing the Validity of Business Gaming Simulation

This section explores the contributions made by authors to the assessment of the validity of business gaming simulation, and more specifically TES. The purpose is to explore how business gaming simulation can be validated by examining the views of past authors. In a general sense, validation has been defined as the process of assessing whether the conclusions reached from a simulation are similar to those reached in the real-world, and therefore that the right model has been built (Fernstein and Cannon, 2001:58). For TES to be recognised as a credible learning tool it is essential that it can be validated; justifying the investment of student time and cost (Gosen and Washbush, 2004). Burns, Gentry and Wolfe (1990) explain that research has focused upon two main categories of validity: internal and external. These types of validity have been explored within two areas: 1) the educational effectiveness of a business simulation (described as educational validity), and 2) the extent to which the business simulation represents the phenomenon being modelled (described as representational validity). Within 1) educational effectiveness (or validity), internal validity focuses upon i) whether students learn from a business simulation, whilst ii) external validity addresses the issue of whether learning that might be achieved is relevant and applicable to real-world contexts. For 2) representational validity, i) internal validity asks whether a simulation accurately models a given phenomenon and ii) external validity extends this concept by requiring that the phenomenon is from the real world – rather than hypothetical. Assessing validity of business simulation is seen to be an ongoing issue and concern that has yet to be tackled conclusively (Gosen and Washbush, 2004; Malik and Howard, 1996).

'The focus of [research] concerns [has been] the issue of validity: internal validity or changes in the student in classroom settings, external validity or the generalisability of any learning effects to outside classroom situations, and transfer-internalisation validity or the ultimate impact of the simulation experience on the student's career' (Gosen and Washbush, 2004: 273).

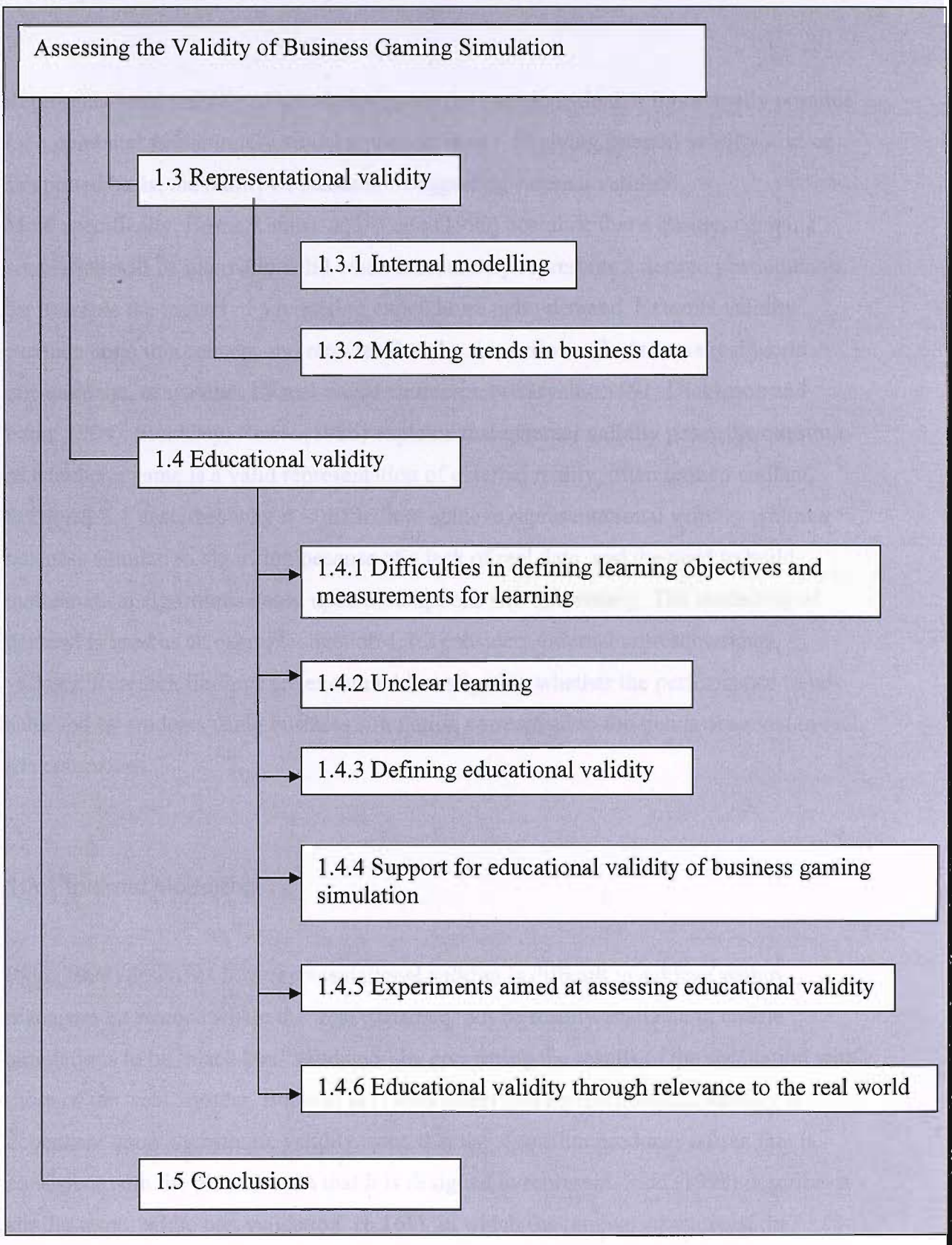
The achievement of representational validity is regarded as extremely difficult. For a computerised business gaming simulation to be an accurate representation of a

phenomenon requires that the internal logic is correct – termed algorithmic validity. There is the view that the business world is probably too complex to be represented with perfect precision via mathematical computer programmes (Gold, 2003). Therefore, it has been argued (Norris, 1986) that business simulation designers should aim for verisimilitude – the perception of reality by users. Hence the main focus of validity discussions has concentrated upon whether there is educational validity irrespective of whether the simulation possesses a high degree of representational or algorithmic validity. Findings in this area have also been inconclusive. There has been insubstantial evidence that students achieve desired learning (Whiteley, Ledue and Dawson, 2004; Faria and Wellington, 2004; Dickinson, Whiteley and Faria, 1990; Dickinson and Faria, 1994; Wolfe and Jackson, 1989) -internal validity - and that learning applies to the real world - external validity (Norris and Snyder, 1980; Wolfe and Roberts, 1986; 1993). Several problems associated with this kind of investigation have been cited. The idiosyncratic nature of learning means that the measurement of learning is regarded as a difficult construct (Fernstein and Cannon, 2001; Gosen and Washbush, 2001; 2004). For example, a good performance within a business simulation is not an indicator of learning achieved (Anderson and Lawton, 1990; Washbush and Gosenpud, 1993; Wellington and Faria, 1991). Experiments to establish whether students are able to discern the simulated phenomenon have yielded generally negative conclusions (Whiteley, Ledue and Dawson, 2004; Faria and Wellington, 2004; Dickinson, Whiteley and Faria, 1990; Dickinson and Faria, 1994; Wolfe and Jackson, 1989). Also, assessment of the applicability of learning to the real world has been conducted with mixed results and in an indirect fashion - These studies have examined whether successful business people are also successful within simulated business (Norris and Snyder, 1980; Wolfe and Roberts, 1986; 1993). There is ambivalence concerning how to design simulation to facilitate learning. For example, there is concern that a lack of realism might lead to inaccurate learning or conversely that the complexity associated with realism may hinder learning due to a confounding number of variables (Alessi, 1988). Furthermore, the accuracy of the simulation is influenced by the knowledge and biases of the designer, which in turn may distort learning. The measurement of learning will be even more difficult if learning objectives are unclear (Grossler, 2004; Malik and Howard, 1996).

Hence, within this section these issues of representational validity and educational validity are explained in sections 1.3 and 1.4 as shown in figure 3: Assessing the

Validity of Business Gaming Simulation. Section 1.3 explains how the representational accuracy of simulation has been considered in terms of the accuracy of the algorithm – shown as a link to 1.3.1 Internal Modelling. – and the extent to which the output data represents real-world data – shown as a link to 1.3.2 Matching trends in business data. Also, as illustrated by figure 3, section 1.4 describes problems encountered whilst assessing educational validity such as section 1.4.1 covering the measurement of learning and section 1.4.2 proposing that learning is often unclear. Sections 1.4.3 to 1.4.6 define educational validity and consider investigations aimed at establishing educational validity. Conclusions are drawn in section 1.5.

Figure 3: Assessing the validity of business gaming simulation



1.3 Representational validity

Representational validity of simulation poses the question whether it is actually possible for a computer to accurately model a phenomenon – implying internal validity - or, on an applied basis, the reality of business – suggesting external validity.
More specifically, Burns, Gentry and Wolfe (1990) postulate that a business gaming simulation will be internally valid when it accurately represents a desired phenomenon, for example the impact of advertising expenditure upon demand. External validity expands upon this concept and requires that the simulation reflects some real world phenomenon, or matches its real-world counterpart (Carvalho,1991; Dickinson and Faria, 1994). Similarly, Norris (1986) explains that external validity poses the question of whether a game is a valid representation of external reality, often termed realism.
Section 1.3.1 describes why it is difficult to achieve representational validity within a business simulation algorithm because of a lack of real data, and the need to build mathematical algorithms based upon assumptions and uncertainty. The modelling of demand is used as an example. Section 1.3.2 considers external representational validity. Research findings are examined investigating whether the performance trends achieved by students using business simulation correspond to the trends observed in real life companies.

1.3.1 Internal Modelling

Pidd (1998) describes how representational validity is difficult to achieve within management science where the 'real' data may not be readily available to enable simulations to be 'black box' validated - by comparing the results of the simulation with those of the 'real' system. Burns et al (1990) assert that representational validity is dependent upon algorithmic validity, such that the algorithm produces output that is consistent with the phenomenon that it is designed to represent. Pidd (1998) describes a similar term, 'white box validation' (p.161), in which the internal structure of the simulation model is compared to that of the 'real' system. However, Pidd (1998) speculates that, within management science, even if comparisons reveal identical data, this will be based upon assumptions and there is always the possibility that data from the model and the 'real' system will conflict. Hence, the uncertainty and complexity of

the 'real' system mean that business cause-and-effect relationships cannot be defined with great accuracy.

Gold and Prey (1990;1997;1998), Gold (2003) and Teach (1990) highlight some of the difficulties in achieving algorithmic validity for TES by attempting to devise some simulation algorithms that are simplified representations of the business environment. Gold and Prey (1990) - and in a different article Goosen, Jensen and Wells (2001) - explain that the modelling of demand is a major problem, for the following reasons. They explain that demand is a function of a multitude of variables - price as well as a number of non-price factors including advertising, promotion, product quality, prices of related goods, consumer income and other factors. Hence, the law of demand used in economics is an over-simplification because it states that as price increases, so demand decreases, but this assumes that other demand factors are held constant. Demand is also affected by a variable price elasticity such that customers are relatively more sensitive to high prices. Concerning marketing, theory states that demand is positively related to marketing spend, however there will be a point at which increasing marketing spend will have diminishing or negligible effect (the point of diminishing returns). Low spends will also be relatively less effective. Subsequently, Gold and Prey (1990) attempt to model demand based on a simplistic algorithm in which market demand is first calculated as a function of price, marketing spend, and Research and Development; and the resulting market demand is then allocated by firm based upon relative prices and spend levels. Diminishing returns issues are addressed by raising "spends" to a "power" that decreases with increasing spend levels. In subsequent work, Gold and Prey (1997) add a market segmentation calculation - devised by Teach (1990) - which compares the attributes of each product with customer requirements to obtain a measure of customer satisfaction, and hence influence the demand of each firm.

Hence it is apparent that achieving representational validity in terms of the internal workings of the model - such as the modelling of demand - is fraught with difficulty due to the sheer complexity of the issue. Gold (2003) acknowledges that the real business environment is much more complex than representations that have been proposed, and that the design of business simulations requires a more holistic systems approach if business is to be modelled adequately.

1.3.2 Matching Trends in Business Data

External representational validity of simulations has been explored by comparing performance data of simulated companies with those of real companies. Napier and House (1985) conducted a limited study based upon a few companies from selected industries and found that within both simulated companies and "real" companies, Return on Investment was significantly correlated with market share. Faria and Wellington (2004) showed that their business simulations demonstrated a strong relationship between market share and profitability which conformed to the findings of the Profit In Marketing Strategies (PIMS) programme; a multi-company research project designed to gather marketing and financial information on a number of different business firms for analysis purposes. Data were collected from 440 simulation companies competing in 96 industries from two different business simulation games. In a subsequent analysis comparing simulation results and the real-life trends published by the PIMS programme, Faria and Wellington (2005) found other similarities such as business success based upon similar strategies, a strong relationship between earnings and market share, and a significant relationship between product quality and Return on Investment. Hence, these studies have shown that certain business simulations are able to emulate a limited number of trends observed for financial data within a range of real-life companies. To this extent they provide evidence of external or representational validity – Although, as Norris (1986) explains, realism is difficult to evaluate in business simulations because there are a multitude of qualitative and quantitative variables that should be compared to the "real" world. Hence external representational validity measured in this way will always be insufficient. All that these investigations have shown is that for a few of the numerous inter-related variables that exist within the real world, a simulation can be made to emulate their expected patterns and trends.

In summary, representational validity investigated from internal and external perspectives has been inconclusive. Internally, it is difficult to model a business environment accurately because it based upon assumptions concerning complex inter-relationships. Externally, emulation of the performance patterns of industries and companies based upon a few performance measures provides a limited assessment of representational validity.

1.4 Educational Validity

Given the difficulties described when attempting to achieve representational validity, it is not surprising that most publications have focused upon the educational effectiveness of business gaming simulation – the educational validity - although the general stance concerning the validity of business gaming simulation has been inconclusive (Fernstein and Cannon, 2001; Gosen and Washbush, 2004). Faria (2001) perceives that the consensus concerning the learning gained is still lacking and it is likely that research on the learning aspects of business simulation and games will be ongoing (p.105). From a systems dynamics perspective, Grossler (2004) explains that although simulation can be used for experimentation and teaching, evaluation of the tool is in its infancy. Topics of interest have attempted to define and measure learning. These have examined issues such as whether learning occurs, for example, experiments to investigate whether students can identify cause-and-effect relationships within business gaming simulation. There are difficulties in defining measurements of potential learning – aiming for measurement and construct validity – for example, simulation performance is not related to learning. There have been investigations to examine whether successful business people also perform well within business simulation. Impacting upon these considerations, there is confusion concerning how to design business gaming simulation to facilitate learning – minimising bias and judging the balance between realism and over-complexity. These issues are now explained in detail.

As shown in figure 3 - Assessing the Validity of Business Gaming Simulation - problems of defining, establishing and measuring learning are introduced in 1.4.1 and 1.4.2. Given that construct and measurement validity (Bryman and Bell, 2003) of investigations into learning from simulation is problematic, the subsequent sections explore evidence supporting or opposing the educational validity of simulation. These are 1.4.3 Defining educational validity, 1.4.4 Support for educational validity of business gaming simulation, 1.4.5 Experiments aimed at assessing educational validity, and 1.4.6 Educational validity through relevance to the real world.

1.4.1 Difficulties in Defining Learning Objectives and Measurements For Learning

Fernstein and Cannon (2001) describe how researchers 'have yet to agree on what defines an effective measurement device for validating a simulation [learning environment]' (p.57). The measurement of educational validity is problematic due to unclear learning objectives and ineffective instruments used to measure learning. For Forrester and Senge (1980), the validity of a model depends on how well it achieves its purpose and hence builds confidence in the user. Yet Grossler (2004) believes that the methodological issues cannot be solved because the characteristics of users, the simulation and its purpose are poorly defined. Goosen, Jensen and Wells (2001) point out that, in their view, simulations are often used with purposes in mind for which they were not originally designed which makes learning constructs difficult to define. Gosen and Washbush (2001; 2004) believe that learning constructs need to be tied to learning goals and measured objectively. However, as far as they are concerned, every attempt that has been made to 'concretise' the learning variable has failed and this makes designing a research instrument to capture learning extremely difficult. They identify measurement of experiential learning as a difficult problem because it is a complex construct that is hard to pin down – such that it is more convenient for some to forget about it all together.

As a measure of learning achieved from the use of flight simulators, Rolfe(1992) describes the concept of negative and positive transfer of training. Rolfe (1992) asserts that training value can be assessed by comparing the performance of participants trained using flight simulators with that of participants trained on-the-job, facilitating a measure of whether the simulator has yielded a relatively positive or negative transfer of skills. For Rolfe (1992), positive transfer of skills could be achieved either because necessary skills are attained more cost-effectively using the simulator, or because greater competence results from simulator usage. However, according to Borodzicz (2005), an approach such as this necessitates a simulation of a well-structured environment, a requirement that is unlikely within a socially complex business gaming simulation. One notion has been to use the performance during the simulation as a measure of learning. However, Faria and Whitely (1990) were unable to find a significant relationship at the individual level when comparing performance in simulation and multiple choice examination. Other similar studies concur with these conclusions

(Anderson and Lawton, 1990; Washbush and Gosenpud, 1993; Wellington and Faria, 1991). For example, Washbush and Gosen (2001) analysed the possible learning gained from ten runs of a management game. Learning was based upon the difference in mean scores achieved in a pre-test and a post-test examination based upon a multiple choice section and a short essay section. For all ten data sets the mean of the post-test scores were higher than the mean of the pre-test scores, nine of which were significant at the 0.001 level based upon a t-test. They applied regression analyses to this data to establish whether there might be a relationship between learning and performance, but were unable to show that one existed. Gosen and Washbush (2004) express there disappointment in these findings, speculating that the measurement of learning effectiveness would have become easier if a relationship between learning and performance had been established. Performance is easy to measure – through variables such as market share and profit margins – whereas measuring learning is always going to be difficult given that it is covert within the human mind. In summary, unclear learning objectives combined with the hidden nature of learning provide plausible additional explanations as to why establishing educational validity is problematic.

1.4.2 Unclear Learning

Learning may be unclear because the learning objectives are vague (Hely and Jarvis, 1995). Additionally, personal differences in business knowledge may enable some people to gain more from a business gaming simulation than others (Teach and Schwartz, 2004). A study performed by Hely and Jarvis (1995) illustrates the problem of unclear learning relative to objectives. Hely and Jarvis (1995:76) conducted experiments - using 59 student subjects - aimed at ascertaining whether business simulation exercises met the expectations of their students. Their methodology was to compare views expressed in a pre-experience questionnaire with those recorded in a post-experience questionnaire – issued after the simulation had been completed. The mean scores from both questionnaires were compared and complementary qualitative data was also elicited through open-ended questions (Saunders, Lewis and Thornhill, 1997). The results showed that students had generally learnt how the exercise operated but that they did not feel that their understanding of how to manage a business had been nurtured to the level that they had hoped. In other words, students had learnt how to play the exercise but not related this learning to the management of real businesses.

The idiosyncrasy of learning may mean that a simulation may be a valid learning experience for some, but not for others. In a study adopting a similar research design to Hely and Jarvis (1995), Teach and Schwartz (2004) analysed pre-simulation and post-simulation questionnaires completed by students using a total enterprise simulation in order to judge participant views concerning their perceived learning on how a business operates. Regression analysis indicated that reported accounting knowledge was strongly associated with the reported level of learning that took place in the game. Therefore, certain types of people – such as accountants in this case – might benefit more from a simulation exercise than others; complicating further the issue of learning validity.

1.4.3 Defining Educational Validity

Educational validity of business gaming simulation defined from an internal validity perspective assesses whether game participants possess the ability to discern the phenomena being modelled, and hence gain managerial insight and understanding (Burns et al, 1990) – more specifically, the experiential causes a change in the student in the desired direction (p.24). Similarly, Norris (1986) describes the internal validity of simulation games as 'the educational value of simulations in teaching specific material to participants' (p.126). For Fernstein and Cannon (2001), it might require that participants can establish interrelationships between variables within the simulation, such that inter-dependency between one variable and another can be ascertained. Internal validity is based upon the inference that the relationship between variables within the model are causal. An example of this might be that participants are able to recognise a certain type of promotion as more effective than another within the simulated environment (Fernstein and Cannon, 2001).

From an "external validity" perspective, Wolfe (1976) describes business gaming simulation as transfering academic insights into useful and effective real-world orientations, perceptions, and business career practices. Similarly, Burns et al (1990) describe that the experiential learning effects can be generalised to real world cases. Ferstein and Cannon (2001) suggest that external validation can be achieved by demonstrating that a simulation teaches key business skills or that those with key business skills perform well within a business simulation game. Rolfe and Hampson (2003) examine flight simulation and propose that improved operational competence can provide demonstrable external validity.

To summarise, educational validity considers learning effectiveness from an internal validity perspective – the ability for students to discern cause-and-effect relationships – and from an external validity perspective – that learning applies to the real business world.

1.4.4 Support for Educational Validity of Business Gaming Simulation

In spite of findings casting doubt on the educational validity of business simulation - and much publicised cynicism and highlighting of potential pitfalls – researchers (Teach and Govahi, 1988; Soukup and Whitney, 1987) do have belief in simulation as a learning tool. These authors cite behavioural skills such as organising and decision making as areas where simulation achieves learning effectiveness. Washbush and Gosen (2001) use a historical argument. They observe that, for many years, TES has been extensively employed both within academic business degree curricula and executive development programmes. Users must therefore believe that TES enriches learning. Leigh (2005) proposes a similar historical perspective within the military and religion as a foundation for simulation validity. In a military context, players engage in simulated battles where moves and consequences are assessed and judged by an umpire. Within religion, our ancestors used games and simulations to embed religious messages into memory – Snakes and Ladders was based upon a religious game that originated from India. Senge (1992) proposes that business simulation can assist an organisation to be a "learning organisation". Senge (1992) describes learning within an organisation to be highly influenced by systems thinking – "the fifth discipline" – which helps to understand the relationships between interrelated parts, the impact of change upon the total system and hence to discern high leverage change from that which may be lower leverage. For Senge (1992), systems thinking is intrinsic within a learning organisation in which both individuals and the organisation may achieve a "metanoia" – a shift of mind. Systems thinking focuses on *detail complexity* which keeps track of the many variables, and on *dynamic complexity* which seeks cause and effect that may not be obvious over time. Senge (1992) proposes that understanding dynamic complexity is key to business success and cites some examples such as the balancing of market growth and capacity expansion; or the development of a strong market position through a profitable mix of price, product (or service) quality, design, and availability. For Senge (1992), business simulations – which he terms "microworlds" – provide the potential to enhance the "learning organisation" through systems thinking to explore the impact of directions within a virtual learning environment. He proposes that, unlike in the real world, they compress time and space and this facilitates experimentation and learning from consequences.

Hence, although educational validity has not been established conclusively through research, there are those who believe in the learning potential that business gaming simulation has to offer.

1.4.5 Experiments Aimed at Assessing Educational Validity

Several experiments have been conducted to assess educational validity - with limited success (Faria and Wellington, 2004) - by testing whether students are able to adapt their decisions over time in response to the simulation's changing environment – implying internal validity - and these are described below.

Whiteley, Ledue and Dawson (2004) attempted to show that business simulation was an internally valid learning experience by assessing whether, after participating in the simulation exercise, game players were able to determine the importance of game variables within the generation of demand i.e. to understand the response function of the simulation. According to reinforcement theory (Stoner and Freeman, 1992), if behaviour successfully achieves desired goals, then a repeat of this behaviour is expected; however, if the desired goals are not achieved, then there may be a change in attitude and a corresponding change in subsequent behaviour. Based upon a belief that this process could facilitate the deduction of game variable importance, Whiteley, Ledue and Dawson (2004) conducted attitude surveys of decision variable importance from 312 students concerning nine business variables such as price, quality, and service. However, results of the empirical study failed to provide sufficient evidence that game players were able to develop the cognitive insight necessary to understand the nature of the response functions.

Dickinson, Whiteley and Faria (1990) tested the internal validity of a simple business simulation by assessing whether decision-making gravitated towards the use of the most effective decision variables – that had been pre-assigned high weightings within the algorithm such that their impact on performance was greater. However, there was no conclusive evidence that participants were able to deduce which variables had the strongest impact. In a later study, Dickinson and Faria (1994) investigated whether participants were able to outperform a competitor that adopted a random strategy within the business simulation, and found that the students were more successful than the

random company for about 60 percent of the time. This therefore may have demonstrated some understanding of the simulated environment given that the structured thinking of the students yielded results that were more consistent – although not for around 40 percent of the time.
Wolfe and Jackson (1989) tested whether simulation players could identify when illogical algorithms had been inserted into the simulation during usage. Again, there was insubstantial evidence supporting participant ability to discern any changes.

Hence, as explained in 1.4.1, in the absence of definitive measures for learning gained from simulation (Washbush and Gosen, 2001), these researchers have used measures based around identifying factors that influence the results within the simulation. However, in the authors opinion, these measures have little construct and measurement validity (Bryman and Bell, 2003) because the link to learning objectives is uncertain. They are exploring a limited set of thinking processes derived by participants from the simulations which might have indicated learning, but not necessarily business learning related to clear learning objectives (Hely and Jarvis, 1995). In the author's opinion, learning objective should have been defined and measures devised to address these learning objectives. For example, the measures described above may have been useful, but additional measures of learning requiring participants to actually explain their deductions might have elicited detailed thinking processes and provided more concrete evidence of understanding.

Therefore, it can be concluded that these experiments have been unable to show that students are able to discern the cause-and-effect relationships acting within the simulated business environment conclusively. These investigations support the proposition that internal validity of business simulations has not been established and further research into this topic is required.

1.4.6 Educational Validity Through Relevance to the Real World

Research in the area of assessing educational validity through relevance to the real world has been based upon assessing whether people who perform well within a business simulation are also more successful within their careers – maybe indirectly implying external validity through applicability to the real world. This approach has been utilised by Norris and Snyder (1980) and by Wolfe and Roberts (1986; 1993); the former unsuccessfully the latter deducing supportive findings to a limited extent.
Norris and Snyder (1980) analysed the responses to a Likert-type questionnaire (Bryman and Bell, 2003) completed by 100 university students who had played a simple business simulation. The questionnaire was completed 5 years after participating in the simulation with a response rate of 54%. Career success was measured as the number of promotions obtained, proximity to the chief executive within the corporate hierarchy, and the percentage of salary increases. For game success, Return on Investment (ROI) and a participation measure were combined, ROI being assigned a greater weighting. This limited analysis indicated that career success and the performance within this particular simulation were not related.
Wolfe and Roberts (1986) used a more complex business simulation. They had a larger group of subjects, 142, who ran the simulated companies as individuals rather than teams so that individual performance could be measured; achieved due to the effort of the individual rather than other team members. Career success was assessed through annual surveys based upon salary levels, percentage of salary change, promotions and expressed career satisfaction. The retention of subjects was good - 80.4 percent. For game results, ROI, total earnings and Return on Equity were used. They discovered a weak but statistically significant relationship between game performance and career success when comparing ROI with salary, total earnings with salary increases, and ROE with the number of promotions received. However, the relationship was not as strong as that existing between college-related career factors - such as subject and grade – and salary achievements. In the author's opinion, this type of investigation used to measure external educational validity may lack internal validity (Bryman and Bell, 2003) given that extraneous factors such as subject, motivation and intellect could bias the results. The skills applied within the simulation were not as significant to career success as degree subject area. Grade was related to salary indicating that personal motivation and

intellect are significant to an individual's success. However, Wolfe and Roberts (1986) proposed that a degree of external validity had been established.

In an attempt to reveal more conclusive findings, Wolfe and Roberts (1993) conducted a similar study but used assessments of decision-making, leadership and social skills instead of simulation performance. Hence, the study was repeated with a revised design. Using the same simulation under identical conditions and set-up, 159 strategic management graduates participated, managing simulated companies in groups of four to five members per company. After the simulation had been completed, all players independently rank-ordered their team-mates based upon perception of contribution to the simulated company's success. Measures such as influence on decision making and leadership ability were used. Over a period of 5 years, the graduates completed a questionnaire twice a year, with 142 of the original 152 responding. It was concluded that peer group evaluations were reasonably effective in predicting the individual's hierarchical position i.e. promotions achieved, but only fair at predicting income or income changes over the 5 years. In the author's opinion, this investigation showed that the business simulation successfully illuminated the leadership traits of individuals. This is not, however, a measure of learning and educational validity.

This research has various limitations. Wolfe and Roberts (1993) point out that, concerning salaries, there is disparity between salary levels achieved within different careers and industries; salary increases are variable; some careers have greater risk than others; salaries may need to be higher due to the cost of living associated with the job location. Also, five years may not have been a sufficiently long duration for career success to be ascertained. Wolfe and Roberts (1993) highlight that the assessment of student managerial talent was conducted by novice student assessors who were lacking in experience and knowledge necessary to formulate robust judgements. It is possible that there was response bias given that respondents may have reported their personal career success incorrectly – although the study accounted for this potential dishonesty by asking respondents to recall their salary levels previously submitted. Bias could also occur because participants learn business skills from subsequent life experiences that contribute to success. Wolfe and Roberts (1993) conclude that 'students who perform well as single players and as members of the decision-making group experience higher salaries, larger salary increases, and greater vertical movement up the organisation's hierarchy' (p.30). However, in the author's opinion, this analysis is not attempting to validate the actual business simulation given that any experiential team exercise could have been used as the vehicle to elicit perspectives on team mate's contribution to

success. It may have been more conclusive if it had considered more specialised business skills that applied to the actual career paths taken by participants such as strategy, marketing, finance, project management and others.

1.5 Conclusion for Section 2 – Assessing the Validity of Business Gaming Simulation

Assessing the validity of business gaming simulation has concentrated upon establishing the degree to which a simulation model represents the real world business environment – the representational validity – and whether students can learn accurately from the medium – educational validity. It is proposed that a simulation may be externally valid if the learning is applicable to the real-world environment.
Both representational and educational validity are difficult to achieve for different reasons.
Representational validity is dependent upon the algorithms and content of the simulation being an accurate model of the real-world equivalent; a goal which is impossible to achieve when attempting to model a complex business environment in which there are numerous interrelated variables. However, it is possible for a business simulation to output trends and interrelationships that are similar to real-world companies for certain items of data used to judge company performance – such as profit versus market share relationships. This is, however, a very simplistic measure of representational validity.
Most research has considered the educational validity of business gaming simulation and has highlighted problems associated with the possible achievement of learning. It may be that learning is unclear given that the simulation is seen to be a game rather than a learning tool or that idiosyncrasies mean that certain people – such as accountants – can learn from business simulation more readily. Of major concern is the conclusion that students have difficulty in establishing the cause-and-effect relationships within the business simulation. Simulation design will probably influence learning effectiveness and hence designers must strive to achieve sufficient realism for learning to be accurate, and without over-complication so that learning is achieved. The designer must therefore be sufficiently knowledgeable and unbiased – a requirement which may be difficult to attain if there is a lack of empirical data.

Investigation of educational validity has yielded more positive findings from an external (as opposed to internal) validity perspective, given that successful business people have also been found to be relatively more successful within business simulation. However, these observations were based upon the assessment of leadership and team working characteristics rather than business acumen; and therefore did not assess business learning as such.

There are other general factors that may hinder learning. Grossler (2004) notes that time pressure may impair decision-making (or hinder learning (Malik and Howard, 1996)), complexity can lead to trial-and-error strategies, individual preferences may be for a less "activist" learning style (Honey and Mumford (1986)), or there may be a lack of motivation to learn. Grossler (2004) also contends that users are not personally liable for the detrimental directions that may result within the simulation as a consequence of their decisions, which may influence their thinking processes and hence learning.

Therefore, it can be concluded that the assessment of the validity of business gaming simulation (and TES) is difficult and has not been achieved with notable success. Senge (1992) observes that few existing simulations are able to cope with real-life complexity to the level that will develop individual or team capacities. 'Few capture the dynamic complexity that confronts the management team when it seeks to craft new strategies, design new structures and operating policies, or plan significant organisational change' (p.315). However, despite these negative findings and caveats, there are many who express their belief in the educational validity of business simulation (Teach and Govahi, 1988; Soukup and Whitney, 1987; Wolfe, 1997). Hence, the remaining chapters of this literature review will explore experiential learning theory and how it might be applied to the business gaming simulation context in order to strive for educational validity. Subsequently, considerations for effective simulation design are investigated.

Section 3: The Contribution of Learning Theory to the Educational Validity of Business Gaming Simulation

This section explores how learning theory might help to understand how to measure learning and to facilitate learning processes in business gaming simulation. Firstly, it is necessary within this research project to establish how learning within a business gaming simulation might be measured, so that research instruments can be designed to assess the quality of learning achieved by simulation participants. As far as possible, data needs to be collected using appropriate measures (possessing construct validity), with accuracy (having measurement validity), and reliably such that biasing factors are considered and eliminated – or at least recognised. However, previous research – described within the last chapter – has been hampered by an inability to design valid and reliable research instruments to measure the educational validity of business gaming simulation. Moon (1999) explains that, because mental processes are covert and private, it is difficult to separate learning from thinking, or reflection from thinking. For Moon (1999), observing learning is achieved through a representation of learning – written or oral. However, a subject within an experiment might be good at learning but poor at representing that learning in the required format. Hence it is probable that any instrument will have limitations; given the idiosyncratic and hidden nature of learning. Secondly, and of great importance, learning has to be derived from the business gaming simulation exercise for it to be subsequently measured. Therefore, lessons may be learnt from experiential learning theory regarding approaches that can be used within business gaming simulation to facilitate learning processes. However, Moon (1999) contends that there can be no standard prescription or methodology to the understanding of learning given that mental activities vary dependent upon the context and nature of the task.

Hence, historical precedent implies that there can be no expectation that learning within business gaming simulation can be achieved and measured with complete reliability and validity. This section seeks to explore recommended and appropriate approaches; acknowledging that reflexivity and appraisal will also be important. The structure of this section is illustrated in Figure 4: The Contribution of Learning Theory.
Addressing how learning might be achieved, figure 4 highlights the inter-related topics of experiential learning (Kolb, 1976; 1984) covered within section 1.6. The cycle concept is introduced in section 1.6.2 and a related concept, constructed learning (Spector, 2000), is explained in section 1.6.1. In section 1.6.3 Problem-based

experiential learning (Biggs, 1999) is considered and in 1.6.4 Double-loop learning (Kim, 1993) is explained. Common to these learning concepts is the activity of reflection (Boud, Keogh and Walker, 1994; Dewey, 1933; Habermas, 1974; Moon, 1999) examined in section 1.6.5 and how to encourage reflection – in section 1.6.5.2.1 Using writing and debriefing, and section 1.6.5.2.2 Through facilitation. Learning necessitates a desire to learn which is addressed in section 1.6.6.
Within sections, conclusions are drawn concerning how the measurement and facilitation of learning could be applied to the business gaming simulation context.

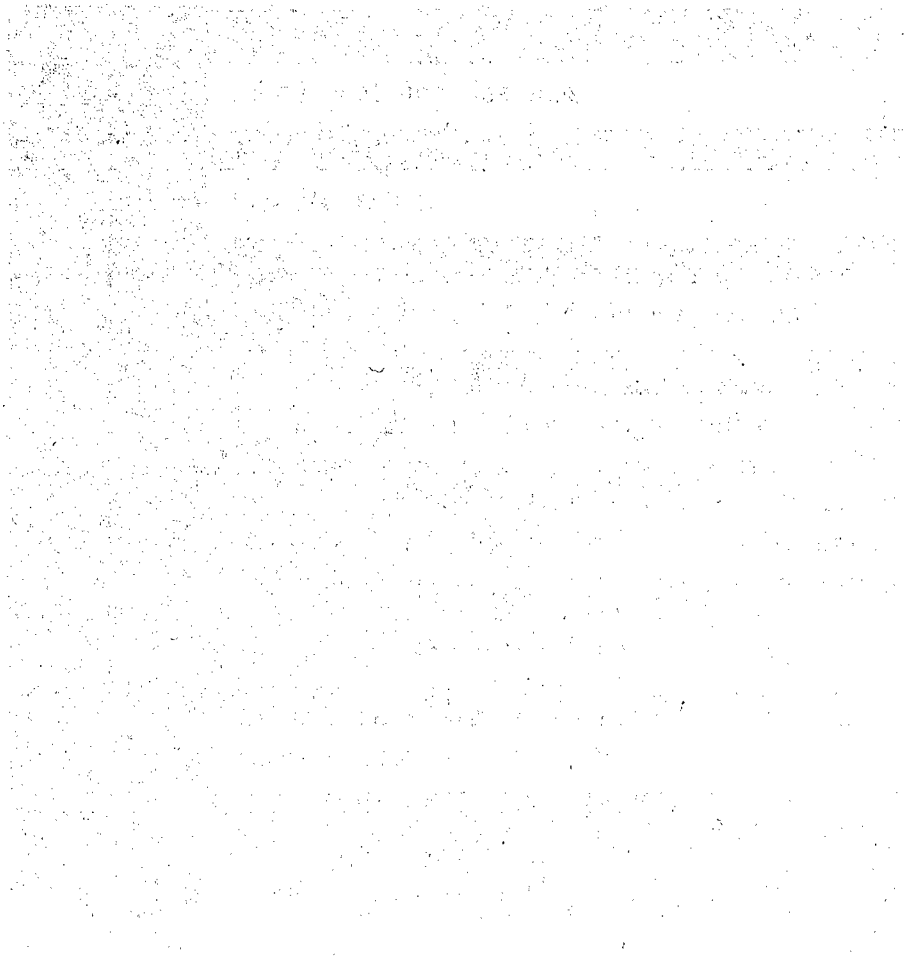
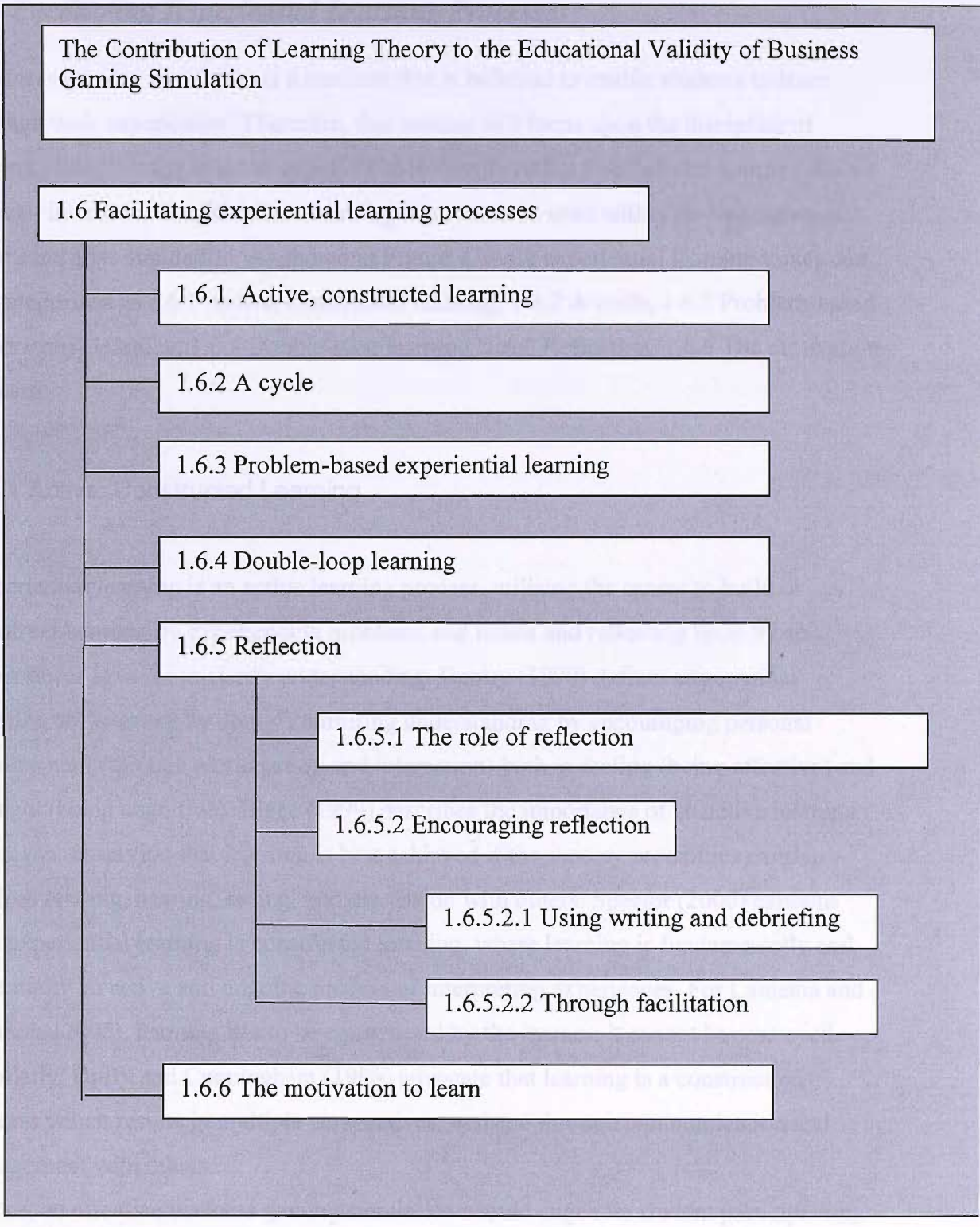


Figure 4: The contribution of learning theory



1.6 Facilitating Experiential Learning Processes

Business gaming simulation is a medium that is believed to enable students to learn through their experiences. Therefore, this section will focus upon the discipline of learning theory categorised as experiential learning - rather than broader learning theory topics - in order to establish how learning theory can be used within the validation of total enterprise simulation. As shown in Figure 4, these experiential learning topics can be categorised as 1.6.1 Active, constructed learning, 1.6.2 A cycle, 1.6.3 Problem-based experiential learning, 1.6.4 Double-loop learning, 1.6.5 Reflection, 1.6.6 The motivation to learn.

1.6.1 Active, Constructed Learning

Experiential learning is an active learning process, utilising the senses to build or construct learning by experiencing problems and issues and reflecting upon those experiences in order to clarify understanding. Gentry (1990) defines experiential learning as "learning by doing", nurturing understanding by encouraging personal involvement (through participation and interaction) both in feeling (being affective) and thought (being cognitive). Biggs (1999) describes the importance of an active learning approach, observing that learning is best achieved if the sensory modalities overlap – such as reading, hearing, seeing, and discussion with others. Spector (2000) explains that experiential learning is constructed learning, where learning is fundamentally and essentially an active and ongoing process of interpreting experiences. For Lainema and Hilmola (2005), learning has to be constructed by the learner; it cannot be conveyed. Similarly, Duffy and Cunningham (1996) advocate that learning is a construction process which results in multiple perspectives; assisted through communication and engagement with others.

Hence, an effective business gaming simulation should engender student participation, interaction, feelings and thought through active exercises. The senses should be engaged and learning should be gradually built upon and constructed.

1.6.2 A Cycle

Kolb (1984) defines experiential learning as a cyclical process; the experiential learning cycle. For Kolb (1984), processes of 'reflective observation' based on 'concrete experience' lead to 'abstract conceptualisation', that guides future actions - 'active experimentation'. There is a perpetual learning cycle as new experiences are analysed and deductions form the basis of more experiences. Moon (1999) identifies the activities of assimilation and accommodation within Kolb's experiential learning cycle. Assimilation involves the intake of information from the environment and, through accommodation, the learner's existing knowledge is modified in light of the new learning, conforming with the constructivist view of knowledge (Spector, 2000). People have different interpretations of the meaning implied by the stages of Kolb's experiential learning cycle and the manner in which it is applied. Henry (1994) conducted a survey of 52 exponents of experiential learning. She noted that "abstract conceptualisation" was considered to be generalisation or sorting things out, and that "active experimentation" might mean experimentation, testing implications in new situations, action plans or planning for the future. The majority believed that experiential learning is a sequence of stages where experience alone is not enough, such that the onus is upon the "experiencer" to consciously realise the value of the experience. Some described the process as being "experience" followed by "reflection" if the requirement was to discuss the meaning of an experience with others, or "experience" then "reflect" then "act" if there was a problem-solving context. There may be a need to "decide" or "generalise" before "act", to clarify the goal, or to incorporate theory. Moon (1999) points out that real-world situations are messy such that there may be no detectable distinction between parts of the learning cycle, or experiences may have already been previously learnt.

Hence, a business gaming simulation should enable experience to be gained of business developments followed by reflection on the causes of these directions, and the formulation and implementation of actions in order to affect the situation. This should be delivered as a continuous cycle so that experiential learning occurs as cause-and-effect is identified.

1.6.3 Problem-based Experiential Learning

Experiential learning can be problem-based, where learning is achieved through the application of knowledge to solve problems within specific contexts. Biggs (1999) introduces the concept of problem-based learning as a technique that can induce deep learning (Moon, 1999) because it is active and hence induces higher cognitive level processes within students. He describes the spectrum as ranging from low-level engagement (a surface approach) – memorising, note-taking, recognising – through to higher levels of engagement (a deep approach) – relating, applying, generating, reflecting, theorising. For Biggs (1999), problem-based learning is effective because it not only involves declarative knowledge (knowing facts and theories) but also requires functioning knowledge - the ability to apply declarative knowledge.

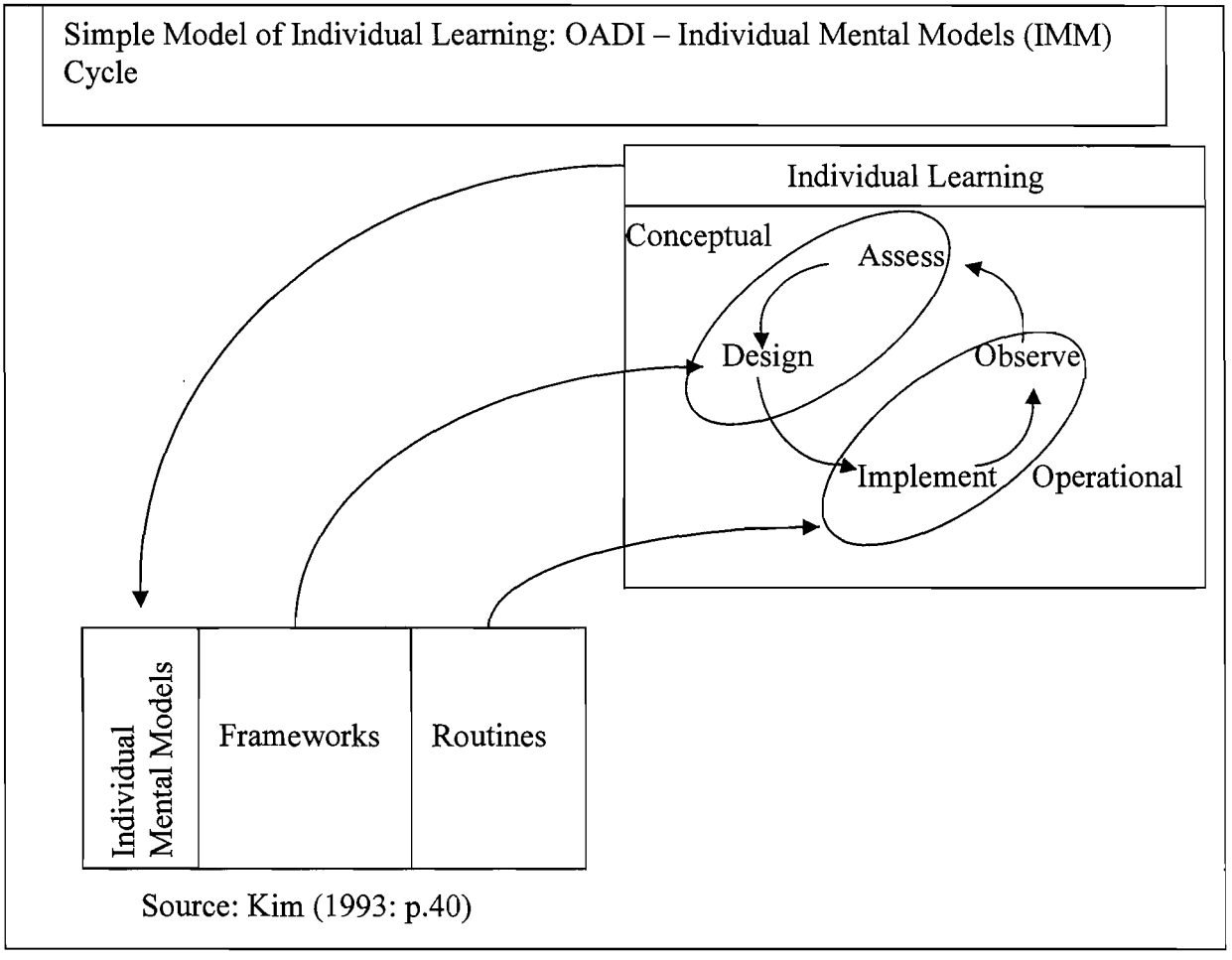
A business gaming simulation based upon experiencing and solving problems might be an effective way of encouraging experiential learning. Solving problems may engage student interest and engender a high level of cognitive involvement (Biggs, 1999; Hacker and Niederhauser, 2000). Students can practise implementing concepts learnt to solve problems (Anderson and Lawton, 2004). Finding solutions to problems may incite feelings associated with reflection – such as doubt, uncertainty, difficulty, perplexity (Dewey, 1933). Solving problems also gives reflection a clear purpose (Boud et al,1994; Moon, 1999), making reflection more likely. Learning may be enhanced if problems are from "real" business (Knowles, Holton and Swanson, 1998). Hence, business simulation based upon problem solving can be an effective way of encouraging experiential learning.

1.6.4 Double-Loop Learning

Kim (1993) expands further upon Kolb's experiential learning cycle (1984) with a model of individual learning. Learning occurs as a double loop where learning is formulated as a mental model that, in turn, shapes future learning.
Kim's model of individual learning (1993) follows a cycle of observe-assess-design-implement within an organisational context. Related to Kolb (1984), through concrete experience of events, people actively *observe* developments which they *assess* through reflection and use these assessments to *design* appropriate abstract concepts. They

implement the concepts which leads to new experience and the cycle repeats. If learning is subsequently stored away in the memory then it is helping to shape a person's views of the world – their individual mental models. A mental model will play an active role in shaping individual actions and perspectives. The mental models may consist of routines such as the steps to complete a particular task - and influenced by operational learning – or frameworks in which solutions to problems are derived through thinking – and hence influenced by conceptual learning. Double loop learning could occur if mental models are affected which in turn influence future learning – as shown by the cycle between individual learning and individual mental models in Figure 5. Double loop learning (Kim, 1993) is similar to the constructivist view of learning (Moon, 1999) where learners actively construct their own knowledge. There is a process of assimilation (where existing knowledge is used to guide new learning), followed by accommodation of new knowledge into the learners cognitive structure. Related to double loop learning, individual mental models influence the areas of knowledge to be "assimilated" leading to individual learning or the "accommodation" of knowledge. Moon (1990) proposes that what is already known can guide, organise and act as a gate-keeper to learning – a perspective shared by Mezirow (1990) and Pines, Fensham and Garrard (1985). Moon (1999) introduces an additional and related concept – the meaningfulness of learning. Moon (1999) postulates that the meaningfulness of learning is idiosyncratic and denotes the relationship between the material of learning and the learner's existing understanding. Hence, double-loop learning suggests that future learning may be more productive and meaningful when a learner uses their existing knowledge to judge what should be learnt next.

Figure 5: Model of Individual Learning



Source: Kim (1993: p.40)

Applying this concept to business gaming simulation, double-loop learning (Kim, 1993) and meaningful learning (Moon, 1999) might be achieved by first understanding clearly the learning needs of the students and their existing understanding. Subsequently, the simulation experience should have sufficient depth and scope to permit students to channel their efforts in directions that are most productive.

1.6.5 Reflection

1.6.5.1 The Role of Reflection

Reflection is considered to be the key learning activity within experiential learning. Authors (Boud, Keogh and Walker, 1994; Dewey, 1933; Kolb, 1984) describe the activity of reflection as learning by thinking about experiences. For Kolb (1976, 1984), reflection is the process that uses the medium of experience to develop concepts - 'reflective observation' of 'concrete experience' creates 'abstract conceptualisation' which guides 'active experimentation' as an ongoing cycle. Kolb's experiential learning cycle (Kolb, 1984) can be interpreted as an extension of Dewey's definition of reflection. Dewey (1933) defines reflection as a learning loop, continually cycling between the experience and the relationships being inferred. Hence, conclusions can be tested and evaluated through action. In this way, reflective activity results in the perception of relationships and recognition of the inter-connections between parts of an experience (Dewey, 1933). Similarly, for Kemmis (1994) reflection compares inward thoughts with the outside situation in order to derive further thought and action - it is "meta-thinking" (thinking about thinking) to connect thoughts. Boud et al (1994) propose that reflection refers to the intellectual and affective activities performed by individuals when they explore their experiences in search of new understandings and appreciations. Hence, reflection on experiences is seen to be the process from which understanding and learning is derived.

Reflection does not have to be conducted by an individual in isolation. Boud et al (1994) observe that reflection occurs both as a group and individual process and Grundy (1982) notes that reflection as a group process creates interaction which brings ideas.

Reflection is induced through a desire to understand and resolve. Dewey (1933) concluded that reflective activity was initiated through feelings of doubt, uncertainty, difficulty or perplexity. Boud et al (1994) proposed that reflective activity was a consequence of events leading to dissatisfaction, but could also result from positive experiences. For Moon (1999), reflection is characterised by relatively complex or unstructured ideas and problems with no obvious solution.

Concerning the characteristics of learners and their mentality, Dewey (1933) proposed that skill and attitude will influence the quality of reflection, and Kolb (1984) suggested that the quality of reflection is crucial to the depth and progression of learning. The learner must be responsible for their learning and reflection, and have positive feelings and emotions such that there are no affective barriers to cognitive processes (Boud et al, 1994). There should be appropriate sentiency, memory and imagination (Hullfish and Smith, 1961). Grundy (1982) believes that self-reflection requires freedom of choice for the individual rather than conforming to the teacher's influence – there must be equal power relationships. Habermas (1974) describes the importance of 'critical intent' within the reflective process in order to generate critical ideas, theories and inferences. Likewise, Dewey (1933) believes that reflective activity requires a critical mentality aimed at reaching a goal, and Boud et al (1994) highlight the need for appropriate intent.

Reflection must be goal-directed (Boud et al,1994), or have purpose leading to a useful outcome – for example, considering the process of learning, a critical review, building theory or making decisions in the face of uncertainty (Moon, 1999) – as shown in Figure 6. There may be inputs to reflection as well such as theories to consider, constructed knowledge or feelings. Hullfish and Smith (1961) describe the purpose as the solution to a problem. Within a work context, a 'reflective practitioner' is a professional who aims to make sense of events and developments within the workplace (Schon, 1983).

1.6.5.2 Encouraging Reflection

It is apparent that the activity of reflection is key within the experiential learning process. Therefore a major factor contributing to the educational validity of business gaming simulation is the facilitation of student reflection during and after participation within a business gaming simulation. It has been proposed that the activity of reflection

Figure 6: Model of reflection

An input-outcome model of reflection

Inputs to reflection	Outcomes/purposes
Theories, constructed knowledge or feelings	learning/material for further reflection; Action or other representation of learning; Critical review; Reflection on the process of learning; The building of theory; Self-development; Decisions/resolutions of uncertainty; Empowerment and emancipation

Source: Moon (1999: p.100)

within learning is influenced by many factors. For example, reflection results from an individuals dissatisfaction, a desire to understand and resolve, discussion with others, a disposition for reflection such as sentiency, imagination and cognitive abilities, a supportive yet critical mentality and intent, a desire to take control of one's learning, and purpose. Much of these activities are personal to the student and difficult – if not impossible – to influence within a business gaming simulation context. The problem-based approach described earlier may help by inducing dissatisfaction and a desire to resolve. Other approaches are writing, debriefing and facilitation which are now described.

1.6.5.2.1 Using Writing and Debriefing

Writing and debriefing are believed to be effective at encouraging reflection. Moon (1999) notes that quality reflection requires time, space and a suitable environment; and proposes that journal writing can provide this. She explains that journal writing is effective because the learner must stop, think and reflect independently, and own the work produced. Through reflection used in journal writing the learner may adopt a deep learning approach or deepen the learning achieved. She advises that a structure is set in the form of questions that should be addressed, with accompanying guidance on issues to be covered. The learner could be describing the process of problem solving, or

focusing on a past experience relevant to current learning. Similarly, Boud et al (1994) recommend methods such as debriefing or diary writing. For them, it is important to return to the experience and recollect what has taken place and reactions that occurred. Likewise, Hely and Jarvis (1995:75) insist that their students record reflective statements after a simulation exercise to encourage the thinking through of events and hence to understand the effects of actions. Hacker and Niederhauser (2000) advise that assignments are set that encourage students to construct deep explanations, justifications and reasons concerning their thoughts and actions, hence necessitating the active participation in one's own learning. This is comparable with Moon's "working with meaning" stage of learning (Moon, 1999) in which the learner reflects on new learning to form explanations, critical overviews, link ideas and innovate.

Jacques (1995) sees debriefing as important with games and simulations because they are contrived experiences and therefore require special attention at the stages of reflection and generalisation within the learning cycle (Kolb, 1984). A simulation debriefing is important because it provides a period of time after (or during) a simulation for appraisal of what happened and reflection on experience leading to learning (Martin and Dunne, 1996).

Hence, reflection on experiences gained from a business gaming simulation can be encouraged by thought provoking, open-ended questions, allowing time for students to think through relationships critically and insisting that students produce a written explanation showing their thinking. This can be assisted by debriefing activities before producing the written statements, followed by review and feedback on written explanations.

1.6.5.2.2 Through Facilitation

The importance of a facilitator within reflection has been highlighted. Moon (1999) stresses that the quality of guidance regarding reflection is significant within effective learning. For Gosen (2004), reflection can be achieved by combining analysis on the part of the learner with input from a facilitator such that there is adequate processing time and a clear summary to enable a "cognitive map" to be formulated. Stretch (2000) proposes that the complex simulation environment means that the learner requires the support of an expert to provide coaching and facilitate reflection at the appropriate time

within the learning process. For Stretch (2000), a prime time to reflect is when the learner has failed in a task and the expert can help the learner to develop a deeper understanding by identifying reasons for failure. Gentry (1990) proposes that feedback is essential to provide positive reinforcement and clarification of learning points. However, feedback should be adequate but not excessive so that learners take responsibility for their learning (Hacker and Niederhauser, 2000). Hence, the facilitator can help the learner to reflect, think and understand. Accordingly, Ramsden (1992) argues that through careful construction of material and the checking of understanding through interaction, the teacher can assist the learner to achieve meaningful learning.

Therefore, feedback and guidance through discussion with the facilitator can also significantly influence student reflection during a business gaming simulation. However, the scope of material and extent of advice requires careful judgement so that students are empowered to think for themselves.

1.6.6 The Motivation to Learn

Authors have alluded to the importance of self-motivation within learning (Jacques, 1995; Gentry, 1990; Dewey, 1933; Moon, 1999). It is therefore necessary to identify means of engendering the motivation to learn amongst students within a business gaming simulation exercise. Motivational theories are useful because they cover crucial issues such as goals, needs, attitudes and environment. These are explained and applied within this section.

For Locke (1981) motivation may be induced through the setting of goals. Within a business gaming simulation context, this could entail the identification of learning objectives and could also relate to performance goals to be achieved by teams; such as profitability and market share of their simulated companies. Several authors have proposed that people are motivated by their individual needs. Maslow (1943) postulates that there is a hierarchy of needs through which people progress upwardly as lower level needs are satisfied. At the bottom there are physiological, security and social needs moving up to the penultimate and final needs which are self-esteem and self-

actualisation. Applied to this research, a business gaming simulation might satisfy such higher level needs by providing a learning medium that helps develop business skills required within the "real" world environment. Duffy and Cunningham (1996) stress the need for a relevant real-world context – abstract, simplified environments being too different from the real-world. For example, managers may have a need to build business acumen in areas such as strategy formulation and implementation, marketing management, financial analysis, project management, leadership, teamwork skills and other management disciplines. Hence, students may be motivated to participate fully within the simulation because they believe that it will contribute to their self-esteem and fulfilment needs by enhancing their job recognition, status and the acknowledgement of their peers. This is consistent with Alderfer's ERG (Existence, Relatedness, Growth) theory (Alderfer, 1972) which – amongst other needs – proposes that people have a need for growth or self-development. Similarly, McClelland (1961) asserts that a need for achievement is a strong motivator - such as a desire to improve personal abilities. Herzberg (1966) also identifies issues such as achievement and recognition as motivators (or satisfiers) within his Two-Factor Theory, but also warns against dissatisfiers (or hygiene factors) that might be imposed upon people by the environment and act as demotivators. Applying these notions to the business gaming simulation context, the simulation needs to be of high educational quality to satisfy achievement needs (i.e. motivators) but conversely, students should not feel over-pressurised by workload and should work within a comfortable environment (hygiene factors). For example, this might mean that the students should be provided comfortable chairs, flipcharts and space to record and communicate ideas, separate rooms for each team – Although the Hawthorne Effect (Mayo, 1933) contends that people work harder if they are being observed; implying that teams should work within a classroom setting watched by the simulation facilitator rather than hidden away within dedicated team rooms. Given that business gaming simulation is often a team exercise, establishing effective team working practices will also be a hygiene factor (Herzberg, 1966) that might influence the motivation to learn. Therefore team cohesion (Summers, Coffelt and Horton, 1988) will be important – for example, students co-operating to help each other with problems, clear communication through explicit discussion and documentation, trusting the judgements of others.

McGregor (1960) highlighted the need for people to have the appropriate attitude in order to be sufficiently motivated. For him, there are two opposing categories of people: Theory X and Theory Y. Within the Theory X category, people have a dislike for work

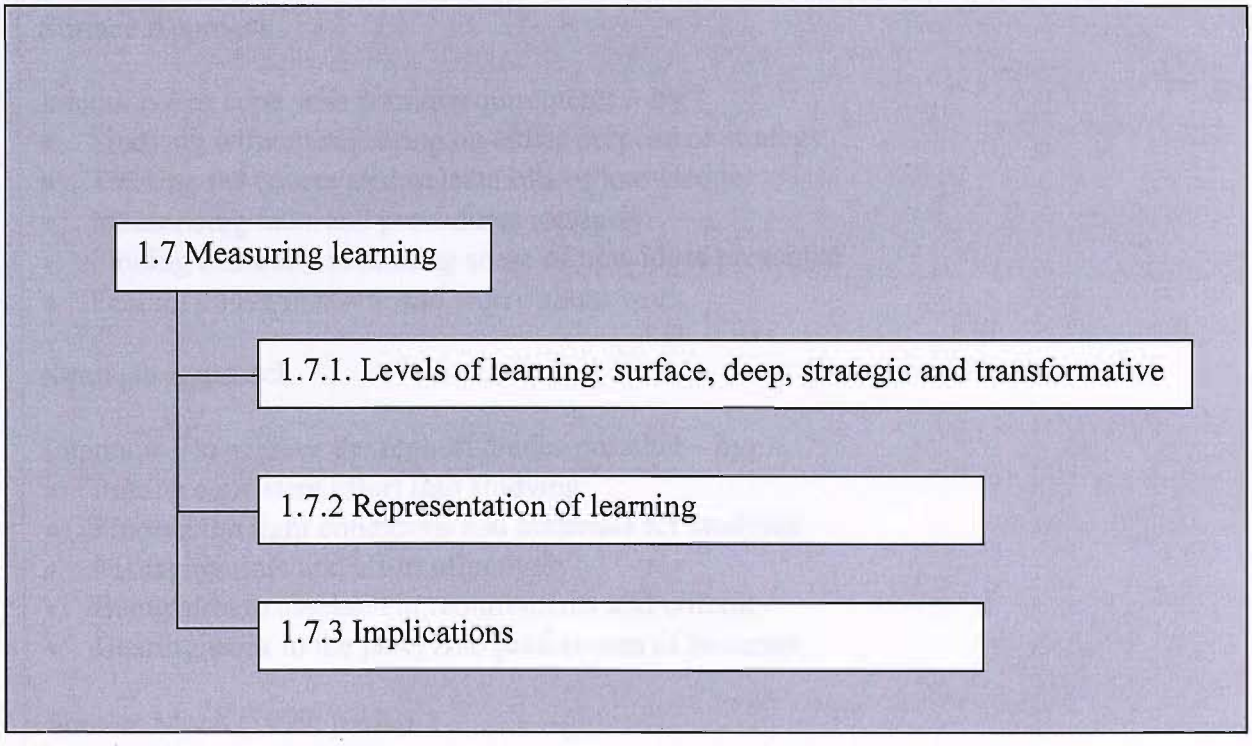
and will avoid taking responsibility. This type of person would not benefit from a business gaming simulation given that students are required to take personal responsibility for their learning. Potential students would need to conform to McGregor's Theory Y category which consists of people who seek responsibility and empowerment (McGregor, 1960). With simulations and games the onus is placed upon the student to learn interactively rather than for the teacher to teach (Jacques, 1995:22), which may add further to the idiosyncracy of learning; given that some students will not wish to take responsibility for their learning. Vroom (1994) also highlights the importance of a suitable attitude in order to achieve goals; which he termed Expectancy Theory - People need to believe and see that their actions lead to their expected results. Therefore, a business gaming simulation must be capable of delivering the learning that the students are expecting so that motivation levels are high and remain so.

These concepts of motivation have been applied broadly to adult learning by Knowles (1980) who defined andragogy as 'the art and science of helping adults learn' (p.43). There are certain principles that have been associated with adult learning (Knowles, Holton and Swanson, 1998). In accordance with Locke's Goal Setting Theory (Locke, 1981), the learner needs to know certain aims of learning – why it is important, how it will be conducted, and what will be learnt. Conforming to McGregor's Theory Y (McGregor, 1960) there is a desire for learning to be self-directed – in terms of the taking of control of techniques and purposes. In terms of needs theory (Maslow, 1943), the readiness to learn is influenced by needs that result from life situations and prior experiences. Important problems requiring new knowledge engender a high motivation to learn (Knowles, Holton and Swanson, 1998). Huang (2002) describes how team cohesion is a factor within adult learning where learners are motivated and stimulated to learn through interactivity and collaboration with other learners. Hence, the study of andragogy (Knowles, 1980) also highlights factors such as established goals, satisfying needs, positive student attitude and teamwork as important considerations that can influence motivation to learn when applied to a business gaming simulation context.

1.7 Measuring Learning

Assessing the educational validity of business gaming simulation is dependent upon the quality of data collected concerning student learning during and after participation in a business gaming simulation. Therefore research instruments need to be designed based upon learning measures that aim for construct and measurement validity. It is clear from previous chapters that the idiosyncratic and covert nature of learning means that any measure will have weaknesses. This section investigates theory that might help formulate learning measures, recognising that there will be limitations. Two concepts are explored as illustrated in figure 7: Measuring Learning. In section 1.7.1 Levels of learning: surface, deep, strategic and transformative, the depth of learning achieved through different approaches and mentalities is explored. In section 1.7.2 Representation of learning, ideas are presented concerning the measurement of learning. The implications for this project are summarised in section 1.7.3.

Figure 7: Measuring Learning



1.7.1 Levels of Learning: Surface, Deep, Strategic and Transformative Learning

The level of learning refers to the relative quality and depth of understanding achieved by students. Marton and Saljo (1997) and Entwistle (1988) studied the approach adopted by students when learning from written texts. These studies demonstrated that there were two contrasting mentalities: deep and surface approaches to learning. The

Figure 8: Approaches to learning

Deep Approach

Intention – to understand ideas for yourself by:
- Relating ideas to previous knowledge and experience
- Looking for patterns and underlying principles
- Checking evidence and relating it to conclusions
- Examining logic and argument cautiously and critically
- Becoming actively interested in course content

Surface Approach

Intention – to cope with course requirements – by:
- Studying without reflecting on either purpose or strategy
- Treating the course as unrelated bits of knowledge
- Memorising facts and procedures routinely
- Finding difficulty in making sense of new ideas presented
- Feeling undue pressure and worry about work

Strategic Approach

Intention – to achieve the highest grades possible – by:
- Putting consistent effort into studying
- Finding the right conditions and materials for studying
- Managing time and effort effectively
- Being alert to assessment requirements and criteria
- Gearing work to the perceived preferences of lecturers

Source: Moon (1999; p.122)

deep approach was implemented by students who wished to elicit the meanings that the writer wanted to convey. This differed greatly from the surface approach to learning employed by students who exhibited a desire to learn for simple recall purposes. A

study at Lancaster University identified a third approach (Biggs, 1993); the strategic approach to learning. Here, the learner's intention was to adopt the necessary approach, deep or surface, to achieve the highest grade possible. There was no deep interest but rather a desire to complete workload efficiently, taking note of assessment requirements. Moon (1999) attempts to clarify categories and stages of learning. For her, the deep learning approach concurs with meaningful learning in which the cognitive structure acts as an adaptable network to guide, organise and assimilate new ideas based on current knowledge. Meaningful learning requires the active construction of information input – modifying, revising, transforming, connecting, relating to what is already known – resulting in the ability to reason and solve problems in new contexts. She explains that this could lead to changed understanding - referred to as transformative learning. In contrast to the surface approach, she is of the opinion that the deep approach involves reflective activity in the process of learning – relating ideas, looking for patterns and others described above. The surface approach does not deliver meaningful learning and may lead to "unconnected learning" where the learner cannot relate the learning material to prior knowledge; and is achieved through rote learning or memorisation (Moon, 1999). These issues are listed in Figure 8.

1.7.2 Representation of Learning

For learning to be measured it needs to be represented in some form. Moon (1999) proposes that learning might be measured in terms of a "representation of learning". She suggests a five stage hierarchical process which describes the representation of learning that might be associated with surface and deep learning (Marton and Saljo, 1997; Entwistle, 1988; Biggs, 1993). A student might move from stage one through to stage five; dependent upon the depth and quality of learning that they are achieving. Moon (1999) postulates that during the first two stages a student will have attained a surface level of learning, moving to a deep level of learning during the latter three stages. If a student can reach the fifth and final stage then they will have achieved transformative learning in which there has been a change of attitude or behaviour. She describes how reflection is involved in all stages, but moreso in the latter stages. The first two stages – associated with surface learning – are "Noticing" and "Making Sense". Moon (1999)

proposes that these activities are concerned with the initial sensory coding of learning material – a concept also acknowledged by Biggs (1993). They are a selective process guided by what is already known, the purpose of the learning and constitutive factors such as the emotions of excitement, and anxiety etc. – traits associated with reflection (Dewey, 1933). The representation of learning can be memorisation and recall, although ideas are not well linked. A student achieving surface learning within a business gaming simulation will therefore be able to provide an account of developments but will offer little explanation of the causes of outcomes. Moving to stage three is showing signs of deeper learning. Moon (1999) describes stage three as "Making Meaning" such that new learning material is accommodated within the cognitive structure relative to what is already known and there is some sense of understanding. The representation of learning at this stage is that ideas can now be linked together, although the subject matter is considered on a general and holistic basis. This process is similar to the experiential learning cycle described by Kolb(1984). Within a business gaming simulation, a student may now be able to provide explanations of what happened and why. The fourth stage of learning is similar to the third, but the student now displays an ability to apply subject matter more broadly. This stage, termed "Working With Meaning" requires the learner to reflect on new learning within the context of the cognitive structure, thinking things over to achieve deeper understanding. The learner engages in a process of cognitive housekeeping. Thought provoking questions may help with this stage. The representation of learning is appropriate explanations, reflection and anticipation. Achieving this stage within a business gaming simulation might mean that a student can explain cause-and-effect relationships clearly, and relate to and predict outcomes within broader contexts. For Hacker and Niederhauser (2000), deep learning occurs when students can construct deep explanations, justifications and reasons concerning their thoughts and actions. In the ultimate learning stage, the student displays a change in attitude and/or behaviour. At this stage, "Transformative Learning" has been achieved such that a new idea or piece of learning creates a transformation of understanding. The representation of learning is that the student can critically overview knowledge. There is reflection and restructuring that is idiosyncratic and creative (Moon, 1999). Habermas (1971) considers reflection as a tool to develop emancipatory interests through critical evaluation of thought so as to understand the human condition and self, and hence deliver personal or social transformation. For Mezirow (1990), *'Transformative learning involves a particular function of reflection: reassessing the presuppositions on*

which our beliefs are based and acting on insights derived from the transformed meaning perspective that results from such reassessments' (p.18).
Within a business gaming simulation context, the student might be able to explain how the simulation experience has lead to a change in attitude and practices within the "real-life" workplace.

1.7.3 Implications – for measuring learning

In summary, if students are able to demonstrate a surface level of learning or better then this will provide data that can be analysed to assess the educational validity of business gaming simulation. Moon (1999) explains how students can be taken through the fives stages of learning using an experiential exercise. Through the necessity to act within the experiential learning cycle, the learner is drawn through the stages of 'noticing' and 'making sense' to 'making meaning' and 'working with meaning' in order to fulfil the action required. Hence, she believes that the learner may move into deep learning and away from surface learning, due to a need to grasp material and understand sufficiently well to implement appropriate action. Within the lower levels of learning (surface learning) the representation of student learning will be an ability to memorise and recall. At higher levels (deep learning) the learning will be represented through more in-depth explanations of cause-and-effect relationships, as well as an ability to apply concepts more broadly. Students will be able to demonstrate that they can relate ideas, identify patterns and principles, and critically appraise logic and arguments. If there is a change in attitude or behaviour then the ultimate level of learning has been attained – transformative learning. Therefore, students need to be encouraged to reflect, explain and apply in order to demonstrate a deeper level of learning.
Moon (1999) and Boud et al (1994) add that quality reflection is required, necessitating time and space, facilitation, and the appropriate environment.

'*In a simulation, reflection provides the learner with the opportunity to integrate the new experience into their understanding. This provides a greater transformative value to the learning, or the degree to which the skills and knowledge acquired are applied in real-world situations*' (Stretch, 2000: p.39).

1.8 Conclusion for section 3 - The Contribution of Learning Theory to the Educational Validity of Business Gaming Simulation

This section has explored learning theory – and specifically experiential learning theory – and the author has suggested ways in which it could be applied to business gaming simulation in order to facilitate and measure learning. To conclude, this section will summarise these suggestions.

Learning can be assisted through an active 'learning by doing' approach requiring student participation and interaction; inducing feelings and thought. The senses are engaged and learning is gradually constructed. One such active approach is experiential learning. A business gaming simulation can be a vehicle for experiential learning by enabling experience to be gained of business developments. As directions emerge, students can reflect on the causes and attempt to formulate and implement actions in order to improve emerging business situations. There is a continuous cycle so that experiential learning occurs as cause-and-effect is identified. Problem solving is an important activity that can be achieved experientially and lead to learning within a business gaming simulation. For learning to be meaningful (Moon, 1999), and to enable students to identify what to learn next - double-loop learning (Kim, 1993) – there should be a clear understanding of the learning needs of students. Accordingly, sufficient depth and scope of learning material must be incorporated within business gaming simulations to permit students to "gatekeep" (Moon,1999) and hence focus their efforts on relevant and useful learning material.

It is apparent that the activity of reflection is key within the experiential learning process. However, the extent and quality of reflection is largely dependent upon the attitudes and abilities of the student; which may be beyond the control of a business gaming simulation designer and facilitator. For example, productive reflection may require that a student is experiencing dissatisfaction. The student should have a desire to understand and resolve problems, a purpose, and feel personally responsible for learning. Sentiency, imagination, cognitive abilities and a critical mentality may also significantly influence an individual's ability to think through, understand and connect "parts" together. However, reflection can be encouraged by thought provoking, open-ended questions, and allowing time for students to think through relationships critically.

Group discussions can assist with this process. Students can record their deductions as written explanation; encouraging clear thinking. This can be assisted by facilitator debriefings, reviews and feedback - although not to excess so that students still take responsibility for their learning. Goal setting can be used to motivate learning (Locke, 1981) – for example, learning objectives or performance goals to be achieved by teams. If a business gaming simulation is perceived to satisfy higher level needs (Maslow, 1943) – such as useful business skills that assist career development – then students may also be more motivated to learn. Hygiene factors (Herzberg, 1966) must also be considered – for example, the comfort of the learning environment, and the effectiveness of teamwork. The Hawthorne Effect (Mayo, 1933) suggests that the simulation facilitator might motivate students purely by watching their activities. Also, the content of the business simulation must deliver learning that is in accordance with student expectations (Vroom, 1994). Hence, by considering the process of experiential learning and influential factors, business gaming simulation can be implemented in a manner that might encourage meaningful learning.

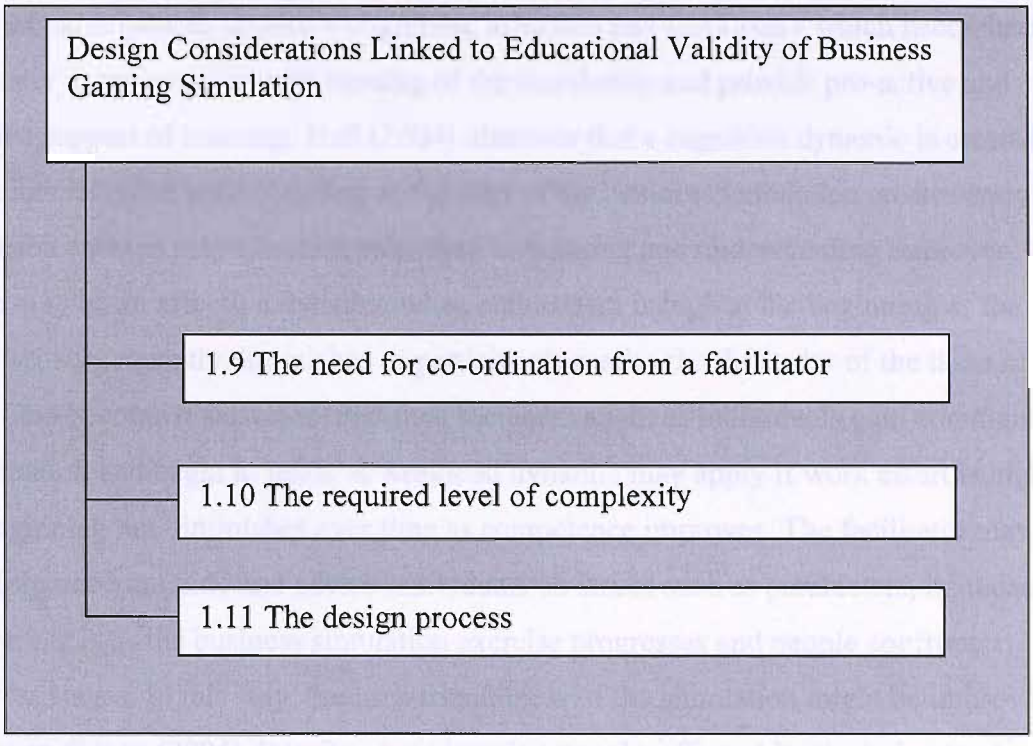
Measures of learning might be achieved by examining the written reflections of students following a business gaming simulation – given that this provides a record of the representation of learning. The educational validity will be dependent upon the level of learning attained. Surface learning will imply lower educational validity than deep and transformational learning. Written reflections that offer little explanation of the causes of outcomes can be categorised as "surface" when contrasted with explanations that clearly explain and apply causes-and-effects; which could indicate that there has been deeper learning. Applying the concepts of internal and external validity from Section 2 to educational validity, the identification of cause-and-effect relationships within the simulated environment might suggest that the simulation has internal validity from a learning perspective. Similarly, an ability to recognise and relate these relationships to the external "real-world" environment might imply external validity; or might provide further evidence of internal validity. The ultimate educational validity will be if a business gaming simulation has facilitated transformational learning; meaning that the student can explain how the simulation experience has lead to a change in attitude and practices within the "real-life" workplace.

Section 4: Design Considerations Linked to Educational Validity of Business Gaming Simulation

This section explores the design issues and problems that may influence the educational validity of computerised business gaming simulation which need to be considered when striving for validity. It has been argued that it is not the students who learn most from business simulation but the designers (Lainema and Hilmola, 2005; Lane, 1995; Spector, 2000); given that the designers are forced to carefully think through and programme the cause-and-effect relationships. The challenge, therefore, is to build a computer medium that will transmit the designer's knowledge and understanding to the student. The last chapter identified some difficulties in establishing and measuring learning. Likewise, the design of a business gaming simulation is also problematic because it needs to provide clear learning outcomes for the students. In short, it must be built so that it is as user-friendly as possible. This problem is further complicated by the fact that a business gaming simulation is used by participants, often as a "one-off" exercise over a short period of time. Therefore, user-friendliness will seriously influence potential learning, given that the student must learn to navigate around the system quickly in order to access the learning content within the course time-scale. If the technology behind a simulation is too complicated to use then it will act as a barrier to learning. Figure 9 illustrates the design considerations that will affect the educational validity of total enterprise simulation. As shown in the figure, section 1.9 highlights the need for a competent facilitator who can support the technology whilst it is used, and try to make sure that students can operate and work with it so that potential learning is not lost. However, a facilitator alone is not sufficient to make a business gaming simulation a useful learning tool. The design must be carefully considered so that it provides a sufficiently real representation of the world that is not too complex to be effectively usable within a short time period. There is conflict given that "realism" may enhance learning potential, but could also augment complexity. This, in turn, might reduce user-friendliness and create a barrier to learning. In figure 9 it can be seen that these design issues are addressed in section 1.10: The required level of complexity. From a project management perspective, simulation design and development must be managed to meet objectives within budgeted costs and according to permitted time-scales and these issues are described in 1.11: The design process. Given that business gaming simulation

operates on a computer platform, rigorous and careful programming is required so that the technology runs reliably and without errors.

Figure 9: Design considerations



1.9 The need for co-ordination from a facilitator

Hall (2004) explains that the ease with which a simulation runs may be affected by three types of participant dynamics – cognition, affection and workload - which necessitate a facilitator to maintain smooth running of the simulation and provide pro-active and reactive support of learning. Hall (2004) observes that a cognition dynamic is created when low levels of understanding at the start of the business simulation creates early confusion - which may diminish over time as learning and understanding improves. There may be an affection dynamic when enthusiasm is high at the beginning of the exercise, subsequently diminishes as participants realise the difficulty of the tasks in hand (and become disaffected) and then increases again as individuals gain command of the situation and begin to learn. A workload dynamic may apply if work effort is high at the beginning but diminishes over time as competence improves. The facilitator may therefore need to guide and advise individuals on issues such as parameters, boundaries and variables as the business simulation exercise progresses and people confront different stages. In this way, the user-friendliness of the simulation might be improved. However, Gosen (2004) describes how learning may be affected by the judgements made by the facilitator. Judgements are required concerning the simulation objectives, the amount and form of practise experienced before the exercise, player objectives, the active involvement of the facilitator, the help and assistance provided to students so that they reflect upon the experience, and team composition.

Hence, the educational validity of business gaming simulation will be influenced by the competence of the facilitator who must be able to understand and judge how to implement the technology, analyse and comprehend the business dynamics being simulated, and be able to communicate clearly with the learner.

1.10 The required level of complexity

There is an apparent ambivalence concerning the issue of whether sufficient realism can be built into a business simulation without creating excessive complexity that limits user-friendliness and obstructs learning. Fernstein and Cannon (2001) describe how researchers *'have yet to agree on what is an appropriate level of fidelity for this type of learning environment'* (p.57). Burgess (1995: 67-73) conducted surveys to elicit views from both users and developers concerning suggested improvements to business gaming software – where teams manage competing organisations in a simulated market. It was suggested that the level of complexity could be increased – such as number of decisions made per cycle – to create a more realistic representation. However, the extent to which realism can be achieved within the practical learning environment is arguable. Alessi (1988) states that realism leads to complexity which taxes memory and cognitive abilities. Likewise, Hely and Jarvis (1995) explain that there is a clash between achieving reality and retaining sufficient simplicity for the content of the simulation to be assimilated quickly and easily. Norris (1986) connects this need for adequate simplicity to learning and explains that, based upon experience, the problem with realism within a game is that it adds complexity such that learning, playing and facilitating becomes more difficult.

'Too complex a game model does not permit identification of the impact of important policies and decisions and isolation of underlying structured relationships and causal factors' (p.126).

Sharing a similar view, Grossler (2004) postulates that complexity of detail and dynamic behaviour - termed dynamic complexity by Senge (1992) - may increase fidelity and external validity but can also reduce the transparency of cause-effect relationships (p.266).

Several authors suggest that designers might attempt to find an appropriate balance between complexity and realism. Pidd (1998) describes the importance of defining the appropriate level of complexity in terms of the trade-off between over-elaboration leading to potential confusion and over-simplification limiting the usefulness.

Hely and Jarvis (1995) suggest that there should be a balance between realism and simplicity by focussing upon the most important decision areas relative to the simulation, such that there is not too much compromise on realism. Trauth, Farwell and Lee (1993) propose that the environment should be sufficiently complex to enable students to learn. Forrester (1973) describes the need to identify the system boundaries, the appropriate interacting variables and parameter values. For Stretch (2000) the validity of a simulation is based on how well it represents the real world, but taking only the aspects that foster, and do not overcomplicate learning given that reality may be overly complex. Rolfe and Hampson (2003) adopt a similar rationale in their consideration of flight simulators. In their view, a readily embraced philosophy in the design of flight simulation is that learning transfer from simulation to aircraft is maximised by making the simulation as close a representation of the actual aircraft as possible, thereby achieving a high degree of face validity. However, it is unlikely that the model will represent all the elements of the real world due to range, complexity, and lack of understanding of influence. Therefore, what is most important is that the level of detail is sufficient to provide required answers to the necessary questions - which must be established during simulation design (Rolfe and Hampson, 2003).

Borodzicz (2005) points out that the level of fidelity may not just be limited to the representation of physical factors but also psychological ones. For Borodzicz (2005), it is important that a simulation incites the same reactions and feelings within participants that might occur in the real-world environment (such as tension, frustration, and uncertainty); a concept referred to as psychological fidelity.

For Elgood (1993) complexity may not be necessary. He categorises a business game as complex if it has many decisions to be made in a time period which require many pages of instruction and hence necessitate time commitment from the user. However, achieving realism through this type of complexity is not necessarily required because some businesses are straight forward to run, and hence provide simple principals with universal application. Alternatively, he observes that certain business games may even be unreal deliberately in order to exaggerate learning outcomes. He concludes, however, that experience has shown that a realistically simulated complex environment can generate a great feeling of interest and excitement as participants experience the uncertainty and challenges of top management. In his view, a realistic model is more convincing and therefore credible.

Machuca (2000) and Forrster (1973) argue that over-simplification can be misleading if it means that the simulation teaches messages about the real world that are inaccurate. They criticise the "black box" nature of business simulation games because they hide the internal relationships; forcing learning through trial and error with potentially inaccurate deductions.

Goosen et al (2001) assert that educational validity may depend upon whether the simulation has sufficient breadth and depth of content to meet the learning objectives. However, many commonly used business simulations consist of a few decisions because the totality of a business setting is too complex to be included in a simulation. With this attitude there is a danger of over simplification, and a loss of scope for learning or inaccurate learning. For example, advertising is a major marketing device within any company and yet only 50 percent of the reviewed simulations contained advertising decisions (Goosen et al, 2001:23). A survey by Keys and Biggs (1990) found that an advertising decision existed in only one half of business simulations even though advertising is a major decision within the real world. They explain that advertising causes problems for simulation designers because it is complicated to model. For example, it can affect the demand function, expand the market, transfer share from one company to another or simply be a waste of money. There are also temporal effects in terms of whether demand in future periods will benefit from current expenditure. Keys and Biggs (1990) also noted that no simulations allowed for more than two products; which severely limited the scope for market segmentation and targeting through product differentiation. Goosen et al (2001) observed that in no simulations was the choice of distribution channel an important factor – a fundamental decision within marketing theory. Hence there is much simplification within simulation design which may limit the potential learning.

Goosen et al (2001) also express concern that the teaching impact of a business simulation may also be constrained by the limited knowledge and bias of the designer.

'The underlying knowledge domain of simulations is basically derived from the traditional business administration core as learned by simulation designers and only secondarily from real-world business experience' (p.35).

Goosen et al (2001) explain that designers are faced with conflicting theories and need to have a broad business knowledge. They claim that designers advocate that simulations portray realism but in fact they are based on constructs derived from academic courses such as accounting, finance and marketing. They cite the problem of modelling demand as an example of an area particularly requiring judgement on behalf of game designers. In this case, they must develop algorithms with unsubstantiated validity given that empirical studies on the behaviour of demand when simultaneous changes are made for several decision variables are unlikely to be available. In summary, Grossler (2004) believes that the validity of the simulation exercise depends on the modeller's ability, knowledge, experience, world view and access to data.

From a development time and cost perspective, Hall (2004) points out that a judgement needs to be made about the level of content complexity and therefore realism necessary to achieve learning objectives cost-effectively. It is often hypothesised that the value of a simulation has a strong positive correlation with complexity which drives the focus of design towards modelling the *"real world"*, and this conflicts with the delivery of value to the customer (p. 168). Hays and Singer (1988) share a similar view, arguing that the cost of creating a more complex simulation may not be justified and that fidelity could be reduced such that training effectiveness is not compromised. Accordingly, Burgess (1995) notes that the aim could be for verisimilitude rather that realism.

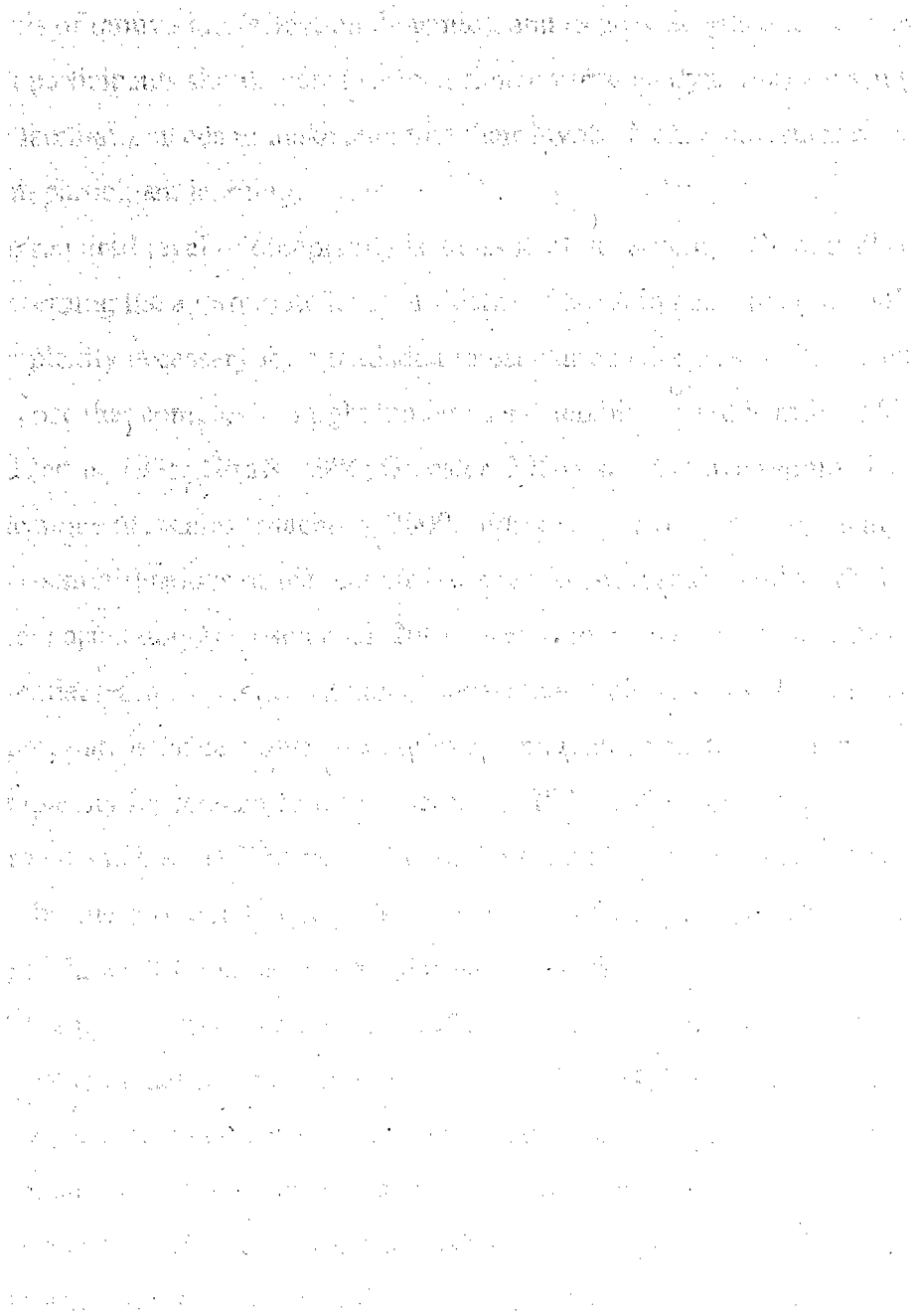
Hence, designing an educationally valid simulation is far from easy. The designer must have sufficient knowledge and experience to be able to judge the effective level of realism and complexity to achieve the learning objectives accurately and cost effectively. This means that the simulation must not become too abstract and simplified, and that the designer must have sufficient knowledge and impartiality when constructing the simulation. This may be problematic if empirical data is not available and designs are formulated based upon assumptions. As concluded by Rolfe and Hampson (2003), determining requirements and what to include within a simulation is the 'art' of simulation design.

1.11 The Design Process

For new simulations, it is necessary to project manage the design and development and Oakshott (1997:130 – 136) suggests necessary stages within a simulation design project. Although it applies to simulations within management science, it maps out necessary stages that can apply to other categories of simulation as well. Firstly it is necessary to formulate the problem and plan the study. The objectives must be defined in terms of problems to be addressed and purpose of results. It is important to carefully define the boundaries of the system in terms of the most important aspects and the assumptions, bearing in mind that making the model too complex can cause usage difficulties. It is necessary to estimate project time, cost and benefit. The next stage is to collect and analyse data associated with the logical relationships within the system and with important parameters. Deterministic data will possess a degree of certainty whereas stochastic data will vary randomly. Concurrently, a conceptual model should be built in which inter-relationships between variables are represented mathematically. The validity of the conceptual model should be scrutinised by other knowledgeable individuals so that errors and false assumptions can be addressed. Next the computer model should be programmed and verified to check that it is functioning appropriately. Face validation should be used to check that the model seems to be representing the real system on a superficial basis. This can be achieved by running the system and inspecting the output. In addition, the assumptions of the model can be tested empirically. Sensitivity analysis can be used in which individual variables or parameters are changed whilst others are kept constant and the effect on output is recorded and assessed in order to judge the level of acceptability. If possible, statistical checks should also be performed (Oakshott, 1997).

Fernstein and Cannon (2001) explain the process of verification - assessing that a model is operating as intended (i.e. the model has been built right). Verification means that the model must be debugged through the isolation and elimination of as many errors as possible. Individuals debug the software by analysing output in order to assess the acceptability of results, and errors are fixed either through re-programming or through design changes – to remedy extreme values or inadequate logic - or both. Testing is first conducted by the simulation developer (alpha tests) and then by independent users under a variety of conditions (beta tests) (Fernstein and Cannon, 2001).

Hence, through careful project management of business gaming simulation development in this manner, it is possible that a more reliable and comprehensive learning tool possessing greater educational validity may be constructed.



1.12 Conclusion for section 4 - Design Considerations Linked to Educational Validity of Business Gaming Simulation

In conclusion, design considerations involve the careful assessment of the role of the facilitator, the most appropriate level of complexity and project management of the design process.

According to Hall (2004), the facilitator has three main goals: to assist participant understanding of the simulation issues (cognition dynamic), to maintain participant levels of motivation (affection dynamic), and to provide guidance concerning aspects that participants should consider over time (workload dynamic). Gosen (2004) adds that the facilitator needs to make sure that their involvement contributes rather than detracts from participant learning.

The required level of complexity is an issue of uncertainty. There is disagreement concerning the appropriate level of fidelity (Fernstein and Cannon, 2001), and complexity necessary for a realistic representation (Burgess, 1995). Contrasting authors propose that complexity might hinder user-friendliness and learning (Alessi, 1988; Hely and Jarvis, 1995; Norris, 1986; Grossler, 2004), but that over-simplicity might teach inaccurate messages (Machuca, 2000; Forrster, 1973). However, many simulations are over-simplifications of the real business world because the real world is too complex to model accurately (Goosen et al, 2001; Keys and Biggs, 1990), and this may limit potential learning. Hence, authors suggest that designers might attempt to find an appropriate balance between complexity and realism such that there is sufficient complexity for realism as well as learning (Pidd, 1998; Hely and Jarvis, 1995; Trauth, Farwell and Lee, 1993; Stretch, 2000; Rolfe and Hampson, 2003). The teaching impact of a business simulation may also be constrained by the limited knowledge and bias of the designer (Goosen et al, 2001; Grossler, 2004).

From a project management perspective, the level of complexity and realism will impact upon development time and cost (Hall, 2004; Hays and Singer, 1988). The stages of design and development will need to be managed carefully (Oakshott, 1997) – problem formulation, objectives, definition of boundaries and assumptions, estimates of time and cost, data collection and analysis, building and testing the conceptual model, computer programming the model, testing and validation of the model.

Conclusions for Chapter 1: A Literature Review - Simulation and its Validity

This chapter explores literature that might assist the validation of total enterprise simulation. This conclusion therefore provides a general overview of topics covered and describes the key implications for this project.

Section 1 defines business simulation revealing that there is no established taxonomy for simulation. The author has therefore compiled a taxonomy and proposes the term Business Management Development Simulation to describe the category of simulation used within this investigation. Within the taxonomy, Business Management Development Simulation is most similar to Business Gaming Simulation and Total Enterprise Simulation.

Subsequently, section 2 explores the validity of Business Gaming Simulation from a representational and educational perspective to provide further insight into how, and the extent to which, total enterprise simulation could be validated. Section 2 shows that both representational and educational validity of Business Gaming Simulation are difficult to achieve. Representational validity is limited by the problem of using mathematics and programming languages to develop an accurate model that reflects a complex and often uncertain business environment. Educational validity is hampered by other problems such as unclear learning. For example, Business Gaming Simulation may be regarded as a game rather than a learning tool, there may be insufficient time for participant activities of decision making and analysis, and there may be a lack of both personal motivation and liability for decision outcomes amongst delegates. Additionally, participants may have difficulty in establishing cause-and-effect relationships or designers may introduce their own inaccuracies and biases based upon their limited understanding of the business environment that they are modelling. From this, it is evident that two aspects of validation are problematic: defining and measuring learning, and designing simulation for validity. Therefore, these issues are pursued in sections 3 and 4.

Section 3 considers how to achieve experiential learning and to measure learning. Concerning the former, varied proposals for encouraging experiential learning are explained which are useful for this project: encouraging participation and interaction, experiences followed by reflection on reasons for outcomes, problem solving, thought provoking open-ended questions, group discussions, participants providing written explanations, de-briefings and feedback, and goal setting, Additionally, learning

objectives need to be clearly defined supported by depth, usefulness and scope of learning material meeting student expectations. A comfortable learning environment and facilitator interest in participant activities may also help. Concerning how to measure learning, this may be achieved by analysing the written reflections of students – given that this provides a record of the representation of learning. Deep and transformative learning will be evident if explanations clearly explain and apply causes-and-effect relationships. The identification of cause-and-effect relationships within the simulated environment might suggest that the simulation has internal validity from a learning perspective. Similarly, an ability to recognise and relate these relationships to the external "real-world" environment might imply external validity; or might provide further evidence of internal validity. The ultimate educational validity will be if a business gaming simulation has facilitated transformational learning; meaning that the student can explain how the simulation experience has lead to a change in attitude and practices within the "real-life" workplace.

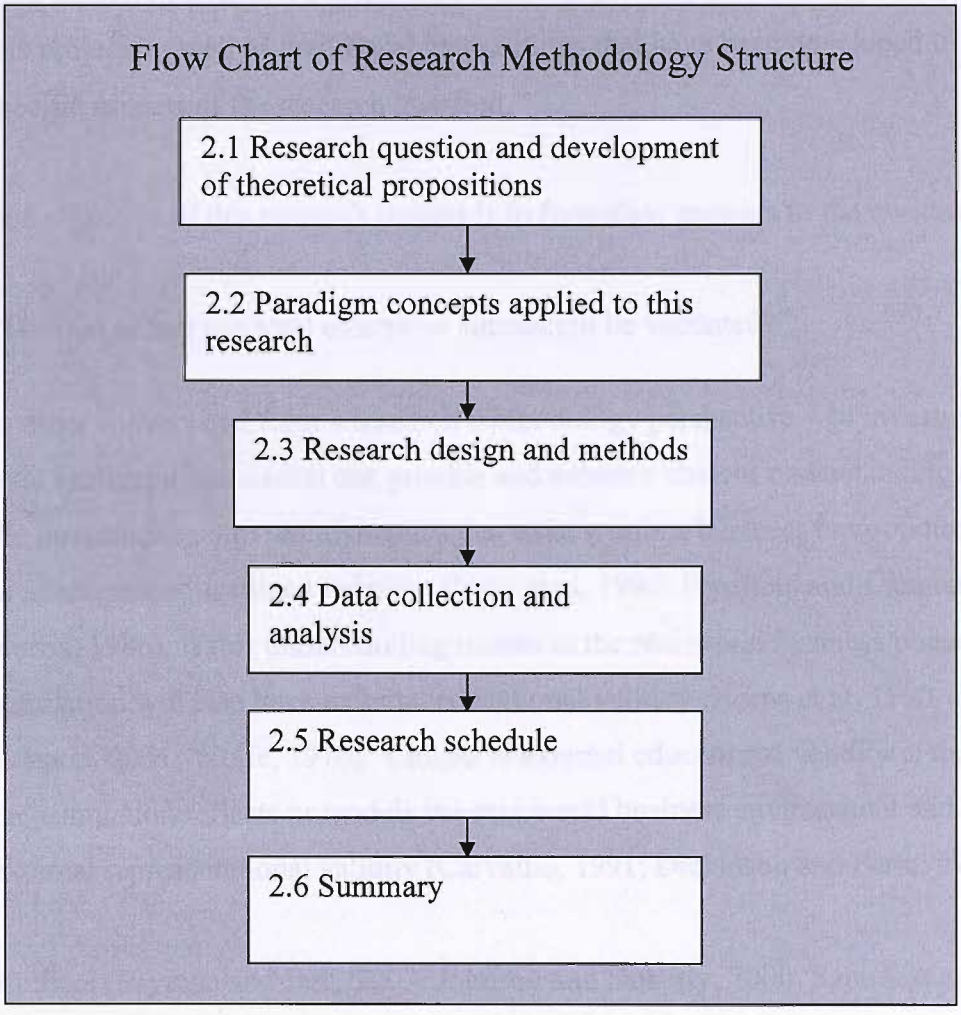
Section 4 presents design considerations that need to be incorporated into the design process when striving for validity. As explained, the facilitator needs to encourage learning through feedback and active interest in participant activities. More specifically, the facilitator should assist participants with their understanding of issues, try to encourage and motivate, and provide guidance concerning factors that participants need to consider over time – but not excessively or too forcefully. Additionally, the design of the simulation needs to be judged carefully - It needs to be complex enough to be real and meaningful, but not so complex that it becomes complicated and confusing. The designer needs to take care to model the business environment accurately and with minimum bias. Finally, the project must be managed carefully so that the simulation can be delivered with suitable quality and within budgeted cost and time deadlines.

Chapter 2: Research Methodology

Introduction

The structure of this research methodology chapter is summarised in Figure 10. A research methodology is important because it provides a justifiable plan of action that enables the researcher to be accountable (Saunders et al, 2003) during the investigation. Section 2.1 - Research question and development of theoretical propositions - explains the purpose of this research in terms of the research question and the specific areas that have been assessed by seeking to support or refute theoretical propositions (Yin, 2003) that propose answers to the research question. Section 2.2 - Paradigm concepts applied to this research – compares the different paradigms that might apply to this project and the author's stance is justified in relation to them. Section 2.3 - Research design and methods – maps out the research strategy adopted together with a detailed exposition of the research methods used. The techniques to achieve validity and reliability for the case study research design (Yin, 2003) are considered and their application to this project is explained. The process of simulation design and implementation is explained. A process of simulation validation through the triangulation (Denzin, 1978) of data collected using complementary research instruments is defined. In section 2.4 - Data collection and analysis – the extent to which data was obtained is assessed and methods used for qualitative data analysis are described. Statistical techniques utilised for quantitative data analysis are also explained. Section 2.5 presents the research schedule, clarifying the order and duration of activities and stages that have been pursued during this project. Finally, section 2.6 provides a summary of the chapter.

Figure 10: Research methodology



2.1 Research question and development of theoretical propositions

This section defines and explains the research question that has been investigated by this project, as well as theoretical propositions that have been developed to address specific aspects of the research question.

The objective of this research project is to formulate answers to the question:

"To what extent can total enterprise simulation be validated?".

In other words - and from a research methodology perspective – to investigate whether a total enterprise simulation can provide and enhance student understanding concerning the interrelationships and dynamics that exist within a business environment – referred to as internal educational validity (Burns et al, 1990; Fernstein and Cannon, 2001; Norris, 1986). If this understanding relates to the real-world business phenomenon the simulation will also have external educational validity (Burns et al, 1990; Ferstein and Cannon, 2001; Wolfe, 1976). Linked to external educational validity is the notion that the simulation reflects or models the real-world business environment and hence has external representational validity (Carvalho, 1991; Dickinson and Faria, 1994).

Authors (Bryman and Bell, 2003; Johnson and Duberly, 2000; Saunders et al, 2003) describe how research can be deductive through the testing of a hypothesis or inductive through a process of "making sense" of data. Johnson and Duberley (2000) define a hypothesis as an empirical prediction of expected outcomes based upon a defined theory. Therefore to formulate a hypothesis requires well-defined concepts so that predictions can be made, and tested to ascertain whether they are supported or refuted (Saunders et al, 2003). Yin (2003) explains that the validity of an investigation is enhanced if the researcher can establish propositions in advance that can be tested against; given that there is a danger that establishing patterns through a purely inductive approach alone may prove problematic and time consuming. Yin (2003) states that theory development within the design phase is essential, irrespective of whether the case study's purpose is to develop or test theory (p.28). The theory should help to clarify the subject being studied and should not be considered as possessing the formality of grand

theory in social science. The goal is to have a sufficient "blueprint" for the study, achieved through theoretical propositions. In this way, the research design will provide guidance on data to collect and the strategies for analysing the data (p.29). However, if there is insufficient existing theory then the inductive approach may be the only route forward (Saunders et al, 2003). Within this research project, the author was confronted with this predicament. Although theory exists – as explained within the literature review section – it is substantive and disjointed regarding validation issues. Substantive theory is restricted to a particular context which can limit external validity and generalisability (Denscombe, 1998; Saunders et al, 2003). There is no established process for designing, implementing and validating a total enterprise simulation. However, there are recommendations, for example the need to clarify objectives clearly (Locke, 1981; Oakshott, 1997) or the value of reflection within learning (Moon, 1999). In addition, as explained in the introduction of this thesis, the author has the benefit of several years of experience successfully designing and implementing total enterprise simulation within several organisations. Therefore, to provide structure to the investigation, the author formulated theoretical propositions (Yin, 2003), cognisant of the need to still remain open-minded, reflexive (Johnson and Duberley (2000:p.4) and inductive when considering emerging evidence.

The theoretical propositions are listed and described in italics below. Yin (2003) describes that, as part of this process, expected patterns – pattern matching – should also be established. Therefore, the patterns that are expected relative to rival patterns (Yin, 2003) are also described. The paradigm stance is explained in detail in the next section – 2.2 Paradigm concepts applied to this research. However, in brief, ontologically the theoretical propositions are based upon constructionism in that many of the thinking processes of participants are socially constructed through interaction with others inspired by the computer medium. Epistemologically, the stance tends towards interpretivism given that the theoretical propositions were formulated based upon substantive, disjointed theory combined with personal experience of the researcher in simulation design and implementation.

Theoretical Proposition 1 – Participants are able to learn about business management from simulation. They are able to understand the reasons for business results:-

1. *The reasons for market developments*
2. *The financial impacts of decisions*
3. *The effects of project issues*
4. *The impact of team effectiveness*

Theoretical proposition 1 is testing for internal educational validity. It will be supported if evidence shows that participants were able to understand how their business results occurred within the simulation. This will be as a consequence of their decision making and analysis regarding four key aspects of business management: marketing, finance, projects and teamwork. It will be refuted if the weight of evidence shows that participants were not able to understand the causes of their business results.
Theoretical proposition 1 has been derived based upon the definitions of internal educational validity provided by Burns et al (1990), Norris (1986) and Fernstein and Cannon (2001).

Theoretical Proposition 2 – The simulation possesses external representational validity

Theoretical proposition 2 is testing for external representational validity. It will be supported if evidence shows that participants were able to relate the business simulation to the real-world business environment. More specifically, the developments in business performance and their causes within the business simulation replicate those that occur in the real world business environment. Also, key parameters, decisions, information and business analyses are comparable. Evidence of learning that is relevant to the real world will also be supportive of this theoretical proposition. This proposition will be refuted if the weight of evidence shows participants could not relate developments in business performance to the real world, that they could not identify similarities between the simulation model and the real world, and that learning was not relevant to the real world.
Theoretical proposition 2 has been derived based upon the definitions of external representational validity provided by Carvalho (1991), Dickinson and Faria (1994) and Norris (1986).

Theoretical Proposition 3 – Participants are able to learn about business management from simulation. Attitudes are influenced regarding business management in the real-world

i) Regarding strategic management

ii) Regarding marketing management

iii) Regarding financial management

iv) Regarding project management

v) Regarding leadership

vi) Regarding teamwork

Theoretical proposition 3 is concerned with whether the simulation has external educational validity. This theoretical proposition will be supported if there is strong evidence that participants perceived that the experiences within the business simulation had changed their attitudes regarding business management in the real world. The analysis examines key areas of business management: strategic, marketing, financial, project. Additional areas are leadership and teamwork. This proposition will be refuted if the weight of evidence shows that participant attitudes had not been influenced. Theoretical proposition 3 has been derived based upon the definitions of external educational validity provided by Burns et al (1990), Fernstein and Cannon (2001) and Wolfe (1976).

Theoretical Proposition 4 – Key design factors influence potential learning concerning business management

Some suggested factors are:-

1.1) Business and Management Knowledge – understanding theory and relating to previous experience

i) The opportunity to apply management theory

ii) Prior business experience and knowledge

1.2) Individual and Team Factors – learning about teamwork, and using teamwork to learn

i) Team effectiveness

ii) A systematic working approach

iii) Personal motivation

iv) Effective use of information

v) A planning, implementation, monitor, and control cycle

1.3) Personal Activity During the Simulation – participating in activities that are likely to encourage learning

i) Analysis of the market

ii) Financial analysis

iii) Strategic management

iv) Searching for causes of results

v) Reflection on events

1.4) Simulation Design and Usage – sufficient realism and content, encouragement and competitive pressure

i) Facilitator support

ii) The consideration of a multitude of business directions

iii) Relevance to real-world business issues

iv) Competition between teams

Theoretical proposition 4 relates to the fact that the educational and representational validity of total enterprise simulation will be dependent upon the quality and structure of its design and implementation. Factors will be identified as influential to validity if the weight of opinion amongst participants is more supportive. The converse will indicate that factors are insignificant. Suggested factors to consider are participant business management knowledge and experience, individual and team factors, participant activities during the simulation, and the design and usage of the simulation. Theoretical proposition 4 has been derived based upon the simulation experience of the researcher combined with considerations sourced from the literature review.

The next section – with reference to Appendix 10 - explores and justifies the paradigm approach adopted by the author by considering further the inductive/deductive nature of the investigation, the objectivity with which data could be collected relative to the theoretical propositions, and the covert nature of participant learning - amongst other considerations.

2.2 Paradigm concepts applied to this research

For a detailed appraisal of paradigms applied to this research see Appendix 10 – Paradigm concepts applied to this research. However, to summarise, ontologically this project is most similar to constructionism because it involves participants formulating thinking processes based upon social interaction. Epistemologically the stance tended more towards interpretivism given that knowledge was derived through the interpretation of viewpoints and the subjective perspectives of participants.

The next section - 2.3 Research design and methods - explains issues of validity and reliability concerning the research design adopted, and the design and implementation of the simulation and research instruments.

2.3 Research design and methods

This section explains how and why a multi-case study research design was employed within this investigation. It describes the research method concerning simulation design and implementation, the selection of cases and the design of research instruments used to collect validation data. Research issues of validity and reliability are addressed in relation to the project. The research strategy has been formulated using the advice of credible research methodology authors applied to the project based upon the researcher's understanding of research objectives and how they might be achieved. This is summarised by Bryman and Bell (2003);

'All business research is the coming-together of the ideal and the feasible. Because of this, there will be many circumstances in which the nature of the topic or of the subjects of an investigation and the constraints on a researcher loom large in decisions about how best to proceed' (p.29).

2.3.1 The Process in Outline

The main research process focused upon how to collect data that had construct or measurement validity (Bryman and Bell, 2003) such that they could be interpreted and used to clarify a theoretical framework from which findings and conclusions could be drawn. Theoretical propositions were formulated early within the project (Yin, 2003) - as explained in 2.1 – based upon literature material and the past simulation experience of the researcher. The process of using the existing knowledge and experience of researchers is recommended. According to Miles and Huberman (1994);

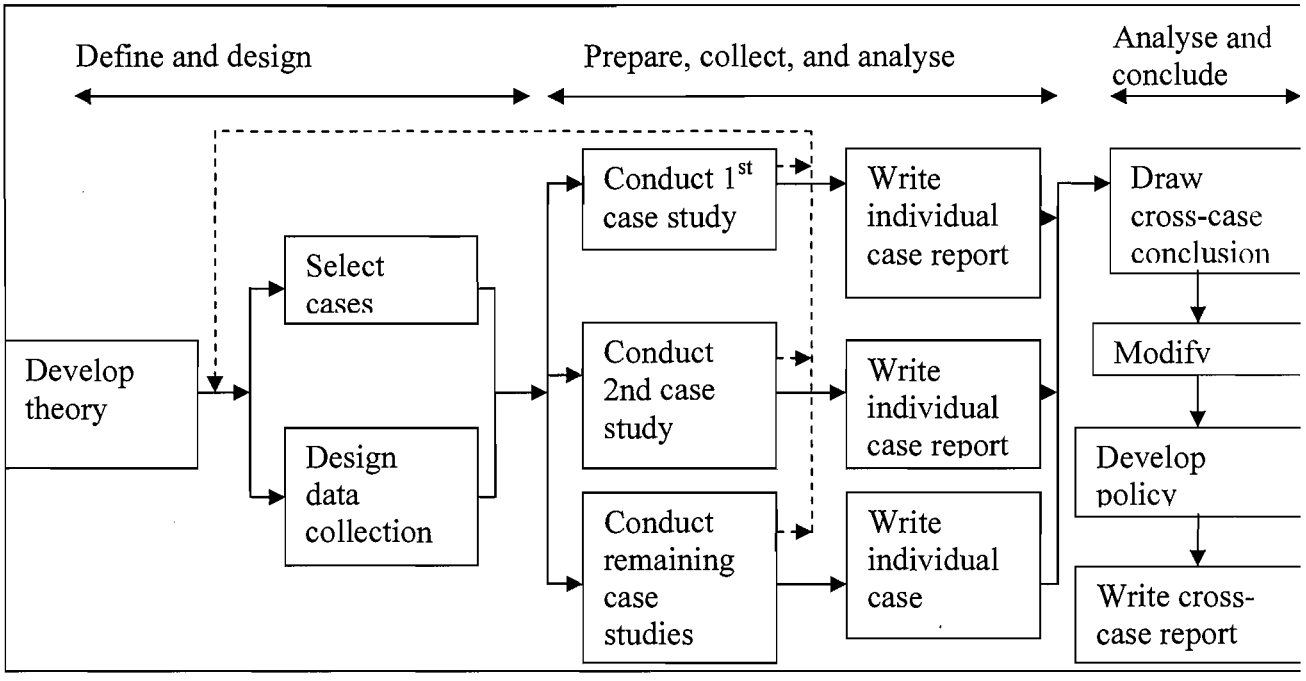
'Not to "lead" with your conceptual strength can be simply self-defeating' (p.17)

Miles and Huberman (1994) describe a similar process of "transcendental realism". Here, a causal description of forces is identified providing explanation for events, and evidence is sought to show instances of that explanation. The research purpose is *'to describe and analyse a pattern of relationships...starting with them (deductively) or getting gradually to them (inductively) are both possible. In the life of a*

conceptualisation we need both approaches...to pull a mass of facts and findings into a wide-ranging, coherent set of generalisations' (p.17). This approach was adopted within this investigation. As data and theory was accumulated, it was analysed and used to formulate theoretical propositions (Yin, 2003) that were then subsequently re-tested as further evidence materialised.

The case study method that was used is summarised in Figure 11. The dotted line indicates feedback used to re-formulate or confirm theoretical understandings as case study findings emerged.

Figure 11: Case study method



Source: Yin (2003: p.50)

Although similar, the research process adopted was not identical to Figure 11: Case Study Method. Theory was developed early in the investigation as explained - it was not the start point of the investigation. Research instruments were designed and cases were selected as shown under "Define and design" in Figure 11. Corresponding to "Prepare, collect and analyse" in Figure 11, there was a preliminary study in which material from the initial literature research plus past experience were used to pilot a simulation exercise and subsequent data collection (Saunders et al, 2003). This enabled the simulation design and implementation, as well as the research instruments to be shaped and honed before embarking upon the main data collection. The cases were not assessed simultaneously because, although cases were targeted, some emerged sooner than others. The cases involved running a simulation exercise with a target audience. From Figure 11, individual case reports were not written as such. Instead, data were collected using the research instruments and were subsequently analysed. In line with "Analyse and conclude" in Figure 11, using all the data together, conclusions were drawn and related to the theory. Overall patterns were defined and recorded.

2.3.2 Case Study Design

2.3.2.1 Why Case Study?

A case study design was selected because *'the case study method allows investigators to retain the holistic and meaningful characteristics of real-life events – such as ...managerial processes'* (Yin, 2003: p.2). To explore the contextual conditions of a phenomenon within its real-life context (Yin, 2003: p.13). Case studies can be used to explain real-life causal links that are too complex for survey or experimental strategies, to describe an intervention within its real-life context, to illustrate topics within an evaluation, and to explore unclear and multiple outcomes from an intervention (Yin, 2003: p.15). By comparison, total enterprise simulations aim to enable participants to implement varied managerial thinking processes within a broad complex business environment, and therefore the case study approach provided best opportunity for this type of unconstrained analysis. The case study approach enabled multiple perspectives of participants to be analysed in depth and triangulated (Denzin, 1978) through different sources of data used to corroborate findings. Yin (2003: p.13) proposes that there may be many more variables of interest than data points, highlighting the need for multiple sources of evidence such that data can converge and be triangulated. Possibilities of such "data overload" are high within a complex simulated business management environment and necessitated a blend of research instruments that will be described in the next section. Other designs such as survey or experiment were not suitable because the level of analysis would have been too superficial relative to the case study design.

Yin (2003) defines case studies as exploratory, descriptive or explanatory dependent upon the nature of the research topic (p.3). This study was descriptive because it aimed to develop a clear and accurate picture of validation issues regarding total enterprise simulation and explanatory because it sought to establish causal relationships such as factors that enhance design validity (Saunders et al). In accordance with Yin (2003), there was sufficient knowledge and experience to formulate theoretical propositions, and there was scope to develop theory further. Hence, the case study design provided the opportunity to describe and explain validation issues.

Case study is an effective research strategy if the research question is asking how or why, and the investigator has limited control over contemporary (as opposed to historical) behavioural events (Yin, 2003: p.5). *'If you needed to know "how" or "why" a [governmental] program had worked (or not), you would lean toward ...a case study'* (Yin, 2003: p.7). Similarly, an effectiveness study of a total enterprise simulation comprises high business complexity and the idiosyncratic nature of learning; which are broadly beyond the control of the investigator. Also there is the goal to assess how much learning was achieved and why it occurred. Central to the learning process within a total enterprise simulation exercise, Yin (2003) explains that case studies often focus upon decisions, why they were taken, how they were implemented and with what results. They may also examine individuals, programmes and events (p.12). Hence, a case study design could enable how and why issues to be addressed concerning the validation of total enterprise simulation.

2.3.2.2 Validity and Reliability

Validity means that there are appropriate, correct measurements and is a core topic within research methodology. For Robson (2002), validity requires that results are accurate; that they correspond to and accurately capture the state of affairs.
Even so, some authors such as Bryman and Bell (2003) discard the importance of validity and reliability within the case study research design. In fact, Bryman and Bell (2003) suggest that it should be left to the jurisdiction of the researcher to decide the extent to which these research design criteria are appropriate for the evaluation of the research, given that they are less important within this context. For example, they propose that a case study has limited or no external validity or generalisability, although sometimes theoretical generalisability is claimed. For them, the intention of a case study is not to enable generalisations but to consider a particular case in great detail and generate theory from findings (p.56). However, rigorous and thorough research requires established methodological standards. Therefore, Yin (2003) provides a thorough approach towards the achievement of validity and reliability within the case study research design - which will be employed within this investigation.

According to Yin (2003), construct validity aims to establish the correct operational measures during data collection. For Robson (2002), construct validity is achieved through the measurement of appropriate factors (i.e. the measure of a concept truly does measure that concept). Therefore, within the total enterprise simulation the concept of learning needs to be operationalised (Saunders et al, 2003) so that it can be measured. Moon (1999), for example, advises a representation of learning such as written accounts of participant reflections. Yin (2003) suggests that multiple sources of evidence need to be established that encourage convergent lines of inquiry (p.36). There is data triangulation in which information is collected so that the same fact or phenomenon can be corroborated (p.99). Denscombe (1998) describes how triangulation may enhance validity and confidence in the data. Several sources of data on a topic allow different perspectives to be gained and hence a fuller understanding. A multi-method approach also permits findings to be corroborated through comparisons of data originating from each method. Hence, within this project, these issues of construct validity were also addressed through multiple sources of evidence: reflective accounts, questionnaires, semi-structured interviews, and to a lesser extent observation. These research instruments are described in detail within the research methods section of this chapter. However, briefly, the reflective accounts provided in-depth open-ended qualitative explanations of participant reflections concerning their understanding during the simulation. This was supported by the questionnaire which provided a more superficial, but more structured quantitative representation of participant understanding. Semi-structured interviews were the most open-ended source of data which afforded further qualitative evidence. Researcher observation was used to provide an additional perspective.

Yin (2003) explains that internal validity is only of concern within explanatory or causal case studies where the question is whether event "x" led to event "y", making sure that no other extraneous factors have influenced the result. Internal validity therefore applies to this investigation since the intention is to assess design factors that influence validity, and to assess participant understanding resulting from the simulation. Robson (2002) states that internal validity is upheld when a study demonstrates that there is a causal relationship between treatment and outcome; hence a dependent variable is affected by an independent variable and not by any other extraneous factors that have not been considered. Threats to internal validity might arise within a simulation environment through instances such as changes in the environment external to the enquiry e.g.

uncomfortable team rooms, alteration to participants e.g. less motivated staff, differences between groups e.g. changes in team dynamics or a more compressed simulation timetable. Yin (2003) proposes that internal validity can be reinforced by testing for patterns that support a theoretical proposition or a rival explanation (p.36). These are defined as general analytic strategies (p.115). In pattern matching, an empirically based pattern is compared with a predicted one to establish the extent to which they coincide. *'If...the initially predicted values have been found and at the same time alternative "patterns" of predicted values have not been found, strong causal inferences can be made'* (p.116).
Hence, for internal validity, theoretical propositions explained in 2.1 were formulated - and are also listed in Appendix 4. In addition, the researcher remained cautious concerning extraneous factors that might bias results. For this reason, where comparable analysis was required, the simulation timetable was identical for each simulation exercise as were course materials and level of facilitator support.

For Robson (2002), external validity questions whether the results are applicable to other contexts or situations – they are generalisable. External validity may prove difficult to achieve if the findings are specific to the group studied or the context studied, and dependent upon particular and historical experiences. It may be necessary to repeat the study with other types of participant or in a different setting, or make a case to show that the group studied or setting is representative of other groups or settings. Similarly, Yin (2003) explains how external validity is achieved through replication logic, where analytic generalisation can be claimed through the examination of multiple case studies (p.37). Multiple case studies are chosen in a similar manner to the conducting of multiple experiments, because they aim to facilitate "analytic generalisation" in which theory that has previously been developed acts as a template against which empirical results of the case study can be compared. Replication is claimed if two or more cases support the same theory, and is further strengthened if they do not support an equally plausible rival theory (p32 – 33). The former is termed *literal replication* however it could be that contrasting results still support a theory because there are predictable reasons, an occurrence termed as *theoretical replication* (p.47). The option pursued within this project was to conduct studies of four different case organisations: Aerospace executives, management students, Kraft Foods and QBE Insurance. The rationale behind these cases will be explained in the next section. It was,

however recognised that there would be no grand theory - this would be a substantive enquiry (Bryman and Bell, 2003).

For Robson (2002), measurements need to be reliable through stability and consistency. This means that the same or similar readings would be obtained on other occasions and by other researchers who might conduct the same investigation - the results of a study are repeatable (Bryman and Bell, 2003). It is therefore important to account for error and bias of participant and observer during data collection. For Yin (2003), reliability aims to minimise errors and biases in a study by making sure that the investigation could be repeated by others such that they could arrive at the same results and conclusions. This was achieved through documentation of areas such as learning theory, simulation design and implementation, the units of analysis – such as research instruments, and data analysis techniques. Additionally, a chain of evidence was accumulated to provide a database of results, data analysis and findings. It is important to construct a chain of evidence, which allows an external observer to follow the derivation of evidence from initial research questions through to ultimate conclusions, and hence contributing to both reliability and construct validity (Yin, 2003; p.105). These issues of validity and reliability are summarised in table 3: case study tactics applied.

Table 3: Case study tactics applied

Tests	Case Study Tactic	Method Utilised
Construct validity	• Use multiple sources of evidence	Research Methods 1. Student reflection – See Appendix 1 2. Participant/ Direct Observation 3. Questionnaires – See Appendix 3 4. Semi-structured interviews
Internal validity	• Do pattern-matching • Address rival explanations	Prior construction and testing of theoretical propositions – See Appendix 4
External validity	• Use replication logic in multiple-case studies	Examining multiple cases for literal and theoretical replication based on theoretical propositions (analytic generalisation), and • Aerospace executives • Management students • Kraft foods • QBE Insurance
Reliability	• Establish chain of evidence	1. Documentation • Learning theory • Simulation design and implementation • Unit of analysis (focus of data) • Data analysis techniques 2. Chain of evidence • Database of results • Data analysis and findings

2.3.3 Simulation Design

The aim of this section is to explain the simulation design and implementation process which was adopted for each case. This process is summarised in Figure 13: Simulation Design Process; adapted from a separate publication written by the author of this thesis. The last section, Validity and Reliability, has described how it is important to achieve external validity through multiple case studies and these cases, and the sourcing of them, are described in the next section – Research Method. However, each case involved the design, implementation and assessment of a total enterprise simulation from the perspective of the case organisation, which this section will now explain. From Figure 13, the first stage was to establish the objectives of the simulation – the participant learning objectives to be achieved and how to measure whether they had been attained by the simulation. As shown in the figure, this was related to establishing measures for internal and external educational validity given that these were also learning objectives. Congruent with these aims, the design of the simulation model could be formulated as shown by the considerations listed in the second box of Figure 13 – such as complexity level, relationships, boundaries and parameters. The third box of the figure shows that the simulation implementation design also needed to be created – for example, simulation timetable, theory inputs, facilitator support requirements. Subsequently, the simulations were implemented within the case organisations and validity data collected for analysis.

2.3.3.1 Simulation Objectives

The simulation objectives needed to address the findings formulated from the literature review. To re-cap, the majority of published research has focused generally on business games and business gaming simulation rather than specifically upon TES. It appears that the stance has been to "play the game" and assume that there will be student learning based upon belief that this type of simulation is a credible learning tool (Whiteley, Ledue and Dawson, 2004; Faria and Wellington, 2004; Dickinson, Whiteley and Faria, 1990; Dickinson and Faria, 1994; Wolfe and Jackson, 1989). This implies a product orientation rather than a customer focus; where there may have been

insufficient consideration concerning the design of business simulation that might enhance learning. There is the danger that existing business gaming simulations have been employed as vehicles to assess the degree of learning that may have been achieved, irrespective of their quality and suitability regarding the customer's learning needs (Gosen, 2001). These factors may have contributed to the observed paucity of evidence supporting the educational validity of business gaming simulation, and specifically TES.

Hence, in the author's view, to attempt to establish the validity of TES requires a more rigorous design and implementation approach based upon a customer orientation that solves the customer's problem (Kotler, 1992); a desire to learn. This contrasts with the traditional approach of utilising a product to play a game and hope that this meets the customer learning needs. In accordance with past research, representational and algorithmic validity are problematic but present challenges that, if tackled successfully, might enhance educational validity (Gold, 2003). Learning might be classified as deep and internally valid if students are able to identify cause and effect relationships within the simulation (Moon, 1999; Fernstein and Cannon, 2001). Learning might be externally valid if students can relate their learning from the simulation to the "real" world (Fernstein and Cannon, 2001). These objectives must be central within the design of TES software. Concerning quality standards, TES needs to be realistic and challenging but also usable and implementable (Burgess, 1995; Alessi, 1988); to elicit the business learning potential associated with experiential and problem-based learning (Kolb, 1984; Biggs, 1999). The design must aim to be sufficiently complex to be real, but still user-friendly enough to enable the simulation to deliver valuable learning over a short time frame (Rolfe and Hampson, 2003). Careful consideration should be given to the running of the simulation so that there is an effective mix of theory, experience and reflection (Boud et al, 1994). Participant reflection needs to be core within the learning process and the representation of learning. The facilitator must to be able to draw out learning through reflection amongst participants and to maintain learner motivation levels during the course. This may be through aligning the complexity and pace of the simulation to suit the stages reached by participants, but also by helping participants to understand issues as they are confronted (Hall, 2004). With this type of customer focus, the term "business gaming simulation" used to categorise TES would be more suitably replaced by the author's term, "business management development simulation". The focus must be to achieve the purpose of management learning and develop business

understanding; rather than to play a game from which there may be no resultant learning.

Stainton and Johnson (2006) – illustrated in Figure 13: Simulation Design Process – propose that the starting point within the simulation design process is to define what is to be achieved and how it will be measured (Washbush and Gosen, 2001). The learning objectives can be defined by establishing the customer needs. For the case organisations within this investigation it was necessary to interview the Learning and Development manager responsible for the course within the organisations. Where necessary, line managers were also interviewed to provide more detail concerning the required learning topics. In general the aim was to enable participants to experience – and hopefully learn from this experience – business management issues that occur within their real-life companies.

If needed, line managers answered questions concerning the drivers of business performance within their industry so that the business simulations could be built to reflect the "real-life" dynamics. This aspect of design was, however, made easier for the researcher given that he had worked for over ten years as a management consultant within the two simulated industries: retail and manufacture of fast-moving-consumer goods, and insurance. Stainton and Johnson (2006) propose that measuring whether learning objectives have been achieved from a business simulation requires that the constructs of learning are defined (Moon, 1999). This is also necessary to achieve construct validity within a research investigation (Robson, 2002). The approach used regarding construct validity of learning measures has been introduced in the previous section, Validity and Reliability. Representations of learning (Moon, 1999) were sought through a mix of open-ended questions and Likert-type rating scales (Bryman and Bell, 2003) to encourage reflective activity concerning learning derived from the simulation. Many authors (Moon, 1999; Boud et al, 1994; Dewey, 1933) describe the value of reflection and reflective cognitive processes in the learning process because they enable an individual to formulate interrelationships and connectivities between the related topics. Stainton and Johnson (2006) postulate that assessing learning also requires constructs for assessing the internal and external educational validity of the business simulation (Ferstein and Cannon, 2001; Gosen and Washbush, 2001; 2004). As explained in the literature review section, internal educational validity of a business simulation is when participants can understand the cause-and-effect relationships within the model, and external educational validity is when participants recognise that these

relationships accurately apply to the real world (Fernstein and Cannon, 2001). Hence, within this project, constructs for internal educational validity were open-ended questions requiring respondents to reflect on what events happened within the simulation, and the causal factors behind these events. This was supported by Likert-type rating scales requiring respondents to rate the extent to which events could be attributed to different causal factors. Similarly, constructs for external educational validity were open-ended questions requiring respondents to reflect on whether events and their causes within the simulation were representative of the real world, and whether their attitudes had changed regarding the real world. Again, Likert-type rating scales were used to provide supporting evidence by asking respondents to rate whether their understanding of the real world had been influenced by the simulation.

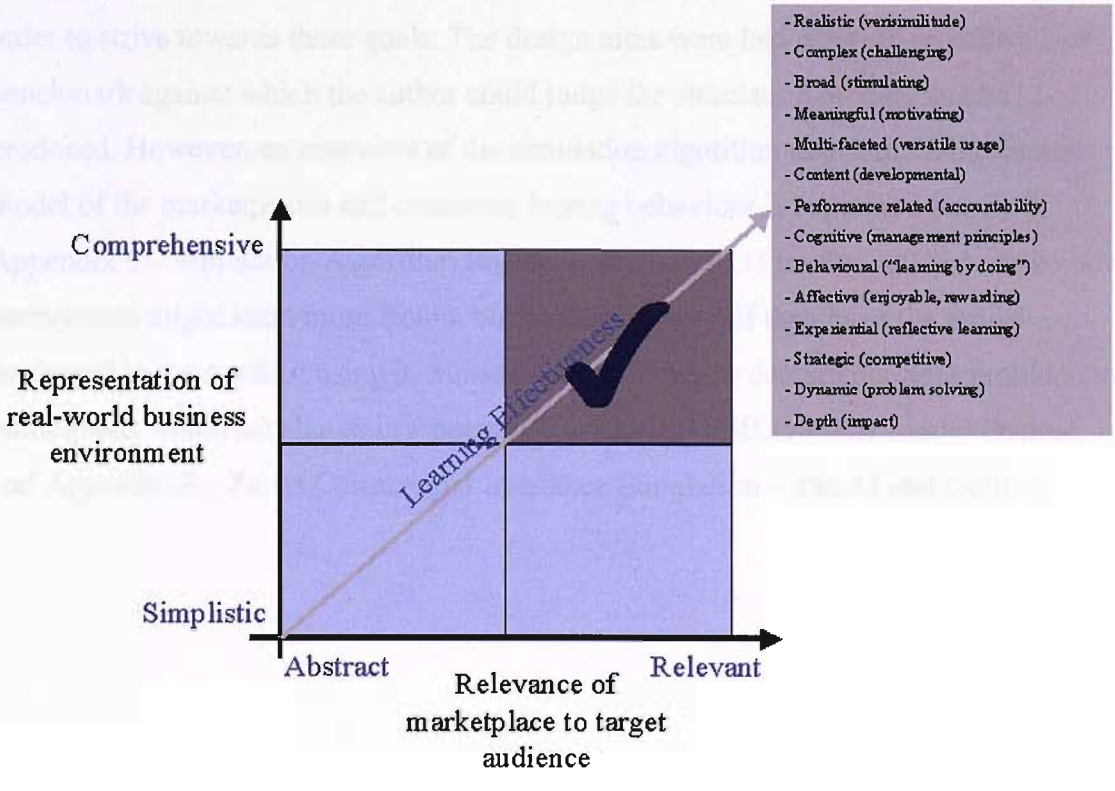
2.3.3.2 Simulation Model Design

Stainton and Johnson (2006) advise that the next stage of the design process following the identification of objectives is to design the simulation. Designing a total enterprise simulation is both a science and an art (Grossler, 2004). The main issue here is to assess the level of realism necessary to achieve the learning objectives without making the exercise too complicated and user-unfriendly. In this project, a systems dynamics approach was adopted (Forrester, 1973) in which it was necessary to identify the system boundaries, underlying interrelationships and decision rules of the model. This was achieved using past knowledge of the researcher – as explained, the researcher has over ten years of management consultancy experience within the simulated industries – in conjunction with data solicited through interviews with middle and senior managers from the relevant industries. The stance adopted concerning complexity and realism is summarised in Figure 12: Simulation design considerations. The author supposed that internal and external educational validity was more likely if the simulation provided a comprehensive representation of the real-world business environment which was relevant to the marketplace of the target audience. Based upon the literature review, authors such as Goosen et al (2001) have described how simulations are often a simplistic and abstract representation of business environments and the author speculated that this might be a reason why simulation has proved difficult to validate in the past (Gosen and Washbush, 2004; Malik and Howard, 1996). Hence, the author

formulated a list of simulation design aims that might enhance learning effectiveness as shown in Figure 12:

1) The simulations needed to provide a realistic representation of the real-world business environment (Elgood, 1995; Duffy and Cunningham, 1996), or at least the appearance of realism – i.e. verisimilitude (Norris, 1986).
2) There should be sufficient complexity to make the simulations challenging (Burgess, 1995), but not to the extent that they become confusing (Alessi, 1988).
3) The content should be broad enough to make the simulations stimulating. This is based upon the concept of double-loop learning (Kim, 1993).
4) The learning should be meaningful and relevant so that participants are motivated to participate (Knowles, 1980).
5) The simulations should be multi-faceted. They should be able to achieve several learning objectives and hence have versatile usage (Locke, 1981).

Figure 12: Simulation design considerations



6) The content should aim to progress the existing learning of participants – it should be developmental (Maslow, 1943).
7) Results within the simulations should be performance related so that participants are accountable for their decision making (Bloisi, 2003).
8) Cognitive processes should be enhanced through management theory (Faria, 2001; Honey and Mumford, 1986).
9) The simulations should be behavioural through "learning by doing" (Gentry, 1990).
10) The simulations should be affective by making them enjoyable and rewarding (Faria, 2001).
11) The simulations should be experiential to enable learning through reflection (Kolb, 1984)
12) They should be competitive and strategic so that participants are motivated by the need for achievement (McClelland, 1961).
13) They should be dynamic so that there are on-going problems to solve (Biggs, 1999).
14) They should have depth so that they have an impact upon participants – satisfying the need for achievement (Herzberg, 1966; McClelland, 1961).

It is not the aim of this thesis to examine the extent to which these goals were achieved or explain the algorithms, documents and simulation interfaces that were formulated in order to strive towards these goals. The design aims were laid down to provide a benchmark against which the author could judge the simulation models that he produced. However, an overview of the simulation algorithm that formed the central model of the marketplaces and consumer buying behaviour is explained briefly in Appendix 9 – Simulation Algorithm Basics. Lainema and Hilmola (2004) describe how participants might learn more from a business simulation if they have the model explained to them whilst using it. Subsequently, overview documents were provided to participants which are shown in Appendix 7 – LIAISE FMCG – The Model Outline, and Appendix 8 – Zapos Commercial Insurance Simulation – The Model Outline.

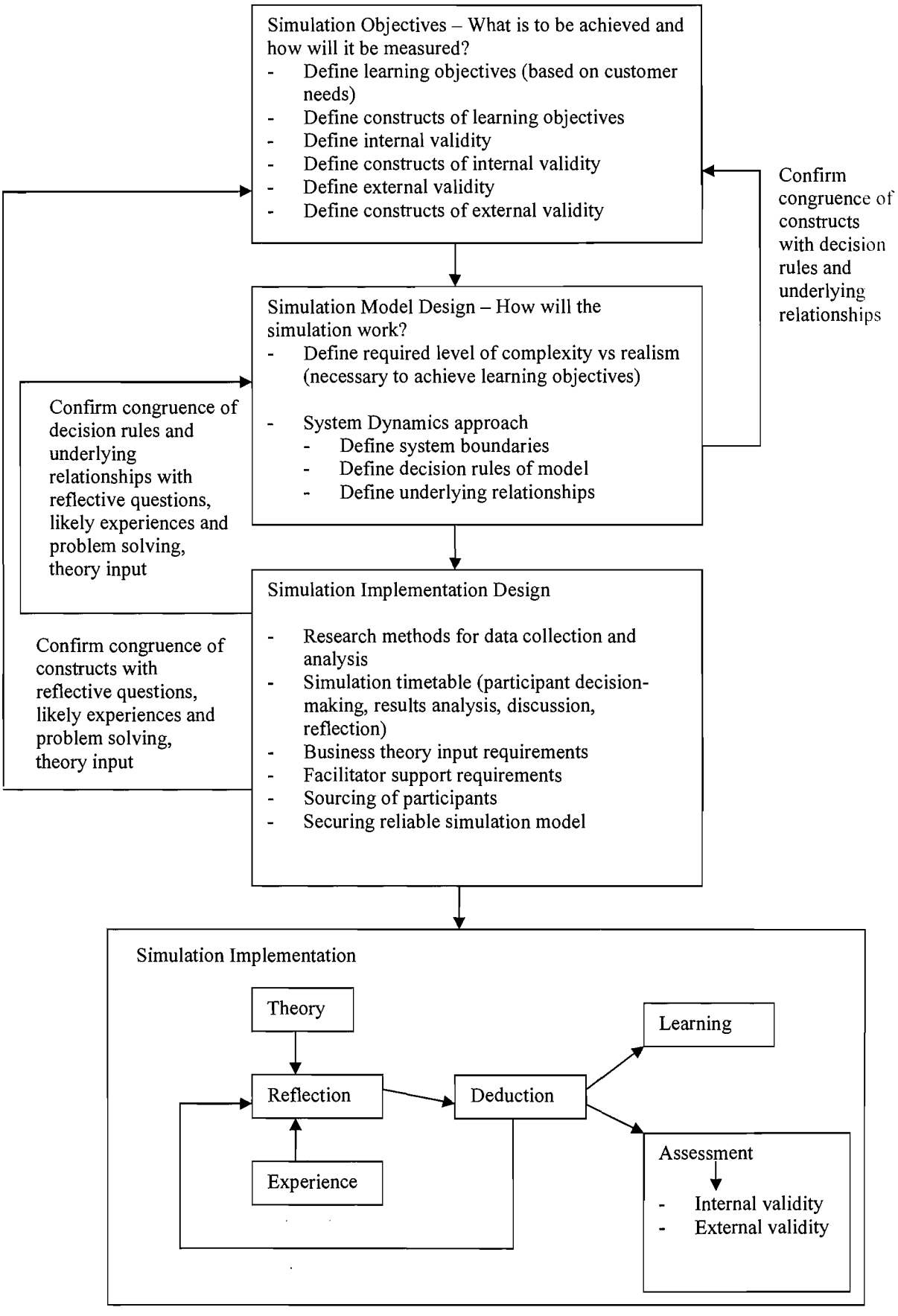
2.3.3.3 Simulation Implementation Design

As shown in the third box of figure 13, Stainton and Johnson (2006) also propose that the simulation implementation needs to be designed too. The simulation timetable needs to be considered carefully allowing sufficient time for results analysis, decision-making, discussion and reflection (Hall, 2004). Within this project, the author judged the time schedule carefully using past experience to assess decision periods. Appendix 2 – LIAISE FMCG Timetable shows the agenda that was used for this particular simulation. It can be seen that more time was allowed at the beginning of the simulation for analysis and decision making but that time allowed per decision period was reduced as the simulation proceeded. This was because participants were able to make decisions faster as the exercise progressed and they became more adept at using the computer interface. There are also reflection periods allowing participants time to reflect on events and relate them to theory (Moon, 1999). From figure 13, material needs to be compiled to provide participants with theory input to assist their thinking processes during the simulation (Honey and Mumford, 1986). This was achieved in three ways. Firstly there was a tutor system that was built into the simulation computer interface. Secondly, background documents were provided to participants. For examples of these see Appendix 5 – LIAISE FMCG Pre-course Briefing, Appendix 6 – Zapos: A Commercial Insurance Simulation, Appendix 7 – LIAISE FMCG – The Model Outline, and Appendix 8 – Zapos Commercial Insurance Simulation – The Model Outline. From figure 13, facilitators need to be trained so that they have sufficient business and technical knowledge to support the simulation and provide feedback to participants (Gosen, 2004, Hall, 2004, Wolfe, 1997). This was not a problem within this project given that the researcher designed, implemented and facilitated the simulations and possessed all the necessary technical and business knowledge. The researcher was capable of this due to past educational qualifications, and experience in management and consulting. From figure 13, the simulation computer model needs to be well-tested and piloted so that it is reliable (Oakshott, 1997). This was an arduous process of designing, programming and testing but the researcher was assisted by past simulation experience and knowledge. From figure 13, research instruments need to be formulated to that data can be collected and analysed concerning the learning effectiveness of the exercise (Bryman and Bell, 2003). Section 2.3.3.1- Simulation Objectives - explained the basis on which research instruments were formulated to provide measures of

validity, and the actual design of the research instruments used in this project is covered in section 2.3.5. Finally, from figure 13, alongside these activities, potential participants need to be sourced. This was not under the auspices of the researcher. Once a case organisation had committed to using a total enterprise simulation it was they who were responsible for organising workshop venues and who would participate. This was not a problem given that the researcher was aware that all participants would be of executive calibre and were highly motivated and business minded.

In this way, from the fourth box illustrated in Figure 13, Stainton and Johnson (2006) speculate that the infrastructure for simulation implementation will be in place enabling participants to make deductions through a process of reflection based upon experiences and management theory. In turn, this may lead to learning for participants and provide feedback for assessing the internal and external educational validity of the simulation. Hence, this section has covered the stages and considerations for simulation design that were addressed and enforced within this project. The next section describes the research method adopted, explaining how the case organisations were identified and brought onboard, and the design of the research instruments used.

Figure 13: Simulation design process



Source: Adapted from Stainton and Johnson (2006: p.105)

2.3.4 Research method

This section will explain how access was gained to case organisations used within this research. It will also describe the research instruments that were used for data collection and their design. The researcher aimed to find case organisations investing in the management skills of their executives and who believed that business simulation might be of benefit for this. The potential participants had to be motivated, wanting to invest time in self-development. In addition, the case organisations needed to support the researcher's validation goals by allowing access to managers and participants so that data could be collected to build and assess the simulations. Sourcing such organisations of people was not easy especially as, for an externally valid investigation (Robson, 2003; Yin, 2003), a variety of executives was required. Also, executives tend to be busy people who cannot spare much time. The author decided to source two types of case organisation for comparison purposes. The first category was executives or participants for whom a simulation that modelled a different industry to their own would be used. The second category was executives who would use a simulation of their own industry. This would provide a variety of participant perspectives for analysis. If possible, the relative impact of the simulation on experienced versus inexperienced managers could also be compared. As explained by Saunders et al (2003), negotiating access to organisations and their staff can be difficult. The research needs to be seen as valuable and the researcher needs to consider whether there may be sensitivity to findings. The researcher needs to allow sufficient time, use contacts, build access incrementally, and establish credibility (Saunders et al, 2003). This approach was used by the researcher within this project and is now described for the two categories of case organisations.

2.3.4.1 Case category One: Participants for whom the simulation did not represent the industry in which they worked

Two main cases were compared and analysed: experienced executives from the aerospace industry and postgraduate management students from Southampton University. These two cases were chosen for several reasons. Firstly, they were available to the researcher given that they were post-management experience and postgraduate students at the university and the researcher was able to negotiate access to them - by offering a simulation course as part of their postgraduate studies. Both data sets comprised motivated and ambitious individuals who possessed a desire to learn and to develop their careers, and were therefore likely to exert suitable effort both during the simulation exercise and whilst assisting with assessment by applying themselves to the research instruments. Secondly, the course was co-ordinated by the researcher within his responsibilities at the university and therefore the researcher had jurisdiction over which research instruments to use. This was not the situation in the other cases – Kraft and QBE - where the research instruments were influenced by the case organisations; given that data was collected subject to permission being granted. This meant that measures could be designed that focused on measurement and construct validity (Robson, 2002) and hence thorough, extensive and rigorous data collection. For example, questionnaires could be formulated that comprised questions specifically addressing issues raised during the literature review and associated with the researcher's past experience – such as complexity, realism, deep learning. These could be supported via open-ended questions addressed through the "reflective accounts" of students, as well as face-to-face and telephone interviews. Thirdly, these two cases enabled external validity (Robson, 2002) to be considered by provided contrasting data sets, given that the students from the aerospace industry were experienced executives compared to the postgraduate management students who had little or no practical management experience; having recently obtained their first degrees. In an attempt to achieve internal validity (Robson, 2002), both sets of students experienced an identical simulation experience and were subsequently subjected to the same research instruments in order to test for effectiveness and learning. The simulation experience was based upon the LIAISE FMCG simulation – see Appendix 2: Liaise simulation timetable, and Appendix 5: Liaise simulation pre-course briefing - which required the participants to run manufacturing and retail companies competing in the Fast-Moving-Consumer-

Goods (FMCG) food and drinks market. The simulation was run over a two-day period during which time two years of trading were simulated; inter-dispersed with theory input provided by the facilitator and participant reflection - supported by feedback from the facilitator. To assess the effectiveness of the simulation delivery, several research instruments were also used in conjunction with each other so that data could be corroborated through triangulation (Denzin, 1978). Questions were posed within a questionnaire that was distributed at the end of the course – see 2.3.5.2 Questionnaire section in this chapter. For a more detailed qualitative analysis, students were required to produce reflective accounts (generally 3000 to 3500 words long) explaining their experiences and relating them to real-world business environments – see 2.3.5.1 Reflective accounts section in this chapter. To further triangulate the data, some participants agreed to be interviewed, which occurred between one and two months after the course – see 2.3.5.3 Semi-structured interviews section in this chapter.

2.3.4.2 Case category Two: Participants for whom the simulation was based upon the industry in which they worked

2.3.4.2.1 Kraft Foods

The reasoning behind the sourcing of aerospace executives and inexperienced management students has been explained. However, given that the LIAISE simulation was of an FMCG market, the testing of the learning validity of this simulation could be further enhanced by running the exercise with participants from the relevant industry - an FMCG industry – these being people who hopefully possess a specific understanding of this business. Running the simulation with managers directly from the FMCG business might further enhance the external validity of the investigation because of their specific knowledge of this environment. It was therefore going to be necessary to "sell-in" the idea of running the LIAISE business simulation to an FMCG business. This was not going to be easy given that the researcher did not have appropriate contacts within this industry and also the potential case organisation would need to invest money and the time of highly-paid executives. Additionally, to attempt to achieve measurement, construct and internal validity (Robson, 2002), the case organisation would also need to give permission for the same set of research instruments to be used with the participants

and the simulation to be run according to the same format. As discovered, this was unlikely given that the participants would need to commit at least 2 or 3 days providing feedback via the research instruments (the reflective accounts were time consuming) – and this was also on top of the 2 days required to participate in the simulation. Also, the case organisation would set their own objectives to be accomplished by the simulation; given that they would only be willing to invest time and money if they felt that the simulation exercise might help them to accomplish certain goals that had been set for their organisation. Therefore, internal validity issues such as a content, format and timetable that were consistent with prior investigations under the jurisdiction of the researcher were less likely. However, following the successes with participant in the aerospace industry, the researcher was introduced to a contact at Financial Times Knowledge (FT Knowledge) – a management training organisation owned by the Financial Times, and a subsidiary of the Pearson Group. Through FT Knowledge, the researcher was able to present the LIAISE Simulation to a Senior HR Manager at Kraft foods, who subsequently agreed to trial LIAISE as part of a management development programme aimed at developing the business acumen of a selection of middle managers. Given that, for reasons explained above, the research instruments were under the control of the case organisation – Kraft Foods – the researcher requested that questions concerning simulation design and relevant learning be included within the questionnaire that the case organisation was to issue following the course. In addition, a number of participants agreed to be interviewed, interviews taking place a few weeks after completion of the simulation workshop. The researcher would have liked to be able to ask for reflective accounts from the participants, but this was deemed not to be appropriate by the case organisation; given that it would consume further valuable time which their management teams could not afford to give. Even so, the questionnaire was useful because the questions were highly valid and the course provided another opportunity to assess the external validity of the simulation with experienced managers sourced directly from the FMCG industry. The course was delivered in March 2006 to 21 middle managers from Kraft foods based in Scandinavia. Their occupations were in marketing, supply chain, operations and financial management providing a broad diversity of knowledge of the FMCG industry and hence a useful test of the simulation validity. Given that the participants were scattered around different Scandinavian countries, the questionnaire was distributed to the participants via the internet site - SurveyMonkey.com - and the participants were given up to a month to complete.

2.3.4.2.2 QBE Insurance

Following the success at Kraft Foods, FT Knowledge introduced the researcher to the Head of Learning and Development at QBE Insurance. Similar to the developments at Kraft, after a period of selling in the idea of business simulation, QBE decided to trial the training medium within one of its management development programmes. QBE decided that a simulation could be used to enhance the business knowledge of a selection of its younger executives who had been selected as potential high-flyers within the organisation. This simulation was to be called Zapos – see Appendix 6: Zapos – A Commercial Insurance Simulation. The researcher was able to build Zapos based upon knowledge of the insurance business that was obtained during a 10-year period working as a management consultant at Zurich Financial Services. However, similar to Kraft, this would be a training course under the jurisdiction of QBE and therefore the researcher was required to deliver in accordance with their objectives, timeframe and evaluation techniques. Therefore, there were several issues that influenced the internal validity (Robson, 2002) of this case compared to the cases of aerospace executives and management students. Firstly, the simulation modelled the commercial insurance business rather than FMCG which, although providing a further source of data for learning validity and external validity, meant that the exercise was not directly comparable. Unlike with the other cases, due to the customer requirement to shorten the exercise, the theory input was limited to half an hour at the start and did not form a central focus of the exercise on an ongoing, reflective basis. Additionally, the exercise was to run over a period of 4 ½ hours rather than the 16 hours that the other three cases lasted, and only a year of business was to be simulated rather than two. Concerning the research instruments, the researcher was permitted to include some questions within the post-course questionnaire that was issued to participants at the end of the half-day simulation exercise. He was also granted permission to contact participants following the exercise in order to arrange post-course interviews. Regarding external validity, the QBE case provided an opportunity to assess whether simulation was deemed to be an effective learning medium within a different marketplace – in this case insurance compared to FMCG.

2.3.5 Research instruments

This section provides justification for the design of the research instruments. It explains how the research instruments achieved their objectives and how issues of bias, validity and reliability were addressed. For triangulation (Denzin, 1978) and corroboration of data, three separate research instruments were used: reflective accounts, questionnaire, and semi-structured interviews.

2.3.5.1 Reflective Accounts

The concept of using reflective accounts as a research instrument originated from the literature on learning processes combined with advice from the research methodology literature. Moon (1999) and Boud et al (1994) postulate that understanding and learning at a deep level can occur because an individual goes through a process of reflection, where the aim is to link related parts together in order to deepen their level of understanding. This process can be inspired by open-ended questions. Hence, the objective of this research instrument was to induce reflection through a series of open-ended questions, and therefore obtain deep qualitative feedback concerning participant understanding. Bryman and Bell (2003) write that open questions enable respondents to *'answer in their own terms. They are not forced to answer in the same terms as those foisted on them by the closed answers'* (p.156). They provide opportunity for unusual answers, do not suggest answers to the respondents, and elicit the respondents' knowledge and understanding (p.156). Robson (2002) explains that a diary can be used as a self-administered questionnaire. They can provide responses to specific questions or be totally unstructured, and are attractive because they generate substantial data. An unstructured variant of a diary is a reflective journal in which participants provide an account of their experiences in a setting or situation and reflect upon the experience (Robson, 2002: 257 – 260). Similarly for Denscombe (1998), diaries enable the researcher to study the thoughts and behaviour of people. They provide a *retrospective account* of things that have happened in terms of decisions made, people involved, important incidents, and personal interpretations (p.216).

Considering issues of construct and measurement validity (Robson, 2002), however, to their detriment, they are very dependent on the respondent's motivation and interpretation, as well as that of the researcher. Within the project, to assist with participant interpretation of questions, the researcher was careful to explain the questions clearly to the participants and to help clarify their understanding of the questions. Also, the questions were first piloted on a set of management students to ascertain whether they were understandable by participants and could elicit useful information. The feedback from this process was used to refine the wording until participants demonstrated that they had clearly understood the meanings. Open questions were used to provoke free-thinking within participant reflection and were designed based upon the past experience and simulation expertise of the researcher. Questions were open-ended and general to avoid influencing the response.

The questions acted as a guide to participant reflection, although the open nature of questions gave the participants freedom to generate ideas and explanations in whatever directions seemed appropriate to them. Relating to motivation, Denscombe (1998) points out that open questions are more likely to elicit rich and complex views but require greater effort on the part of the respondent and produces raw data that is time-consuming to analyse. In this project, respondents were motivated to apply themselves because they received a mark for their work which contributed towards their degree grades. Asking specific questions at set times has been shown to be effective but still prone to bias (Robson, 2002). Denscombe (1998) supports this perspective stating that they are not a statement of fact, just a version of things from the writer's perspective. In this project, by analysing the perspectives of a broad set of participants frequency of trends and patterns could be ascertained such that deductions were representative of the overall opinion. Robson (2002) adds that there can be mis-reporting to please the enquirer or to enhance the position of the author. Within this project, there were no ulterior motives regarding potential mis-reporting given that the onus was upon the participants to explain and relate their understanding. The researcher was able to assess whether explanations were over-exaggerated or inaccurate based upon the fact that he designed the simulation and observed the events. Strauss and Corbin (1998) describe how active participation of the researcher can assist researcher understanding. Also, the wording of questions required respondents to justify their answers so that any fabrication of participant understandings or inaccurate accounts would be obvious.

The issue of reliability (Robson, 2002) of this research instrument was tackled by striving for consistency. All respondents experienced the same simulation exercise – concerning theory, format and timetable – and were asked to write the same number of words (3500 in total) in response to the same set of questions.

The reflective account research instrument used is illustrated in Appendix 1: Open-ended questions for reflective accounts. In summary, the first question invites participants to explain their business understanding that they derived from the simulation in terms of what happened and why regarding key business drivers. This relates most closely to the concept of internal educational validity (Fernstein and Cannon, 2001). The second question asks participants to relate their business understandings derived from the simulation to the real-life management environment. Hence, this question most closely addressed the concepts of external educational validity and external representational validity (Fernstein and Cannon, 2001). Therefore, the reflective accounts aimed to elicit subjective viewpoint that were to be interpreted in light of the theoretical propositions (Yin, 2003) and research question based upon an interpretivist paradigm (Bryman and Bell, 2003).

2.3.5.2 Questionnaire

A questionnaire was used to quantify participant perspectives concerning beneficial design considerations for total enterprise simulation, understanding derived from the simulation, and the relevance of learning to the real-world business environment. The questionnaire was used in its entirety for assessing the views of aerospace executive and management student case organisations. Due to accessibility and priority constraints imposed by the other case organisations - see 2.3.4.2.1 Kraft Foods and 2.3.4.2.2 QBE Insurance – only the parts concerning learning and the applicability of learning to the real world were used with theses organisations.

According to Saunders, Lewis and Thornhill (2003), questionnaires can be an important part of the case study research strategy. The general technique requires that people individually respond to a pre-determined set of questions in a certain order. One area of difficulty is ensuring that the questionnaire collects the precise data to answer the research question. Questionnaires work best for descriptive or explanatory research (to

test out theories) where a more standardised and closed form of questioning can be employed (Saunders et al, 2003, p.281); Bourque and Fielder (1995). This is because the questions can specifically address cause-and-effect issues.

The questionnaire was therefore created to quantify viewpoints regarding the theoretical propositions - to support or refute the theoretical propositions. The questionnaire is illustrated in Appendix 3: Questionnaire, and comprises a list of closed questions based upon a 5-point Likert scale (Saunders et al, 2003) as well as open questions inviting further comments. Regarding the rating scale, opinion data was collected using a Likert-style rating scale such that respondents could decide how strongly they supported a statement on a 5-point rating scale. A semantic differential scale used to judge the strength of respondent attitudes was felt not to be appropriate (Saunders et al, 2002: p.297) given that a Likert scale allowed specific readings to be taken according to the five-point scale.

Question 1 considers the issue of designing for validity addressed through theoretical proposition 4 - key design factors influence potential learning concerning business management. To summarise, it assesses whether understanding from the simulation was assisted by a range of factors: management knowledge and experience; individual and team factors; activities during the simulation; and simulation design and usage.

Question 2 seeks perspectives concerning internal educational validity as described by theoretical proposition 1 - participants are able to learn about business management from simulation. They are able to understand the reasons for business results. Issues such as market developments, financial impacts, project issues and team effectiveness are considered. Questions 3 and 4 address external educational validity and, from a learning perspective, external representational validity. They seek viewpoints concerning theoretical propositions 2 and 3: theoretical proposition 2 – the simulation possesses external representational validity; and theoretical proposition 3 – participants are able to learn about business management from simulation. Specifically, enquiring whether attitudes are influenced regarding business management in the real-world in key areas such as strategy, marketing, finance, projects, leadership and teamwork.

Issues of validity and reliability were considered during the questionnaire design. Concerning construct validity, the questions were designed carefully, with a clear layout accompanied by lucid explanations of contents and purpose (Saunders et al, 2003). This was achieved by piloting the questionnaire with students, collecting feedback from them

and altering the wording and layout until students reported that they were able to understand the questions clearly.

'Prior to using your questionnaire to collect data it should be pilot tested. The purpose of the pilot test is to refine the questionnaire so that respondents will have no problem in answering the questions and there will be no problems in recording the data' (Saunders et al, 2002: p.308).

Other validity issues advised by Saunders et al (2002) were applied. Concerning wording, questions were worded to collect data at the right level of detail and provide answers to the investigative questions. Wording was simple such that respondents might have a clear and common understanding of meaning. Following syntax recommendations, questions were short, asked only one question at a time, and avoided confusing negatives and double negatives. Care was taken not to make questions leading or imply answers and a residual "not at all" category (Bourque and Fielder, 1995: p.60) was included. The advice of Bourque and Fielder(1995) was adhered to such that the researcher was careful not to project personal biases into the wording of questions and answer categories (p.41), and also to omit adverbs like "usually" which have different meanings to different people (p.46).

The questionnaire was filled out by participants in the presence of the researcher, who if needed, could provide further explanation as required. Bourque and Fielder (1995) state that questionnaires can be administered in-group settings with the advantage that a supervisory person is available to instruct and answer questions (p.4). Measurement validity was aided by a 5-point rating scale such that the strength of opinion could be assessed. However, relativism (Johnson and Duberley, 2000) suggests that opinions are relative to existing attitudes, experience and knowledge such that strength of opinion will in itself be subjective. One individual might interpret a strong feeling as stronger than another individual. For this reason, it was necessary to distribute the questionnaire broadly so that the perspectives of many individuals could be amalgamated and typical opinions could be ascertained. For this, sampling was not a consideration given that the aim was to invite all participants to act as respondents within the data collection process (Saunders et al, 2003).

Saunders et al (2002) recommend that, as far as possible, a coding scheme should be established prior to data collection and incorporated into the questionnaire. Hence, the 5-point rating scales were assigned a number 1 to 5 which was used to perform

statistical analysis upon the data to summarise the responses - The numbering system was 1=not used/useful, 2=quite useful, 3=useful,4= very useful, and 5=extremely useful.
For reliability, where possible several questions were included covering the same issues (Saunders et al, 2002) so that they could be cross-checked. For example, participants were asked whether team effectiveness had helped them to understand the simulation, and subsequently asked whether their performance could be attributed to team effectiveness.

Hence, the questionnaires enabled all of the theoretical propositions to be assessed quantitatively and led to an opinion rating concerning the detailed elements associated with the theoretical propositions. To be valid and reliable, the questions needed to be structured and simple and therefore did not achieve the same level of depth as the open-ended questions of the reflective accounts. However, they did provide a numerical rating of the extent to which factors had influenced effects and the extent to which effects had resulted. They therefore enabled a positivistic (Bryman and Bell, 2003) assessment of the theoretical propositions to be conducted.

2.3.5.3 Semi-structured interviews

Semi-structured interviews were conducted four to six weeks after completion of the simulation exercise. The main focus was to test for transformational learning (Moon, 1999); to ascertain whether there had been a change in attitude or behaviour as a consequence of participation in the simulation exercise. This was achieved through an open-ended question addressing this issue, followed by free-format discussion. Denscombe (1998) proposes that interviews are a good way to collect data that has depth. Yin (2003: p.90) supports this view, suggesting that interviews are an essential source of information within a case study, with questions being fluid and open-ended, rather than rigid - although it is important to pose questions in an unbiased manner. The researcher believed that a semi-structured interview would yield useful data more effectively than other forms such as structured or unstructured. In a semi-structured interview, the researcher explores a list of themes and issues using a pre-determined list of questions that do not have to be adhered to rigorously. This provides the researcher with greater flexibility relative to structured interviews because issues can be focused upon as they emerge (Saunders et al, 2003). In a structured interview, questions and

responses are pre-determined so that the researcher is, in effect, administering a questionnaire on an individual basis (Saunders et al, 2003). As a questionnaire had already been designed and established as an effective research instrument for collecting responses to simple, structured questions, this type of research instrument would replicate rather than contribute to data collection.
With unstructured interviews, there is not list of questions, just ideas to be explored. This is the most flexible technique but the quality of resulting data is dependent upon the expressive abilities of the interviewee and the interaction between the researcher and the interviewee (Saunders et al, 2003). The researcher chose semi-structured interviews because a blend of flexibility and structure was required. There was a pre-determined question which was elaborated upon in response to answers provided by the interviewee. The interviews were either face-to-face and telephone (Saunders et al, 2003) and the interview question was sent in advance via e-mail. It was, however, hard to secure interviews with busy respondents.

Considering reliability and bias, the interviewer was careful not to infer answers to questions and hence bias responses. Validity may have been a problem given that people may not have wished to be critical of the researcher's work when in a face-to-face situation. However, the researcher did actively encourage criticism. Also, the interview was tape recorded (Saunders et al, 2003) so that the researcher could give his full attention to the interviewee. Bryman and Bell (2003) describe the concept of "credibility" in which research findings are submitted to the participants originally studied in order to confirm that the researcher's understanding of the participant's social world has been sufficiently accurate. Interviewees were therefore invited to comment on copies of the transcripts of their interviews.

Therefore, semi-structured interviews provided a further source of qualitative evidence which could be used to further corroborate data investigating whether the simulation had resulted in transformative learning (Moon, 1999). The results were analysed and interpreted, and patterns were deduced. As with reflective accounts, this research instrument also conformed to the interpretivist paradigm (Bryman and Bell, 2002).

2.3.5.4 Participant observation

Yin (2003) defines participant observation as when the researcher collects evidence by taking on roles within the case study situation and even participating in the events being studied. It can provide opportunity to *'perceive reality from the viewpoint of someone "inside" the case study rather than external to it'* (p.94) – Mainly, in this case, observations of the actual participants. In the case of the simulation exercise, the researcher participated in the role of a facilitator, providing technical and business advice in response to participants' questions – but still leaving the decision-making to be made by the participants. Hence, in this way, the researcher was able to form a clearer picture of the developments that occurred. Observation was a research instrument used by the researcher so that he could reflect on team dynamics, a factor that may have influenced participant understanding derived from the simulation. If the working dynamics between participants proved to be unproductive, then it was important to observe this occurring. This research instrument also conformed to the interpretivist paradigm (Bryman and Bell, 2002).

2.3.5.5 Experiment

Experiments can be used to test a hypothesis. There is control of extraneous variables and manipulation of key variables so that the effects of changes can be investigated. Participants are given different versions of the exercise to see if they react differently (Saunders et al, 2003). The literature review stressed that the learning effectiveness of a business simulation can be seriously impeded if the simulation is too complex and there is insufficient time to reflect upon and make decisions (Alessi, 1988). However, realism might improve the learning effectiveness of simulation (Burgess, 1995) – although increased realism might result in greater complexity. Fortunately, the circumstances at one of the case organisations, QBE Insurance, provided the opportunity to conduct a simple experiment regarding these issues. QBE decided that they wanted to run the simulation within a tight 4 ½ hour time frame but did not want to compromise on the realism of the business simulation – They wanted it to reflect the real-world business environment. Therefore the simulation was to initially be as complex as possible and squeezed into a tight timeframe; both of which are design characteristics that, according

to the literature review (Alessi, 1988) can potentially damage the learning effectiveness of the simulation. QBE adopted the attitude that they would start complex, review the comments made by participants and then reduce the complexity for future participants. Hence the key variable (the independent variable) was simulation complexity, and the dependent variable was perception of participant learning. A complexity experiment was conducted in which three distinct sets of insurance executives participated in three commercial insurance simulation workshops using a complex and representative simulation model of the insurance business. The complexity of the simulation was decreased between consecutive workshops. In the first workshop participants were required to manage up to 288 target markets, and received no facilitator feedback concerning business decisions. In the second workshop the number of potential target markets was reduced to 144, but still no facilitator feedback was provided. In the third workshop, the number of potential target markets stayed at 144, but this time facilitator feedback on decisions was provided. At the end of each workshop, the participants were asked to rate the simulation as a learning medium (1 equals "poor"...5 means "excellent") and to optionally make comments.

This experiment was not a main topic of enquiry within this investigation but provided useful further evidence to triangulate (Denzin, 1978) the design validity data produced via the questionnaire. From a paradigm perspective, the experiment provided another positivistic approach within the investigation given that it sought to relate a dependent variable to an independent variable (Bryman and Bell, 2003).

2.3.6 Avoidance of bias

Denscombe (1998) highlights the importance of objectivity on behalf of the researcher when using a research method. Objectivity means that there must be minimal bias, or at least explicitness concerning biases that exist. *'The analysis of qualitative data calls for a reflexive account by the researcher concerning the researcher's self and its impact on the research'* (p.273). Bryman and Bell (2003) possess a similar viewpoint acknowledging that research cannot be value free and the importance of being self-reflective (p.27). Within this project, the researcher tried to avoid biasing the data by recognising and addressing the potential causes. The approach was to review the principles of validity and reliability regarding research design and research instruments

and apply these within the investigation. The application of these principles has been described in detail during this chapter under the sections on research design and research instruments.

Researcher error and bias during data collection and analysis was a major consideration (Saunders et al, 2003). Researcher error was not possible during qualitative data collection because data was all written directly by respondents. There was the possibility of missing data entries within the questionnaire which the researcher would need to account for in statistical calculations by excluding that respondent from the analysis for that particular data item. The possibility of extreme values was avoided through the use of 5-point likert scales. Researcher bias was not a factor when analysing the quantitative data provided by the questionnaires because established descriptive statistical techniques (Shao, 1976) were applied and interpreted carefully. However, researcher bias was possible when analysing the qualitative data within the interviews and reflective accounts. This was addressed by objectively searching for explanations supporting or refuting the theoretical propositions and triangulating (Denzin, 1978) explanations with the quantitative conclusions derived from the questionnaire. The researcher aimed not to over-state the value of findings (Saunders et al, 2003), and to draw conclusions transparently so that it was clear how deductions related to data.

2.3.7 Confidentiality

Researchers must recognisé the ethical rights and interests of participants (Saunders et al, 2003). Transgressions of the right to privacy are not regarded as acceptable research practice, but this is only a particular issue if the subject matter is sensitive to participants (Bryman and Bell, 2003: pp.539 – 541). Within this project there were no ethical conflicts. Organisations and their employees co-operated for their own benefit or on the basis that they believed they might benefit from participation. They were not concerned about anonymity or confidentiality. Participants co-operated of their own volition and could choose to opt out if they so wished. The stance taken was to inform participants that their data would form part of a research study unless they requested otherwise, but as stated, there was no reason to abstain given that participants were assessing the simulations, rather than being assessed themselves.

2.4 Data analysis

The aim of this section is to describe how qualitative and quantitative data collected to assess simulation validity was analysed. As can be seen, methods recommended by established research authors were employed.

2.4.1 Analysing Qualitative Data

The process of qualitative data analysis applied to this project involved analysing reflective accounts and interviews looking for regularities. The aim was to identify a structure for the observed phenomenon, and hence gain insight and understanding (Saunders et al, 2003). More specifically, to establish the degree of understanding derived from the simulation, and the relevance of that understanding to the real-world business environment. Miles and Huberman (1994) base their analysis around coding systems – descriptive and pattern codes. Codes can be created as a "start list" prior to the field work and then amended and added to during subsequent analysis. Codes are keyed to the research question, and have clear definitions. Hence, this was the approach adopted by the researcher.

Denscombe (1998) describe three well known software packages for analysing qualitative data - Ethnograph (http://qualisresearch.com), Nud.ist Nvivo (http://www.qsr.com.au) and ATLAS.ti (http://www.atlasti.com) – in addition to word processing packages. However, the extent to which these aid qualitative data analysis is a matter of controversy. It is argued that they help manage data and to undertake analysis, but there is a danger that mechanistic procedures kill off the art of intuition necessary to analyse and interpret qualitative data; and induce enlightenment. Through 'chunking and coding', text can become decontextualised. The author considered using Nvivo for qualitative data analysis but decided that it was not the best way to proceed. The reflective accounts were over 200 000 words long and were in hardcopy form given that they had been written by participants. The researcher felt that the time required to type and load this data into the computer system would be better spent reading and understanding the data carefully given that this was the essential aim of the analysis.

Before the analysis, a list of possible codes was formulated that would relate the data to the theoretical propositions. Because the theoretical propositions (Yin, 2003) had been defined clearly early in the investigation, the coding system was in fact a process of categorising evidence within the qualitative accounts according to the detailed issues listed under theoretical propositions 1 to 4 – see Appendix 4: Theoretical propositions. The reflective accounts and interviews were analysed until analytic generalisation (Yin, 2003) was achieved. This means that sufficient evidence had been formulated for the researcher to be able to summarise the perspectives of the participants. In this way, the approximate proportions of participants who shared a similar view could also be deduced. Hence, the process was to attribute a class of phenomena to a segment of text – defined as descriptive coding (Miles and Huberman, 1994: p.57). For example, a participant might describe the importance of forecasting demand within the supply chain, an issue within theoretical proposition 1 – that business results are affected by certain market drivers. Many participants were able to identify chains of events associated with the theoretical propositions. For example, in real-world business situations, if you do not communicate your strategy clearly with suppliers then they may not invest in capacity and products into the future - Consequently, it may be difficult to deliver according to customer requirements. These were examples of understanding that Miles and Huberman (1994) define as illustrating a pattern that has been discerned in local events and relationships – causal links (p.69).
Miles and Huberman (1994) describe a similar process as the writing of memos;

'*Memos are primarily conceptual in intent. They don't just report data; they tie together different pieces of data into a recognisable cluster, often to show that those data are instances of a general concept*' (p.72).

However, it is important to recognise that data collection is a selective process where it is impossible to source complete information – there will always be some areas missing (Miles and Huberman, 1994: p.56). Therefore, this was a process of interpreting the reflective accounts and interviews. It involved sifting through many thousands of words in order to formulate generalisations, assessing the extent of agreement for these and recording supporting or refuting examples and quotations.

2.4.2 Analysing Quantitative Data

The 5-point likert scale used in the questionnaires produced numerical ratings of participant opinions from which deductions were to be drawn. Hence, descriptive statistics (Shao, 1976) were used to summarise these quantitative data. The data were entered into an Excel spreadsheet which the researcher used to calculate statistical summaries. The summaries were recorded in tabular form within the Excel spreadsheet and then transcribed to tables illustrated within the Data Analysis – Results section of this thesis, where the numerical ratings were summarised as their qualitative equivalent. The statistical calculations employed were the mean, mode, median, lower quartile, lowest and highest. These were deemed to be most useful for several reasons.
The mean, mode and median provided a measure of the average view. The mean provided an indication of the expected view and the mode showed the view that was expressed most often and therefore gave an indication of the "typical" view.
The median showed the "middle" view being the viewpoint corresponding to 50 percent of the cumulative frequency of all viewpoints from a cumulative frequency distribution of viewpoints (Shao, 1976). Applied to this investigation the median showed the most critical view expressed by the most positive 50% of respondents. These summaries were informative in themselves but analysis was enhanced by measures of spread - lowest, lower quartile, and highest. The lower quartile showed the viewpoint corresponding to 25 percent of the cumulative frequency of all viewpoints from a cumulative frequency distribution of viewpoints (Shao, 1976). Applied to this investigation, the lower quartile showed the most critical view expressed by the most positive 75% of respondents. Similarly, the lowest showed the most critical view and the highest the most positive view. These measures were used in conjunction with each other to formulate an overall understanding of the student perspectives.

2.5 Research Schedule

Figure 14: Research schedule

Start Date - June 1st, 2004

Scheduled Submission - January 31st, 2007

Activity	2004	2005	2006	2007
Literature Review				
Research Training				
Research Methodology				
Pilot Studies: Simulation design and evaluation				
Data Collection: Post-graduate Management Students				
Data Collection: Aerospace Executives				
Data Collection: Executives from Kraft Foods				
Data Collection: Executives from QBE Insurance				
Data Analysis				
Conclusions				
Final write up and submission				

The research schedule for this project is summarised in Figure 14: Research Schedule. The schedule was formulated as an initial plan that was amended and emerged more clearly over time. As highlighted by Saunders et al (2003), the researcher had to co-ordinate the project in order to achieve the research aims but limited by resource constraints such as time, money and opportunities. Hence, this is why the more uncertain aspects such as securing case organisations emerged gradually over time. The literature was ongoing over a period of two years from June 2004 to June 2006. Research training was conducted during the first half of 2005 such that the research methodology could be constructed and shaped. This was an ongoing process during the second half of 2005 and the first half of 2006. Concurrent to this, the activities of data collection and analysis could occur. Pilot studies were conducted in order to test out the design of the simulation implementation and research instruments which were reviewed and enhanced accordingly. Documentation and evidence was stored and analysed on an ongoing basis. From the beginning and throughout the project several drafts of the major chapters were drawn up and admitted to the project supervisor for feedback. Review meetings with the project supervisor occurred six weekly after which minutes were drawn up and signed off by both the supervisor and the researcher. Based upon the

data analysis, conclusions were drawn and these, together with the draft chapters formed the basis for the final write up of the thesis and subsequent submission.

2.6 Research Methodology Summary Related to Data Analysis-Results

The next Chapter - Data Analysis-Results - analyses the data that was collected through the application of this research methodology and evaluates the theoretical propositions. The structure of the Data Analysis - Results chapter is summarised in Figure 15: Flow chart of data analysis-results, such that it complies with the research methodology explained in this chapter. As shown, the starting point is to reiterate the aim of this research investigation - the research question "To what extent can total enterprise simulation be validated?". For this, four main interrelated sub-categories of investigation are considered: internal educational validity, external educational validity, external representational validity and design validity.

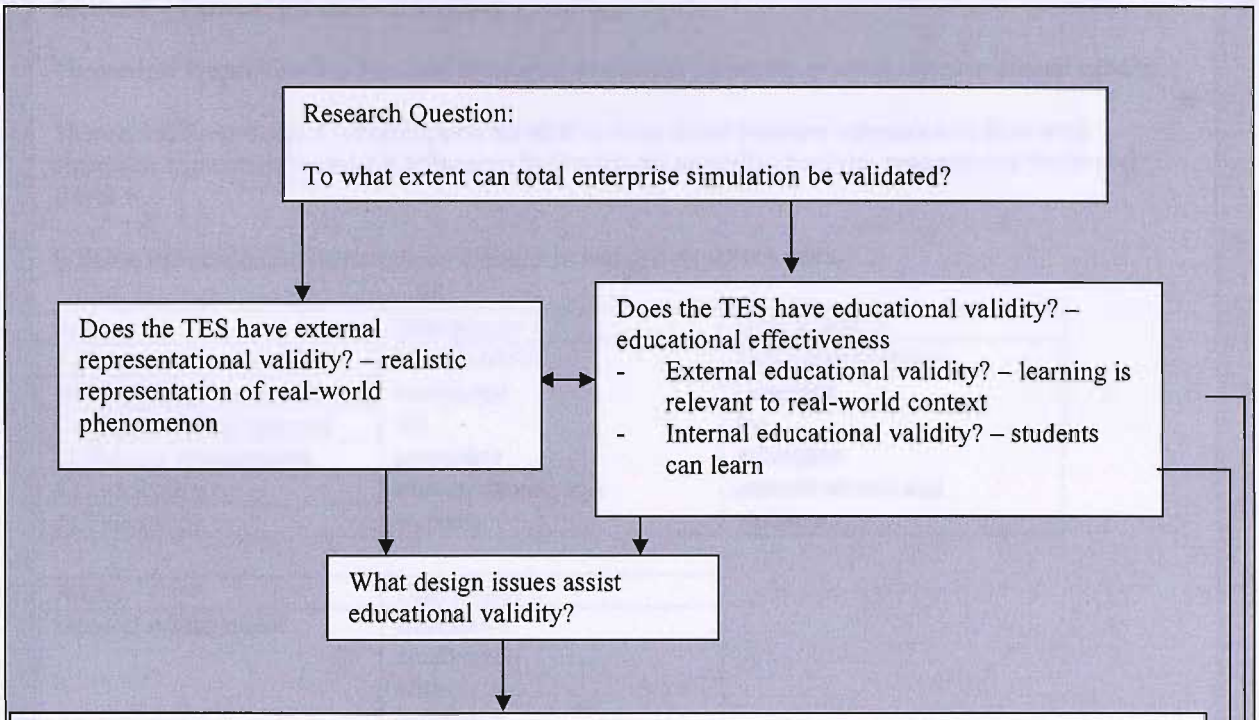
The main focus of this research is the educational validity – or learning effectiveness - of TES, which can be categorised as internal or external (Fernstein and Cannon, 2001). Internal educational validity considers whether students can learn from the simulation experience and is addressed in Section 1 – Internal Educational Validity. The Data Analysis-Results chapter investigates student understanding resulting from the simulation exercise by considering theoretical proposition 1 – participants are able to learn about business management from simulation because they show understanding of the reasons for business results. Four main areas of learning are assessed using two data sources: questionnaires and reflective accounts. The four areas were built into the simulation because they form core concepts within the discipline of business management, and are the understanding of: market developments, financial impacts, project issues and team effectiveness. For these, data are collected from two categories of participant cases: aerospace executives and management students. This is because they provide contrasting perspectives comparing experienced business executives with inexperienced students.

Section 2 – External Educational Validity considers whether there is learning that is relevant to real-world contexts. As indicated in figure 15, by definition, external educational validity also relates to external representational validity – that the simulation provides a realistic representation of the real-world phenomenon (Fernstein and Cannon, 2001) – since learning about the real world requires a representation of the real world. Hence theoretical proposition 2 suggests that the simulation possesses

external representational validity. Related to this, theoretical proposition 3 asks whether the simulation influences attitudes regarding business management in the real world; and hence possesses external educational validity. Here, two categories of participant are assessed: i) those for whom the simulation represents an industry in which they do not work, and ii) those for whom the simulation represents an industry in which they work. This provides a cross-case synthesis (Yin, 2003) and hence enhances the external validity of the investigation. Taking the former category, two participant cases are examined – aerospace executives and management students – using three research instruments: questionnaires, reflective accounts and interviews. For completeness, a broad range of management disciplines - strategy, marketing, finance, projects, leadership and teamwork - are explored. A similar analysis is achieved for "participants working within the same industry as that being simulated", although the busy executives who provided data were unable to commit time to compile reflective accounts, so the analysis is based around questionnaires and interviews. As shown in figure 15, executives are sourced from two industries: fast-moving-consumer goods and commercial insurance. This is because these are industries in which the author had previously worked and so possessed the appropriate level of business understanding necessary to build computer simulation models of the respective businesses (Goosen et al, 2001).

For total enterprise simulation to possess educational validity – or educational effectiveness – it must be designed such that it can facilitate learning. Therefore a precursor to educational validity is design validity (Forrester, 1973). This leads to the issue of establishing design issues that might assist educational validity. Hence, Section 3 – Design Validity, explores theoretical proposition 4 – key design factors influence potential learning concerning business management. Two sources of data are used to consider four main design factors: business and management knowledge, individual and team factors, personal activity during the simulation, and simulation design and usage. These key design factors were identified from ideas that were formulated during the literature review and from prior simulation experiences of the author. Considering the data sources, the first source of data is a questionnaire that compares the views of two participant cases: aerospace executives and management students. The second source of data is an experiment conducted at QBE Insurance which aims to explore whether simulation complexity affects learning potential. In all sections, findings are compared to literature and conclusions are drawn.

Figure 15: Flow chart of data analysis – results



Section 3 – Design Validity.
Addresses Theoretical Proposition 4 - Key design factors influence potential learning concerning business management.

Factor	Data source 1	Data source 2
A) Business and Management Knowledge	Questionnaire completed by aerospace executives and mgt students	Complexity experiment at QBE
B) Individual and Team Factors		
C) Personal Activity During the Simulation		
D) Simulation Design and Usage		

Factor	Some Literature Sources
A) Business and Management Knowledge	Stretch, 2000; Hall, 2001
B) Individual and Team Factors	Biggs, 1999
C) Personal Activity During the Simulation	Knowles, 1980
D) Simulation Design and Usage	Gosen and Washbush, 2004

Section 1 – Internal Educational Validity.
Addresses Theoretical Proposition 1 – Participants are able to learn about business management from total enterprise simulation because they show understanding of the reasons for business results.

Area	Data source 1	Data source 2
A) Market developments	Questionnaire completed by aerospace executives and mgt students	Reflective accounts compiled by aerospace executives and mgt students
B) Financial impacts		
C) Project issues		
D) Team effectiveness		

Some literature sources: Senge, 1992; Faria and Wellington, 2004; Moon, 1999; Dewey, 1933; Kim, 1993; Elgood, 1993

Figure 15: Flow Chart of Data Analysis – Results (Continued)

Section 2 – External Educational Validity

Theoretical Proposition 2 – The total enterprise simulation possesses external representational validity.

Theoretical Proposition 3 – Participants are able to learn about business management from total enterprise simulation because it influences their attitudes regarding business management in the real world :-

i) When the simulation represents an industry in which they do not work.

Area	Data source 1	Data source 2
A) Strategic management B) Marketing management C) Financial management D) Project management E) Leadership F) Teamwork	Questionnaire completed By aerospace executives and mgt students	Reflective accounts compiled by aerospace executives and mgt students

Area	Data source 3
General management	Interviews conducted with aerospace executives and mgt students

ii) When the simulation represents the industry in which they work.

Area	Data source 4	Data source 5
General management	Questionnaire Completed By FMCG Executives	Interviews conducted with FMCG Executives

Area	Data source 6	Data source 7
General management	Questionnaire Completed By Insurance Executives	Interviews conducted with Insurance Executives

Some literature sources: Moon, 1999; Habermas, 1974; Hely and Jarvis, 1995; Fernstein and Cannon, 2001; Gold and Prey, 2003

As shown in figure 16: Summary of data sources, in total questionnaires were obtained from 21 of the aerospace executives, 42 management students, 15 executives from Kraft Foods and 12 from QBE Insurance. Reflective accounts were submitted by 44 aerospace executives and 24 were produced by the management students. Interviews were conducted with 9 aerospace executives, 34 management students, 3 executives from Kraft Foods and 11 from QBE Insurance.

Figure 16: Summary of data sources

Case	Questionnaires	Reflective Accounts	Interviews
Aerospace Executives	21	44	9
Postgraduate Management students	42	24	34
Kraft Food Executives	15		3
QBE Insurance executives	12		11
Total	90	68	57

With the exception of the interviews, the sample sizes were the sizes shown because this was the size of the population. All students who attended the course responded to the questionnaires (a response rate of 100%); given that they filled them out immediately following the end of the course, so there was no issue concerning missing data items (Saunders, Lewis and Thornhill, 2003). Likewise, all aerospace executives and postgraduate management students produced reflective accounts (a response rate of 100%); the motivation for which may have been the fact that this assignment was a requirement of the management degree courses they were studying. For the aerospace executives, there were 44 reflective accounts compared to 21 questionnaires because the reflective accounts were collected from two separate courses whereas the questionnaires were only collected following the second of the two courses. This is because a pilot version of the questionnaires was used during the first course, and the anomalies were

worked on so that the questions posed were as effective as possible ready for the second course – as explained in the research methodology section. For the management students there were 42 questionnaires submitted compared to 24 reflective accounts because these students were permitted to work in teams in order to write up their reflective accounts – given that they had high workload placed upon them by other subjects studied as part of their degree courses. Except for QBE insurance, the response rate for interviews was lower than for questionnaires due to the fact that participants were not required to give an interview and did so voluntarily. The researcher was able to achieve a good response rate for interviews (92%) with QBE executives by attending a follow-up workshop where all the participants were present. However, the response rate for interviews amongst other participants was much lower – aerospace executives (43%), management students (81%), and Kraft executive (20%). This was due to the fact that executives were generally not so readily accessible, being busy people operating around the world within dispersed work places.

2.7 Conclusion for chapter 2: Research Methodology

This chapter has explained and justified the research methodology that was applied to this research project. The research methodology was formulated based upon past experience of the researcher in the use of total enterprise simulation as a vehicle for management education, combined with recommended practices within research methodology literature. Section 2.1 defined the research question. It explained how the theoretical propositions provided suppositions to be supported or refuted, and hence criteria against which the research question could be addressed. From this, section 2.2 considered research paradigms epistemologically and ontologically and provided justification for the paradigm stances adopted by this research. Next, section 2.3 explained how the case study design suited this investigation, its paradigm and described how issues of case study validity and reliability were addressed. Similarly, simulation implementation design and research instrument design were explained, related to the paradigm, and their validity and reliability justified. The setting up of case organisations was also described. Section 2.4 covered the processes and approaches used to analyse both the qualitative and quantitative data. Finally, section 2.5 - Research schedule - described the activities completed within this project and the order in which they took place.

To summarise, the paradigm employed was principally epistemologically interpretivist given that knowledge was formulated through subjective viewpoints, and ontologically constructionism given that views were socially constructed by the participants as a result of simulation exercises that were run within case organisations. However, within the research strategy, the formulation of theoretical propositions was positivistic although it was recognised that these were based upon the researcher's subjective interpretations and not upon established theory; and therefore arguably induced through interpretivism. Concerning research instruments, the reflective accounts and interviews were interpretivist although the questionnaires and experiment were positivistic. Hence, the paradigm was mainly interpretivist although there were also positivistic elements.

Hence, in this way, the research methodology for this project was established.

Chapter 3: Data Analysis - Results

Introduction

As can be seen, the following tables compare the questionnaire results of aerospace executives with those of management students. The questionnaire consisted of a 5-point Likert scale ranging from "not used/ useful" through to "extremely useful", or "always unclear" to "apparent always". Some questions had a 3-point Likert scale – "no", "in some area", and "in many areas". Respondents were asked to tick appropriate boxes dependent upon their views. For analysis, a numbering system was allocated to each box such that a score could be calculated for each sample of respondent – i.e. management students and aerospace executives.
The numbering system was 1=not used/useful, 2=quite useful, 3=useful, 4= very useful, and 5=extremely useful, or 1=Always unclear, 2=Apparent sometimes, 3=Largely apparent, 4= Apparent, 5= Apparent always. For the 3-point scale the numbering system was 1= no, 2= in some areas and 3= in many areas. The resulting scores were calculated using simple descriptive statistical methods (Shao, 1976). It can be seen from the tables that the statistical calculations employed are the mean, mode, median, lower quartile, lowest and highest. These were deemed to be most useful for reasons explained in 2.4.2 Analysing Quantitative Data.

It is useful to ascertain the view that was shared by most of the participants "the view expressed most often" as a measure of general reaction. The average view shows the typical view and it is useful to compare this view with the most critical view held by the most positive 50 percent of respondents and the most positive 75 percent of respondents; to ascertain how close these are to the typical view or whether there is a diverse spread of opinion. The most critical view and most positive view give an indication of the extreme viewpoints held by participants, and therefore tended to be included for interest rather than for ascertaining any particular trend.

Figure 17: Theoretical Proposition 1

Theoretical Proposition 1 – Participants are able to learn about business management from simulation. They are able to understand the reasons for business results (internal educational validity):-

1. *The reasons for market developments*
2. *The financial impacts of decisions*
3. *The effects of project issues*
4. *The impact of team effectiveness*

As shown in figure 17, theoretical proposition 1 addresses the issue of internal educational validity, proposing that participants are able to learn about business management from total enterprise simulation. More specifically, they are able to understand the reasons for business results with particular emphasis upon four key influential management areas: the reasons for market developments, the financial impacts of decisions, the effects of project issues, and the impact of team effectiveness.

As explained in figure 15, this issue was investigated using two research instruments - questionnaire and reflective accounts – from two participant cases – aerospace executives and management students. The questionnaire incorporated a section that aimed to assess whether participants were able to identify the reasons for their business results during, and through subsequent reflection on the simulation developments. The objective was to examine how clearly the participants were able to discern the cause-and-effect business relationships. For this - as explained in the introduction - a five-point Likert-type scale (Saunders, Lewis and Thornhill, 2003) was translated into corresponding word descriptions - "Apparent always", "Apparent", "Largely apparent", "Apparent sometimes", and "Always unclear". Connections explored assessed whether participants were able to: explain market developments, recognise the financial impact of decisions, identify project issues, and experience the impact of team effectiveness –

these being major issues within the management of companies both within the real-world and the simulation.

The reflective accounts were able to elicit evidence from participants from a deeper perspective, as is often the case with qualitative data (Bryman and Bell, 2003). Analysing the reflective accounts showed that the simulation experience had induced thinking and deductions concerning a broad range of business issues. From a behavioural perspective, participants formed views on aspects of leadership and teamwork. Regarding strategic and marketing management, perspectives were formulated concerning planning, strategy, customers, the marketing mix (product, price, place, promotion, people), the supply chain, service, projects and performance. Within their reflective accounts, many participants were able to recognise the dynamic complexity (Senge, 1992) of the business environment (i.e. the fact that the business developed due to certain interrelationships and chains of events that occurred over time).

One participant noted that,

"The simulation taught me to recognise and understand the impact of dynamic complexity and how best to manage this under such extreme change and uncertainty within the work environment that we work in every day" (RR0616).

This participant describes the importance of identifying the key drivers of success within the organisation and assessing and addressing the risk and uncertainty associated with them. Senge (1992) postulates that this type of systems thinking is essential to achieve "metanoia" or a shift in mind in terms of recognising the cause-and-effect relationships that affect business performance within a dynamic, competitive business environment i.e. dynamic complexity. As in the real-world, the TES used within this investigation was not pre-programmed with defined scenarios and established chains of business events in which business decisions would have pre-defined effects upon company results. Instead, although decision areas were pre-established, outcomes and developments in company performance were completely open and dependent not just upon a company's decisions but also those made by its competitors as well as other organisations within the supply chain. Hence, this section also illustrates some of these dynamic chains of events that participants were able to deduce following their simulation experience. Such chains of events occurred within the management activities

dealing with the supply chain, pricing, product, promotion, people, or all elements together in the marketing mix.

These issues are now explored in detail.

3.1 Ability to Identify Reasons for Market Developments

This analysis is based upon questionnaire results and descriptions provided within the reflective accounts.

3.1.1 Questionnaire

Table 4: Perspectives - Q.17 *The explanations for market developments were...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	Apparent	Apparent	Apparent	Largely apparent	Apparent sometimes	Apparent always
Aerospace Executives	Largely apparent	Apparent	Largely apparent	Apparent sometimes	Always unclear	Apparent

The table above shows question 17 of the questionnaire which asks whether participants were able to explain the reasoning behind market developments that occurred during the simulation exercise. The "view expressed most often" was that, for both management students and aerospace executives, the reasons for market developments were "apparent". It is interesting that the management students were more confident concerning this issue, stating their view that their understanding of market developments was more "apparent" than the level of understanding attained by the aerospace executives. Given that the simulation is competitive and dynamic, participants can move the market and their businesses in numerous directions dependent upon the types of decisions made and the team dynamics. Therefore, from the author's observation, it is possible that levels of understanding achieved might vary between one simulation exercise and another, dependent upon the team interactions and directions that the participants make unfold.

3.1.2 Reflective Accounts - Observations

All of the reflective accounts composed by both management students and aerospace executives demonstrated a moderate to high level of understanding regarding the reasons for market developments that emerged during the simulation exercise. Participants were able to establish causes for business results being due to strategic management and more specifically related to customer strategy, product strategy, pricing strategy, promotional strategy and supply chain strategy. These participant observations are described below.

Participants reflected at length upon strategic management issues affecting market developments. One typical comment made by participants was:-

"To be successful required application of skills in marketing, strategy and financial analysis and the integration of these disciplines. As such, it helped to show how various disciplines are inter-linked whilst building skills such as analysing and assessing opportunities and threats, negotiating and evaluating and justifying a chosen strategy of business performance" (SM0606).

This participant was alluding to the fact that strategy needs to be formulated holistically across many influential aspects of the business, whilst also attempting to identify the possible performance implications associated with potential decisions. In fact, over 80 percent of participants recognised the importance of strategic planning, explaining that operating without a strategy can damage business performance. Therefore, they identified the need, at least, to attempt to formulate a strategy. However, many described difficulties and issues that they faced whilst trying to plan strategically. For example, a common view was that it is easy to become entangled within operational issues and postpone the planning of strategic initiatives necessary to achieve future objectives. Furthermore, strategy requires planning, listening to each other and teamwork which may prove difficult if the team dynamics are not conducive to productive working. It was also recognised that planners need to decide how plans are actually going to be achieved, rather than just engaging in the activity of formulating plans. Around half of participants noted that devising strategy requires sufficient time to

think – which is not always available within the time-scale of a simulation exercise or in the real world. Therefore, it may be necessary for strategy to emerge over time rather than being established quickly. Almost all participants recognised the need to understand the business environment and information concerning performance and market opportunities in order to be able to plan strategically. They explained how this involves the identification of factors that have most influence on business success, and related to this, to aim to align all elements of the business in order to deliver sustained business performance. Some related the need to set goals to this, otherwise the business lacks targets to aim towards and to review progress against. A participant (RR0614) described how his company should have resisted over-reacting to competitor actions, and instead, should have enacted a well-thought out strategic response consistent with a strategy.

"*We also began lowering prices...we re-acted rather than enacted a well thought out strategic response consistent with our strategy. With hindsight, such an aggressive reaction to a small piece of information was predictable but not prudent or effective. If we had utilised a broader data set taking into account the impact of this move on financial performance then this inconsistency between strategy and action would not have occurred*" (RR0614)

There is a time lag in strategic management and it can take months before the consequences of decisions become apparent, so over-reacting can be detrimental to performance (RR0614).
Within strategic management, the need to monitor and control people and business performance was also highlighted as an influential factor by some participants. For example, RR0607 commented that;

"*We failed to set targets against a set of key metrics which would have allowed us to steer the business and react effectively within the changing business environment. With hindsight a target for stock, cash, margin and sales would have avoided the reactionary decision-making we were forced to make. We lost sight of the true drivers of the business environment; profitability and customer satisfaction became a secondary consideration. We were preoccupied with market share growth and missed the important financial indicators within the business. As the simulation progressed this myopic focus became a defining and destructive characteristic of the entire market*".

This quote is referring to strategic issues arising from the simulation that were broadly discussed by participants. There was recognition of the need to monitor performance, both of the business results and people. For the business, the importance of devising targets, measures and key performance indicators - for example, market share, sales, stock, cash, profit, and contribution margin – were highlighted, and concerning people, participants identified the need to benchmark the productivity of staff. The quote also shows the significance of a comprehensive management approach, considering a broad set of key data rather than focusing too narrowly - failing to monitor all drivers of business performance leading to a decline in profit or market share. Similarly, too much focus on market share can damage profitability, as can growth that is not sufficiently controlled. The quote demonstrates that the monitoring of appropriate market information and trends is imperative so that business can be maintained and nurtured; whilst costs can be balanced against income.
Hence the impact of strategic planning on market developments was widely discussed with various examples and learning experiences being elicited from the simulation exercise.

Customer strategy was seen to be a key area within strategic and marketing management that affects market developments. Over ninety percent of participants described how it is advisable to target defined markets in order to take advantage of market opportunities. Views were expressed how this entails a focus upon specific customer types based on certain market potential criteria such as profitability, size, seasonality, unfulfilled opportunity or established business interests and resources. There was cognisance of resource limitations such that a company might strive to shape its corporate image and service so that it meets customer expectations, but it should be careful not to overspend. Hence customer strategy was seen to have a major influence over market developments.

Related to this, many noted that possessing a product strategy may also be beneficial. Similar to a customer strategy, a product strategy may be a focus by product area based upon market potential criteria such as profitability, size, unfulfilled opportunity - or established business. Some participants formulated ideas concerning effective product strategies that they applied to the simulation. For example, there are merits in having a

varied product range because this may attract more customers, however a more specific focus may be needed if resources and funds are limited (RR0607). Another participant (RR0616) explained how a "product design" partnership with other organisations within the supply chain may be beneficial because this encourages "buy-in" and commitment. Another participant (RR0611) identified the need for market research and how it is advisable to monitor the product development activity of competitors so that initiatives to gain competitive advantage can be counteracted – e.g. a company can achieve better product fits with customer expectations. Hence, it can be seen that reasons for market developments were related to product strategy.

Pricing strategy is another issue that was seen to impact upon market developments within the simulation. A recurring goal described by participants was to lower the cost base of their simulated companies, often by exerting pressure on suppliers and squeezing margins. Correspondingly, order volumes were often used as a ploy to negotiate discounts. Competitive pressures forced frequent price wars as retailers cut prices in the hope that these would generate customer loyalty and market share. By contrast, product differentiation was identified as a means of improving customer appeal such that price rises could be achieved. The repercussions of ineffective pricing strategies were often noted - for example, price cuts leading to a competitive price war that consequently hits sales, margins and supply-chain relationships.
Therefore, many participants (over 50 percent) were drawn into pricing issues that had recognisable impacts upon their company performance.

Promotional strategies were also planned and implemented such that they affected market developments. Many participants recognised the need to achieve congruence between promotional strategy and the other categories of strategy. For example, using "shelf space" allocation to support product focus (SM0616), supporting product launches and focus with advertising and promotional campaigns aimed at increasing customer awareness (SM0610), or persuading other companies within the supply chain – manufacturer or retailer – to spend on product advertising so that mutual benefit might be derived for companies through increase in demand (RR0609). Some participants appraised the effectiveness of advertising, recognising that too much advertising might no-longer have a beneficial effect on sales and hence damage profitability, or

conversely, too little spend on advertising or promotion might lead to loss of business. There were discussions around working within limited resources such that advertising campaigns may need to be targeted and focused by product area so that profitability is retained. The need to monitor competitor activity through market research on promotional activity was noted as part of the process of understanding market developments. For example, many participants recognised that competitor spend on advertising can lead to diminishing market share and even an upward spiral of advertising as competitors attempt to maintain their customer recognition.
For example, RR0607 commented that;

"*Retailer D invested significant capital in advertising which resulted in growth in their presence in the wealthy sector. Given our pre-occupation with market share this came as a jolt and as a reaction we increased advertising investment to recoup this position*".

Hence, several points were elicited concerning the effects of promotional strategies upon market developments.

A supply chain strategy was also identified as vital within a fast-moving manufacturing and retail business environment. The main discussions formulated by participants concerned the necessity to achieve congruent strategies between supplier and distributor, otherwise there will be detrimental developments in market performance. Over 80 percent of participants described how the simulation had highlighted the importance of developing and maintaining good relationships within the supply chain such that there is a clear and established communication of strategy and requirements. In line with this, some participants recognised the merits of anticipating and discussing supply problems within the supply chain before the problems arose – e.g. falling demand, capacity constraints – rather than afterwards; by which time relationships and trust may have been damaged. Major discussion concerned the need to attempt to forecast demand and avoid the running out of stock - resulting in lost sales and profit. There was recognition of the importance of a "smooth" supply chain enabling products to move from supplier to end customer as required through efficient communication of orders and associated adequate capacities being in place – e.g. warehouse capacity, distribution capacity, production capacity, sales capacity. Other contributing factors identified were skilful negotiation and persuasion so that suppliers and retailers form amicable agreements concerning supply requirements, inventory management so that

orders are monitored and controlled in relation to demand, and the need for a culture of mutual benefit within the supply chain. For example, manufacturers identified that working effectively with retailers in the supply chain created greater opportunity to utilise their production capacities and hence improve profitability. For this, the maintenance of production capacity and staffing competence were vital in order to guarantee delivery and build trust with retailers (SM0602).

There was much consideration of the benefits of formulating strategic partnerships, as highlighted by the following example that emerged from events within the simulation.

"*The pursuit of market share had profound implications on the relationships between retailer and manufacturer. Our intent was to work with manufacturer A, developing a partnership to enable the creation of new products and provide stability within the supply-chain system. By establishing this relationship we could maintain a low level of inventory and increase our profitability. Initially the relationship worked well, we embraced the partnership concept and discussions regarding a new high end product proved successful. However, as the market environment changed with the aggressive pursuit of market share and the substantial erosion of margin, our relationships with manufacturer A deteriorated. The initial tension was generated through price, as our margins were reduced, pressure was placed on the manufacturer to lower price. Within the simulation this generated two key outcomes, the level of co-operation between buyer and supplier deteriorated, and manufacturer A sought alternative avenues to sustain profitability. This reaction was consistent amongst the majority of manufacturers as the frequency of engagement between our business and other manufacturers increased as price tension and margin erosion continued to deteriorate*" (RR0607).

In line with this example, participants who had encountered similar developments within the simulation commented that on the one hand, strategic partnerships provide opportunity for shared information, preferential orders, reliable supply, discounts, and aligned advertising and promotion. However, they might also limit development opportunities, or provide the opportunity for people to take advantage and act according to self-interest; given that organisations are tied-in together. It was observed that partnerships require openness, honesty, timely communication, give-and-take which is not easy to maintain when business performance is suffering. Market conditions – such as price wars – can erode the benefits of partnerships. Conversely, participants

recognised the merits of having several associated suppliers because this reduces supply risks, increases supply chain competition and can lead to beneficial purchase prices. However, expanding the supply chain can aggravate existing suppliers. Hence, the simulation enabled participants to experience several supply chain challenges that have an impact upon market developments.

Issues around service strategy were also considered, although these are subsumed within some of the other strategy areas already explained. From the simulation, participants identified that service factors affecting market developments focused upon achieving customer satisfaction so that business and profits are maintained. For example, the anticipation of staffing requirements so that hiring and firing costs are avoided, or investing in people to maintain service throughout the supply chain. Service strategy was therefore another issue that affected market developments.

Some observations were deduced concerning project strategy as well. Future marketing strategy might be adversely affected by projects for reasons such as costs outweighing benefits, delays caused by lack of prioritisation, an inability to deliver on time. For example, cost-benefit analysis was identified by some to be a useful approach when trying to assess cost versus benefit before and during the management of projects. The need to prioritise was highlighted when running several development projects concurrently that utilise common resources. The importance of maintaining customer relationships was also mentioned by teams when they discovered that delivering to customers late strained relationships and customer confidence, even if delays were for reasons beyond their control. Hence, issues within projects were identified as having a knock-on effect on market developments.

In summary, the reflective accounts yielded many participant observations concerning business issues that caused market developments to be affected, with most participants showing a broad recognition of factors that were influencing the market, and supporting theoretical proposition 1. More specifically, issues were encountered within the disciplines of strategic management and strategies concerning customers, products, promotional activity, pricing, service, projects and the supply chain.

3.1.3 Reflective Accounts – Dynamic Complexity

Within the introduction to this results-analysis section it was noted that participants were able to describe within their reflective accounts how developments within the market had occurred as a chain of inter-linking events. This was described by Senge (1992) as a possible learning outcome from a business simulation experience which he termed as the recognition of dynamic complexity within the business environment. This section describes eleven examples that have been drawn from the reflective accounts of participants which demonstrate how participants were able to connect together these chains of events and deduce the effects that they had upon market developments. There were many examples of "dynamic complexity" recorded by participants, so the number has been limited to the eleven most common encountered. For each example, a "percent of participants" has been included to give an approximate measure of frequency of participants who described this type of issue or an issue of this kind, and the examples have been listed in descending order of frequency of participants. Examples 1 to 7 relate to the supply chain and 8 to 11 more generally to other business drivers.

Many different chains of events occurred dynamically within the supply chain, a variety of which are listed as examples 1 to 7 below.

Example 1 – Excess demand causes stock-outs and price rises (90 percent of participants)

The situations arose where manufacturers found that in certain product areas they had reached production and distribution capacities, and could no-longer fulfil orders. This affected retailers further up the supply chain. Firstly, the supply of products was limited and hence business was lost as stocks were consumed. Secondly, the manufacturer was now forced to embark upon an expensive recruitment campaign such that prices were forced up and retail margins were damaged.

Example 2 – Demand is difficult to forecast causing ordering difficulties (90 percent of participants)

There was often a cycle between over-ordering leading to excess stocks followed by under-ordering with the aim of clearing stocks. This could occur if the retailer over-estimated demand and hence orders, and was subsequently forced to cut orders. Further down the supply chain, the manufacturer profits deteriorated until the retailer was able to clear inventory and reinstate orders.

Example 3 – Repercussions from poor communication within the supply chain (80 percent of participants)

Within this example, the manufacturer negotiated order volumes with the retailer that it was subsequently unable to deliver due to poor management of its production facilities. The problem arose because its sales people committed to new orders without first consulting the factory in order to establish capacity constraints. As a result, the orders were not fulfilled because there was subsequently a shortage of production capacity as well as distribution limitations. Consequently, the retailer ran out of stock of this product area, and hence lost sales and potential profit. Feeling let down, the retailer had now lost confidence in the manufacturer's supply capabilities and, during discussions, informed the manufacturer of its intention to seek new suppliers to safeguard future deliveries. As a result, the manufacturer was forced to undertake an expensive recruitment campaign which improved the reliability of its deliveries but severely damaged its profitability.

Example 4 – Relationships in the supply chain are affected by level of success (80 percent of participants)

It was noticeable that when decisions within the supply chain lead to successful outcomes then relationships improved, but conversely failures tended to result in a deterioration in relationships. For example, if a retailer and manufacturer were able to forecast demand accurately then this facilitated a steady scheduling of orders, fulfilment of expectations and enabled both parties to plan more reliably. Consequently relationships were good. However, if there was insufficient communication within the supply chain then a lack of commitment, trust and co-operation might ensue. This

occurred when a major retailer decided to raise prices and eliminate advertising in an attempt to improve profits. Consequently, demand dropped, orders declined and the manufacturer's profit was hit.

Example 5 – Misalignment of strategy within the supply chain damages business and relationships (60 percent of participants)

The manufacturer decided upon a strategy of growth but did not communicate and agree this with their main retailer through which they hoped to achieve the improved sales volumes. Hence, the manufacturer invested in additional production capacity and managed, through negotiation, to persuade the retailer to place large orders with them. Unfortunately, the anticipated demand did not materialise and sales were not as high as expected, such that the retailer became over-stocked. The retailer now began to suffer high stock-holding costs and subsequently reduced their further orders. This caused relationships with the manufacturer to deteriorate who was now forced to find new suppliers through which to distribute. By not achieving buy-in for their initial growth strategy, key relationships within the supply chain had now become strained and future business began to suffer.

Example 6 – Market conditions may strain supply chain relationships (60 percent of participants)

There were situations where a successful partnership relationship between supplier and retailer was strained due to developments in the market that were beyond their immediate control. One such situation occurred when a price war developed amongst retailers forcing their profits to decline. One retailer decided to use its buying power to pass the price cuts on to its main supplier and subsequently forced purchase costs down, eroding supplier margins in the process. The supplier was forced to seek other retail outlets and the partnership relationship broke down. The transparency of agreements was now much more limited between these organisations.

Example 7 – Strategic influence of other organisations in the supply chain may be detrimental (40 percent of participants)

A supportive culture within the supply chain may lead to an organisation investing to support organisations further up the supply chain who subsequently fail to deliver. A situation arose where a retailer persuaded a manufacturer to invest greatly in additional production capacity based upon their forecasts of future demand. However, the retailer did not generate the demand that it had promised such that the manufacturer was unable to recover its investment and was forced into an expensive redundancy programme.

Interestingly, it should be noted that the simulation was not designed with these specific scenarios in mind – they emerged as a result of the interactions and decision-making processes that were implemented by the participants. The simulation was built to represent the business environment as realistically as possible and the scenarios that emerged were a result of this. It can be concluded from these examples that there were common recurring themes that emerged in varied forms within different teams as time progressed within the virtual world of the simulation. Factors such as anticipating demand and coping with demand fluctuations, communicating and aligning strategy within the supply chain, maintaining customer-supplier relationships and dealing with turbulence caused by competitive pressures were broken down into interrelated chains of events unfolding dynamically and interactively over time. Therefore, the dynamic complexity (Senge, 1992) of several major supply chain issues and interrelated events affecting market developments was effectively identified by many participants.

Examples 8 to 11 describe some chains of events around other aspects of the marketing mix (Kotler, 1993) such as product, people and promotion.

Example 8 – Events may involve several aspects of the marketing mix (90 percent of participants)

It may be that chains of events involve several aspects of the marketing mix concurrently. For example, a retailer aimed to grow sales so decided to increase orders, spend more on advertising targeted products, and reduced prices on targeted product lines. Even so, sales did not increase sufficiently well and inventory rose to a high level

with declining cash levels. Despite this, the retailer continued ordering the same volumes in the hope that sales would pick up and supply prices would stay low. Unfortunately, inventory continued to rise to the extent that there were now shortages in available warehousing space. Eventually, the retailer was forced to cancel orders and disrupt the supply chain, with consequential negative effects on relationships.

Example 9 – Fast growth can stretch staff and cause service problems (80 percent of participants)

Companies that grew particularly quickly would often neglect their staff, allowing them to become over-stretched and eventually creating service problems. This resulted in expensive recruitment campaigns to win back disgruntled customers with improved levels of service.

Example 10 – Competition can cause costs of promotion to spiral upwards (50 percent of participants)

It was notable that companies could be drawn into a promotional war resulting in an upward spiral of advertising and promotion. Developments occurred such that strong competitor advertising led to loss of market share. In reaction, companies would increase advertising accordingly leading to diminishing returns as promotional spends spiralled upwards.

Example 11 – Success within a new market attracts competition (40 percent of participants)

It was often the case that competitors were attracted to new markets after they had been proved profitable. The situation arose where a manufacturer would launch a new, differentiated product early into a new market, taking a risk on recovering their investment. As the product developed high market share and profitability competition was attracted and market share diminished as the market became more competitive. Competition intensified as competitors used advertising in an attempt to build customer awareness and brand loyalty.

Therefore, it can be concluded that a significant and broad range of interrelated factors concerning all areas of the marketing mix (Kotler, 1993) were identified by participants as key drivers of market developments. There were not just examples of supply chain issues but also competitive developments such as increasingly aggressive pricing, advertising and promotion wars, uncontrolled growth leading to service problems, and new markets becoming increasingly competitive. Hence, these examples provide illustrations that support the proposition that many participants are able to elicit from the simulation many interrelationships between factors that influence market developments. In short, it appears that they are able to recognise the dynamic complexity (Senge, 1992) of the business environment.

This section has addressed the first part of theoretical proposition 1, that participants are able to understand the reasons for market developments that occur within the business simulation. The quantitative analysis of the questionnaire provided a numerical overview of the viewpoints of both management students and aerospace executives that strongly supported the proposition, suggesting that the common belief is that the reasons for market developments were "apparent". This has been triangulated (Denzin, 1978) with a deeper qualitative analysis of the reflective accounts composed by participants describing what developments transpired and their causes. Many credible observations were made explaining how the simulation had facilitated experience of how strategies concerning customers, products, promotional activity, pricing, service, projects and the supply chain had affected the development of the market within the simulation.

3.2 Ability to Recognise the Financial Impact of Decisions

This analysis is based upon questionnaire results and descriptions provided within the reflective accounts.

3.2.1 Questionnaire

Table 5: Perspectives - Q. 18 *The financial impacts of decisions were...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	Apparent	Apparent	Apparent	Largely apparent	Apparent sometimes	Apparent always
Aerospace Executives	Apparent	Largely apparent	Apparent	Largely apparent	Apparent sometimes	Apparent always

From the questionnaire, the table above provides a quantitative analysis of participant perceptions of their ability to recognise the financial impacts of decisions. Both management students and aerospace executives were very supportive, with the average view being recorded as "apparent". As with the previous question, the management students were more supportive than the aerospace executives, the respective views being expressed most often being "apparent" and "largely apparent". As explained, the author attributes this to the fact that the dynamics within the teams and the simulation can vary which could have an impact upon team productivity.

3.2.2 Reflective Accounts – Dynamic Complexity

The concept of dynamic complexity (Senge, 1992) has been explained within previous parts of this chapter. Accordingly, the reflective accounts of participants contained several explanations of the effects of decisions upon financial performance. Four common examples mainly concerning pricing are described below. They appear in descending order of the approximate proportion of participants who encountered this chain of developments or one that was similar.

Example 1 – Price reductions may be beneficial if volumes improve sufficiently and costs are low (80 percent of participants)

A price reduction strategy was found to be beneficial to a retailer because it was able to use its improved sales to negotiate discounts on purchase costs. This in turn enabled further price cuts to be implemented and market share subsequently improved. However, in a similar situation, the supplier ran out of production capacity and decided to focus on supplying those retailers who were willing to pay the most. Hence prices were forced up, supply was constrained and retail margins were squeezed.

Example 2 – Pricing new products can be difficult (80 percent of participants)

There is potential to lose profits if a new product is not priced correctly. For example, a retailer faced a pricing dilemma when it launched a new low specification product at low price into competitive market but subsequently discovered that sales were not as high as expected. Although profitability was already low, the company now faced the prospect of having to reduce prices further in the hope that volumes might pick up.

Example 3 – Price wars may affect profitability (60 percent of participants)

A price war may be risky because competitors repeatedly lower prices in an attempt to secure market share. One such situation occurred when a competitor introduced a superior product at a low price triggering a succession of price cuts and ensuing losses.

Example 4 – Price rises might damage profitability (40 percent of participants)

A situation developed where a retailer decided to raise prices for a mass-market, undifferentiated product, believing that this could improve profitability. However, although margins increased, sales started to decline and inventory levels began to rise. After several months of escalating stocks, an advertising campaign was implemented in an attempt to clear stocks but by now a large proportion of market share had been lost. Even when prices were lowered, volumes did not recover and profitability had been severely damaged.

In summary, the quantitative analysis from the questionnaire showed that the aerospace executives and management students were both supportive of the proposition that participants can recognise the financial impacts of decisions made during the simulation. However, although also supportive, the qualitative analysis yielded fewer examples and direct observations related to this topic of investigation compared to the previous proposition concerning the reasons for market developments. This is because the impact of decisions upon financial performance is a result of decisions that fall more neatly into other management disciplines such as marketing and operations management. For example, the issue of hiring staff to support growth can be considered as a marketing stance necessary to maintain customer satisfaction, but equally it is a financial decision which can seriously damage a companies net profit. Hence, although upheld by an indirect and narrower body of qualitative evidence, there is positive quantitative and qualitative support for the theoretical proposition that participants believe that they are able to recognise the financial impacts of decisions.

3.3 Ability to Recognise the Effects of Project Issues

This analysis is based upon questionnaire results only.

Table 6: Perspectives - Q. 19 *The project issues were...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	Apparent	Apparent	Apparent	Largely apparent	Always unclear	Apparent always
Aerospace Executives	Largely apparent	Largely apparent	Largely apparent	Largely apparent	Always unclear	Apparent always

From the table above, the quantitative analysis deduced from the questionnaire again showed support for the proposition that participants were able to recognise the effects of project issues upon business results. This said, there was no specific description of what these effects were within the reflective accounts - where participants were invited to comment upon factors affecting business performance. This might have been because there were far fewer project management issues to consider within the simulation in comparison to the marketing and financial aspects. However, participants did volunteer descriptions on how project management issues related to real-world business environments; which is covered in the next section under external educational validity. Conforming to the other questions in this section, the management students were again

more confident than aerospace executives concerning their abilities to recognise the impact of project issues upon business results; with the views expressed most often being "apparent" and "largely apparent" respectively. The author suggests that this was due to team dynamics which can vary between simulation exercises based upon the attitudes and abilities of the participants.

3.4 Ability to Recognise the Impact of Team Effectiveness

This analysis is based upon questionnaire results and descriptions provided within the reflective accounts.

3.4.1 Questionnaire

Table 7: Perspectives - Q. 20 *The impact of team effectiveness was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	Apparent	Apparent	Apparent	Apparent	Apparent sometimes	Apparent always
Aerospace Executives	Largely apparent	Apparent	Apparent	Apparent sometimes	Always unclear	Apparent always

The table above shows a summary of the quantitative response submitted by participants regarding team effectiveness; the fourth and final management discipline within the business environment of the simulation. Again, the participants were strongly supportive of the proposition that they were able to relate the impact of team effectiveness to business performance, with as usual, the management students being more supportive than the aerospace executives by concluding that, on average, relationships were "apparent" and "largely apparent" respectively. As the author has already stated, this was probably due to the management students having more effective teams that were therefore able to recognise the impact of team effectiveness.

3.4.2 Reflective Accounts - Observations

The questionnaire was again supported by some observations within the reflective accounts; providing some qualitative triangulation (Denzin, 1978). Most participants (over 80 percent) described how the simulation helped to highlight the importance of behavioural issues such as leadership and teamwork within management. A typical comment from one participant summed up this view:

"The simulation was crucial in demonstrating a critical understanding of the vital combination between individual behaviour, group behaviour and the management process" (SM0602).

Certain observations were recorded by participants concerning leadership. For example, it was noted that a dominant personality can lead to decisions being made without the full backing of the team, and therefore there should be consensus agreement if possible. However, it was observed that a leader is needed so that tasks are co-ordinated. There was recognition of the importance of teamwork within the organisation. Teams commented on how they worked more effectively when there was open discussion and when members listened to each other. They stated the significance of common goals with regular progress reviews, roles that suit skills and communication between team members. Other points made concerned the value of established rules to achieve objectives, team understanding, empowerment, trust, and an active contribution by members to the team.

Hence, there was both quantitative and qualitative support for the proposition that participants were able to recognise the impact of team effectiveness on business results.

3.5 Summary for section 1 - Internal Educational Validity

On average, the management students reported that the relationships were "apparent" in all areas considered – market developments, financial impacts, project issues and team effectiveness. This was more positive than the aerospace executives who reported that only the financial impacts were "apparent"; market developments, project issues and

team effectiveness falling into the next category of "largely apparent". As indicated above, this could have been due to more effective team dynamics amongst the management students, but additionally, maybe the greater experience and maturity of the aerospace executives means that they have learnt to be less self-assured when considering the uncertainties of business management. Taking the most critical viewpoint of the most supportive 75 percent of the participants, the management students believed that relationships in all topic areas were "largely apparent" or better, except for team effectiveness where relationships were "apparent" or better. These viewpoints - of 75 percent of participants – for the aerospace executives concur with the management students in the topic areas of financial impacts and project issues but concerning market developments and team effectiveness the rating is "sometimes apparent". The researcher can recall that, whilst observing the simulation exercises, the team dynamics were sometimes quite destructive and this issue appears to have been notably more prevalent amongst the aerospace executives. This means that some teams did not have efficient and effective team working processes which impacted adversely upon team performance. Given that the simulation aims to be a learning tool, the internal educational validity might have been supported more strongly if relationships in all areas had a "view expressed most often" as "apparent", and no "largely apparent" verdicts. However, in the author's view, the simulation aims to be a realistic representation of the real world where there is uncertainty and risk leading to unclear cause-and-effect relationships. Therefore, it follows that participants should not be able to identify all relationships with complete clarity - if the simulation achieves its goal of realism. If the simulation, as one of its objectives, aims to teach participants that the business world has much uncertainty, then it may be unreasonable to expect participants to be completely "certain" when making deductions concerning the causes of developments. Even so, as a learning medium, clear relationships are advisable so that confusion is minimised and the correct learning messages are portrayed. It is interesting to note that, looking at the extremes, for nearly all questions there were participants who believed that reasons for business performance were "always apparent" and, at the other extreme, those who reported "always unclear". Although these participants were by far in a minority it indicates that extremely positive and negative responses are also always possible.

In the author's opinion, the qualitative viewpoints expressed in the reflective accounts provided a high degree of depth and substance regarding participant perceptions that

strongly supported and triangulated (Denzin, 1978) the quantitative assessments resulting from the questionnaire. The effects of marketing and strategic management upon business results were the most widely discussed, followed by financial impacts and team effectiveness. Project management issues induced little comment, which as stated by the author, was probably due to this part the simulation being more limited. Participants were able to describe how business results had been affected by issues within strategic management, pricing, customer focus and satisfaction, product strategy, supply chain strategy, promotional activity, service strategy, and effectiveness of leadership and teamwork. The impact upon financial performance appears to have been widely understood, although covered generally rather than in detail – this was not seen to be a priority within the scope of the reflective accounts.

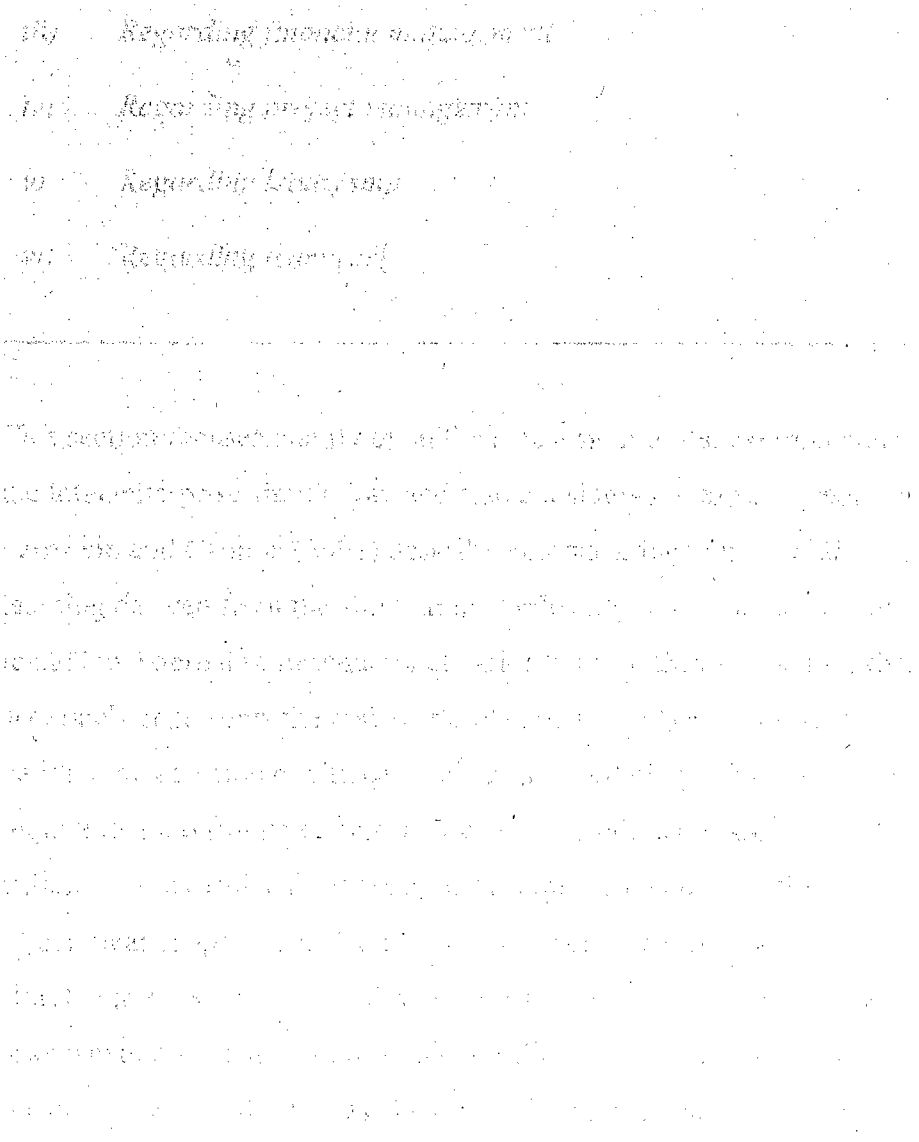
Hence, there has been much evidence to support the views expressed by Wolfe (1997), that simulation can be an effective tool for teaching strategic management, or Saunders (1995) that it enables participants to practise and experience management in terms of roles, planning, and profit generation. In the author's view, the evidence has contradicted the deductions Faria and Wellington (2004), that simulation students have had little success in deciphering the interrelationships within business simulation. The conclusions of Whiteley, Ledue and Dawson (2004) that students are unable to develop the cognitive insight necessary to understand the nature of the response functions of a simulation has been shown to be invalid within this investigation. This is also the case regarding investigations by Dickinson, Whiteley and Faria (1990), Dickinson and Faria (1994), and Wolfe and Jackson (1989) which all concluded that there was a lack of student understanding of the internal relationships within the total enterprise simulation exercises that they were assessing. Going further, the author believes that this evidence demonstrates that total enterprise simulation can be a powerful learning tool not just in strategic management, but in the management of operations, marketing, finances, the management team, and the pulling together of all the interrelating parts of the business. There is much evidence here that many avenues of business thinking have been induced. Some participants even volunteered very conclusive, general statements concerning their learning achieved,

"The business simulation provided a safe environment where decisions could be made, outcomes evaluated and learning points established" (SM0609).

"The simulation clearly highlighted a number of key learning experiences that are consistent with real issues faced by Rolls-Royce plc" (RR0607).

Hence almost all participants have stated that they were able to understand reasons for business results, have provided examples of this at length describing how factors interrelate and some, as above, have provided unsolicited statements that they have learnt from the experience. As explained by authors such as Moon (1999) and Biggs (1999), direct measurement of learning is impossible because it is covert and hidden. However, authors specialising in learning and reflection - Moon (1999), Kolb (1984), Dewey (1933), Habermas (1974) – have expressed the importance of attitude and reflective activity within the learning process. The simulation, and the manner in which it was implemented, certainly forced participants to reflect upon business developments for which they were responsible. However, whether participants were able to truly learn from the exercise is impossible to judge; given that their written reflection is the only representation of learning (Moon, 1999) that we can assess. According to Kim (1993), learning may be a double-loop cycle such that participants store away learning to influence future learning, but in so doing may forget where the original learning came from. So assessing learning achieved using measures that possess construct and measurement validity (Bryman and Bell, 2003) is fraught with difficulty. Even so, participant reflection has demonstrated that participants were able to interrelate different business drivers in order to explain the business performance that they achieved, and were able to apply business thinking processes in order to shape and influence the performance of their businesses within the simulation. This is consistent with certain aspects of the concept of "deep learning" described by Moon (1999) and Biggs (1993). Moon (1999) describes how deep learning is when the cognitive structure acts as an adaptable network to guide, organise and assimilate new ideas based on current knowledge. There is the active construction of information input – modifying, revising, transforming, connecting, relating to what is already known – resulting in the ability to reason and solve problems in new contexts. Associated to this definition, participants within the simulation certainly demonstrated that they could connect, relate, reason and solve problems in the areas of strategic, marketing, operations, team and financial management either through reflective observations but also recognition of the dynamic complexity (Senge, 1992) within the simulated business environment. Hence, in the authors opinion there is strong evidence that an infrastructure for deep learning was achieved by the simulation exercise, and this is the limit of learning effectiveness that

this kind of investigation might achieve. As far as the author can ascertain, there has been no evidence to suggest that deep learning was not possible from the simulation exercise and evidence can be interpreted to support the theoretical proposition that, based upon participant perspectives, the simulation was an effective learning tool for key areas of business management. Hence, the simulation demonstrated internal educational validity (Fernstein and Cannon, 2001).



Section 2 – External Educational Validity

Figure 18: Theoretical Propositions 2 and 3

Theoretical Proposition 2 – The simulation possesses external representational validity

Theoretical Proposition 3 – Participants are able to learn about business management from simulation. Attitudes are influenced regarding business management in the real-world (external educational validity)

i) Regarding strategic management

ii) Regarding marketing management

iii) Regarding financial management

iv) Regarding project management

v) Regarding leadership

vi) Regarding teamwork

This section focuses mainly upon the assessment of the external educational validity of the total enterprise simulation, and also considers the external representational validity. Fernstein and Cannon (2001) describe external educational validity existing when learning derived from the simulation is relevant to the real-world context. It is therefore related to external representational validity which they explain is when the simulation accurately represents the real-world phenomenon. Hence, these two categories of validity are associated with each other since learning about the real business world may require that the simulated business world is modelled realistically. These two aspects of validity are investigated based upon two theoretical propositions shown in figure 18: Theoretical Propositions 2 and 3, above. Theoretical proposition 2 inquires whether the simulation possesses external representational validity, and theoretical proposition 3 asks whether the simulation is able to influence attitudes regarding the management of businesses within the real world. Some key management areas are examined under theoretical proposition 3: strategic management, marketing management, financial management, project management, leadership, teamwork and the amalgamation of all

these disciplines under the topic of general management. To enhance the external validity (Bryman and Bell, 2003) of the investigation, there is cross-case synthesis (Yin, 2003) across different participant cases and hence this chapter has been split into two parts in accordance with these cases. Part 1 examines two participant cases - aerospace executives and management students – who participated in a simulation that represents an industry in which they do not work to ascertain whether their attitudes regarding the real business world had been influenced as a consequence. Part 2 investigates for other participant cases – QBE Insurance and Kraft Foods – to inquire whether a simulation that represents the industry in which they work has an influence upon their attitudes regarding business management in the real world. In order to triangulate data (Denzin, 1978) and improve construct validity (Bryman and Bell, 2003), three research instruments were used in Part 1 providing a blend of quantitative and qualitative data – questionnaire, reflective accounts and interviews. For Part 2, two research instruments were utilised - questionnaire and interviews – which were more limited due to the fact that the participating executives could not commit the same time to the data collection process.

Part 1: When the simulation represents an industry in which the participants do not work

Three research instruments were used to source data for participants participating within a simulated industry in which they do not work: questionnaire, reflective accounts and interviews. The aim was to assess external educational validity and external representational validity as described above in relation to theoretical propositions 2 and 3. Concerning the questionnaires, the participants were asked whether the simulation had influenced their attitudes regarding business management in the real world and the quantitative responses have been represented using three qualitative terms: "no", "in some areas", and "in many areas". This therefore provides a direct measure of external educational validity and an indirect measure of external representational validity.
The reflective accounts examine the similarities and differences that participants perceived between the business developments that occurred within the simulation and those that exist within real life. They provide a direct measure of external representational validity and an indirect measure of external educational validity.
Several weeks (4 to 6) after completing the simulation exercise, interviews were conducted with a selection of volunteering participants. The aim was to seek evidence that might show changes in attitude or behaviour to their business thinking resulting from their participation in the simulation. This provides a direct measure of external educational validity and an indirect measure of external representational validity.

3.6 Influenced Attitudes Regarding Strategic Management

This analysis is based upon questionnaire results and perspectives drawn from the interviews.

3.6.1 Questionnaire

Table 8: Perspectives - Q. 21 *Have business deductions resulting from the simulation influenced your attitude regarding strategic management in the real world?*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	In many areas	In many areas	In many areas	In many areas	In some areas	In many areas
Aerospace Executives	In many areas	In many areas	In many areas	In some areas	No	In many areas

The quantitative data from the questionnaire is strongly supportive of the proposition that business deductions resulting from the simulation influence attitudes regarding strategic management in the real world. For both management students and aerospace executives the view expressed most often was "in many areas". The management students were a little more positive than the aerospace executives, with at least 75 percent recording a view of "in many areas" and "in some areas" respectively. This was probably due to the fact that many of the aerospace executives were working in senior roles entailing strategic responsibilities within their organisations.

3.6.2 Interviews

Points were made in all interviews concerning how the simulation had induced more thinking around aspects of planning - such as contingencies, costs, asking questions, relationships, impacts, the difficulties of complexity, forward thinking, uncertainty and the fact that there are many factors affecting performance.

"The simulation has made me think a lot more about contingency planning than before...making me more cautious about what might go wrong...thinking more about the cost basis and the implications...asking more questions...thinking about relationships and effects" (RRI3).

An interviewee explained that when analysing business cases he now considers the potential impacts of the economic and political issues on his business more carefully (RRI4). Another stated that he now recognises more readily that the world is complex and business can be difficult to manage (RRI6). For another, the simulation had stressed the importance of thinking forward in terms of where a company wants to be and how to get there (MSI1/2).

Comments were made concerning the concurrent assessment of different influences on business performance:

"*The most important thing for us is that it is important to think about all the things together...finance, operations" (MSI1/2). "Trying to hedge your bets when faced with uncertainty" (MSI1/2). "The fact that you cannot think about business areas separately because they all influence each other"* (MSI3).

Although these points were quite general in nature, they did show that participants had been alerted to the importance of various planning issues within the real world such a contingency planning, assessing uncertainty, thinking about knock-on effects from decisions, forecasting, assessing costs and answering more questions (rather than just accepting). Therefore, these qualitative statements supported the findings from the questionnaire indicating that, for theoretical proposition 3, participants believed that their attitudes had been notably influenced regarding strategic management in the real world, and that there is external educational validity in the areas of strategic management.

3.7 Influenced Attitudes Regarding Marketing Management

This analysis is based upon questionnaire results and descriptions provided within the reflective accounts.

3.7.1 Questionnaire

Table 9: Perspectives - Q.22 *Have business deductions resulting from the simulation influenced your attitude regarding marketing management in the real world?*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	In many areas	In many areas	In many areas	In some areas	No	In many areas
Aerospace Executives	In many areas	In many areas	In many areas	In some areas	No	In many areas

The questionnaire yielded strong evidence supporting the proposition that business deductions resulting from the simulation influenced attitudes regarding marketing management in the real world. For both management students and aerospace executives the view expressed most often was that attitudes had been influenced "in many areas" and at least three-quarters of participants believed that their attitudes had been influenced at least "in some areas". This supports the theoretical proposition that participants think that there is external educational validity in the area of marketing management.

3.7.2 Reflective Accounts

In the reflective accounts participants identified many similarities between the business simulation and the real-world business environment in the area of marketing management. For participants, this reflective activity might enhance understanding and lead to further learning given that it is an activity encouraging connecting, relating and applying concepts – associated with deep learning (Moon, 1999). From a validation perspective, it provides data indicating external representational validity - because the simulation represents real-world phenomena - and arguably internal educational validity - given that participants are showing that they can inter-relate concepts (Fernstein and Cannon, 2001). If, additionally, participants indicate that they have realised or could

potentially realise something new about the business world, then it is further evidence of external educational validity - qualitative data to triangulate (Denzin, 1978) the findings of the questionnaire.

One similarity was the challenge of managing existing operations whilst also attempting to think strategically. More specifically, the balance of maintaining expected levels of performance for existing business whilst concurrently preparing for the future (RR0607).

Another parallel was the difficulty of forecasting demand, and hence the problem of forecasting orders relative to sales and stock as expressed by one typical participant;

"The complex nature of business resulted in it being very difficult to forecast demand" (RR0604).

Similar situations within organisations were cited. For instance, in the software games market, Microsoft failed to meet demand for their X-box which resulted in a loss of potential sales and profits to the Sony PlayStation (SM0603). Similarly, at Sainsbury's during New Year 2005 shelves were left empty for days around London due to delivery problems within the supply chain (SM0607).

Customer satisfaction issues were related by over ninety percent of participants to the real world. There was consideration of the need to develop relationships with customers. The understanding of customer needs was seen to be essential, although these vary dependent upon the industry. For example, customer drivers within the aerospace industry such as fuel efficiency, noise reduction, low cost, and life cycle maintenance (RR0611). Success in the longer term may require product innovation to create customer satisfaction. One company likened their innovation approach within the simulation to the customer strategy adopted by the Toyota Motor Corporation regarding the Lexus motor car. By understanding the relationship between quality, perceived value, customer satisfaction, pricing and profitability they were able to offer high perceived quality and a strong brand which enabled pricing to be kept high (SM0603).

There was the parallel that new innovations might improve customer satisfaction but can also damage market share. A participant commented that;

"The competitive environment experienced in the simulation was very much similar to real-life: price competition, new products etc. Although our new confectionery product looked attractive when it first came to market, our competitors soon usurped our position and took market share" (RR0610).

Some aerospace executives described how they suffer from similar disruptions within their market due to new innovations. An example was the Airbus A340 and Rolls-Royce Trent 500 scenario. The A340-500/600 was launched by Airbus with sole sourced Rolls-Royce engines and was intended to be the airlines long-haul wide bodied aircraft of choice. However, when Boeing introduced the Boeing 777X powered by General Electric's engines with improved emissions and higher performance, sales of the A340 – 500/600 were hugely damaged. Consequently, the anticipated production product life cycle of the A340 and Rolls-Royce Trent 500 has become much shorter, having a knock-on impact on the various suppliers (RR0609).

Several supply chain issues were related to the real world – for example, negotiation, communication, financial management, strategic conflicts, resource management, reliability, co-operation, market influences. These are now described in detail.

The simulation was considered to provide a forum for testing negotiation skills needed within supply chain management. As commented by one participant;

"The simulation was an endless round of negotiations month after month, very similar to operating in real-life. Also similar to real-life was the need to acknowledge that compromises must be reached in order to progress" (RR0610).

Communication, co-operation and reliability needed within the supply chain were highlighted. The necessity to communicate and administer orders carefully so that supply was not disrupted was regarded a similarity. One participant stated that;

"Within Rolls-Royce the highest contributor to poor quality performance is not actually product defects but poor packaging and paperwork" (RR0619).

Some participants explained how they had attempted to emulate the co-operative supply chain strategy successfully implemented by Dell. Through closer co-operation between suppliers and retailers, Dell has managed to create a demand-driven supply chain that has saved costs by minimising stock (SM0608). Likewise, the need for reliability within the supply chain was a recurring topic. Suppliers often failed to fulfil promises by committing to orders which they could not honour, and subsequently suffered a damaged reputation. A participant noted that;

"Rolls-Royce is investing heavily in updating its logistics management processes to improve its scheduling stability. As in the simulation, volatility of schedule has a significant and detrimental impact on the performance of the supply chain" (RR0614)

Strategic conflicts within the simulation supply chain related to the real world were referred to by over 80 percent of participants. One participant commented that;

"There was a lack of joined-up strategy between Retailer D and ourselves who were solely sourced by us and were consequently nervous about our developing business with other retailers. Similar situations have occurred within Rolls-Royce where suppliers have moved their business to Pratt and Whitney because they were able to guarantee a greater volume of work" (RR0610).

This example refers to a conflict situation that emerged when strategies between supplier and retailer within the supply chain were not suitably aligned. For example, if a drive for growth within the supply chain as explained in the citation above is not suitably supported by all organisations within the supply chain then adversarial relationships will develop as those organisations will show themselves to be unreliable and untrustworthy.

The pressure to reduce costs to maintain competitiveness was a realistic supply chain conflict that emerged during the simulation. A participant commented that;

"There is significant tension within the Rolls-Royce supply chain as relentless pressure for price reductions is applied. As in the simulation, this tension is starting to dominate many of the supplier relationships with suppliers looking for ways to protect their

overall financial performance. Again, this is facilitating behaviour consistent with that experienced during the simulation" (RR0607).

A supply chain conflict occurs when organisation shift to new markets and neglect existing ones. This situation was described by a participant;

"With the growth in the oil and gas industry driven by higher oil prices, high margin work is available to our supply chain and much of the market capacity is being saturated by this industry. As a further similarity between the simulation and Rolls-Royce plc, as supplier capacity becomes saturated with non Aerospace work the priority balance between Rolls-Royce and other customers has shifted within the supply chain. In many suppliers, Rolls-Royce plc is no longer a key account and as a result quality and delivery performance has deteriorated" (RR0607).

Another supply chain conflict occurs when customers exert pressure on suppliers to invest in additional capacity in order to bid for, and secure future business. For example, a participant noted that;

"As Rolls-Royce continues to decline in its contribution to supplier profitability the willingness of our supply chain to develop and deliver new products and processes has also declined. Rolls-Royce plc now faces a major challenge to identify new suppliers willing to invest or to carry out a far greater proportion of development itself" (RR0613).

Conflict caused through strategic partnerships within the supply chain were related to the real world. For example, the use of retail power to pass risk down the supply chain to suppliers, insecurity due to a lack of communication of strategy between a manufacturer and its major retailer and over-dependence upon each other. As an example, a participant commented that;

"The drive for price reduction has resulted in a substantial deterioration in supplier performance; in many cases the price benefits we have experienced have been more than offset by the total cost implications of failure to meet customer expectations. As a key learning point from the simulation, it is critical that Rolls-Royce plc and its supply

chain focus on the removal of cost and waste rather than having a blinkered, short-term, price focused approach" (RR0607).

This participant is recognising from the simulation that a strategic partnership within the supply chain needs to be thought through and implemented carefully. It does not mean forcing price reductions upon suppliers so that they are in an invidious position of delivering according to customer expectations with limited income to cover the cost. It means a joint strategy to address the problems – cost reduction in this case – which is understood and communicated between organisations.

Another participant highlighted the need for communication between parts of the supply chain based upon complimentary strategies within the supply chain. In this way, expectations are met and unexpected difficulties are avoided. A participant summarised the learning;

"The learning point from a business perspective is that, to minimise the threat of surprises to your business, ensure that you engage and communicate regularly with your customers and suppliers and ensure that there are complementary strategies in place. If not, find out where you can put complementary strategies in place" (RR0617).

Managing according to available resources was recognised as a realistic issue within the simulation's supply chains. It was recognised that a simpler supply chain - in terms of fewer suppliers or retailers - is easier and cheaper to manage. For example, this learning point was described by a participant;

"*The business simulation also identified many detailed operational complexities at the supplier-customer interface. As new supply chains evolve each manufacturer had more than one customer to do business with and thus the operational complexity became greater. Each manufacturer after every month of business spent a significant amount of time managing the contract with each customer*" (RR0616)

The uncertainty caused by market influences on the supply chain was a feature believed to be common to both the simulation and reality. For example, a participant explained that, similar to developments within the simulation, Rolls-Royce has persuaded suppliers to invest in additional production capacity but then not fulfilled expected

orders as market conditions have changed. Consequently, the suppliers have endured little return on their investment and this has lead to mistrust. This participant concluded that;

"The simulation provided an opportunity to highlight some of the complexities faced in real-life business. How does one react to changing market conditions? How to grow new or existing markets? How to create sustainable profit and returns for shareholders?" (RR0610).

Price wars were apparent within the simulation and also occur within real life business. Situations arose within the simulation in which companies were trying to offer better value than competitors by providing superior products at comparable prices, or just cutting prices in an attempt to generate volumes and profit. Participants explained how these scenarios exist within many industries such as the airline industry and high street retail. For example, British Airways compete against no-thrills airlines on price by providing better in-flight service (SM0611); Tesco and Sainsbury's engage in price rivalry aimed at creating a better price image (SM0603). Price cutting within the simulation was often detrimental to profitability, a situation that is not unusual within the real world. As commented;

" In a bid to become market leaders, the price wars between the supermarkets have led to them cutting away their profit margins. Customers on the other hand have saved enormously from the price competition with them saving a total of £1 billion between 2003 and 2005" (SM0604).

In summary concerning theoretical proposition 3, the issue of whether attitudes regarding marketing management had been influenced by the simulation experience was addressed conclusively through the questionnaire. The view expressed most often by both management students and aerospace executives was that they had been influenced "in many areas". This provides strong quantitative evidence that participants believed that the simulation had external educational validity. This was also supported - either directly, or indirectly - through the reflective accounts which produced much evidence that participants were able to relate the simulation experiences to the real world. Participants were, without being prompted, able to connect the simulation to the real

world regarding strategic thinking, forecasting, inventory management, innovation, customer satisfaction, communication, negotiation, supply chain conflicts, price wars and other aspects related to the marketing mix. Within their reflective accounts, although unsolicited, some participants explicitly stated that they had learnt more about the real world through the simulation experience and subsequent reflections. Both questionnaire and reflective accounts also produced much evidence that participants believed that the simulation had external representational validity – theoretical proposition 2 - given that there was widespread recognition that issues within the simulation were representative of the real world.

3.8 Influenced Attitudes Regarding Financial Management

This analysis is based upon questionnaire results, descriptions provided within the reflective accounts, and perspectives drawn from the interviews.

3.8.1 Questionnaire

Table 10: Perspectives - Q.23 *Have business deductions resulting from the simulation influenced your attitude regarding financial management in the real world?*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	In some areas	In many areas	In many areas	In some areas	In some areas	In many areas
Aerospace Executives	In many areas	In many areas	In many areas	In many areas	No	In many areas

Again, from the table, the results from the questionnaire showed strong support for the proposition that deductions resulting from the simulation influenced attitudes regarding financial management in the real world. The view expressed most often was "in many areas" for both management students and aerospace executives. Unusually, the management students felt that they had been less influenced than the aerospace executives; given that the aerospace executives have much more practical management experience. On reflection, the author can recall that finance was not such a strong area of knowledge amongst the aerospace executives who were mainly from other management disciplines within the organisation. By contrast, the management students had studied finance as a major part of their management degrees. Examples of the

absence of financial thinking amongst the aerospace executives emerged during the interviews as explained in the next section.

3.8.2 Reflective accounts and Interviews

Almost all participants mentioned how the simulation experience had made them recognise the need to consider the financial implications of decisions. Participants described the value of careful consideration of margin, i.e. price relative to cost, not just for their particular company but also others affected by their decisions within the supply chain. For example, a retailer who uses buying power to negotiate lower prices from a supplier may also need to consider that a lack of margin within suppliers can diminish incentive to achieve an efficient and reliable delivery performance. However, both supplier and retailer may benefit if higher volumes lead to lower costs and discounts that can be passed on to the customer. Participants highlighted the need to monitor and control performance using varied financial measures and key performance indicators. For example, a participant commented that;

"The simulation gave me a clear understanding of the financial complexity that organisations such as TIMET face daily" (RR0619).

The issue of performance and how it can be measured seemed to have become more significant to participants that were interviewed. Points mentioned were the need to identify business performance drivers, to identify useful business data, assess margins and profitability, to ask questions. For example, concerning measurement one participant stated;

"*It has made me think a little bit more about how we measure ourselves...we measure the output as opposed to what is affecting the output*" (RRI7).

A major change in attitude was that the simulation had stressed the importance of identifying and measuring the key drivers of business performance within the team.

"*Other key learning has been establishing measures and levers to pull at a given time...it has been really helpful in that as a team we now have a simple clear set of visual metrics based upon my learning from the simulation*" (RRI1).

Obtaining the appropriate data to measure performance was seen to be an issue. The need to spend time "seeking out supporting/related data on an issue" and being "aware of the volume of influencing data that is likely to be available" (RRI2).

The need to assess profitability was highlighted by a participant;

"I have started to think about contribution margins...weighing up the costs versus the benefits...looking for potential problems and how they might affect future profitability" (RRI3). This particular interviewee was excited that he had now been able to understand profitability issues which had helped him to identify how to make a 1.3 million pound gain through the installation of a new forging press.

For another participant, a major outcome was the need to ask more questions concerning margins and the effect of actions on the bottom line;

"It has certainly prompted me to ask questions and challenge on some of our current working practices" (RRI5).

Hence, in conclusion, concerning theoretical proposition 3, there was strong evidence to suggest that the simulation experience and the reflection upon this experience had facilitated changes in attitude regarding financial management in the real world. Therefore evidence implies that participants believe that the simulation demonstrated external educational validity regarding financial management. Also, the questionnaire, reflective accounts and interviews yielded supportive evidence that participants believe that there is external representational validity – theoretical proposition 2.

3.9 Influenced Attitudes Regarding Project Management

Table 11: Perspectives - Q.24 *Have business deductions resulting from the simulation influenced your attitude regarding project management in the real world?*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	In many areas	In many areas	In many areas	In some areas	No	In many areas
Aerospace Executives	In some areas	In many areas	In many areas	In many areas	No	In many areas

From the table, it can be seen that the questionnaire produced strong quantitative evidence that the simulation had influenced attitudes regarding project management in the real world. The view expressed most often was that attitudes had been influenced "in many areas". It is interesting to note that the "average view" for management students and aerospace executives was "in many areas" and "in some area" respectively, which is the inverse of "the most critical view expressed by the most positive 75 percent of respondents". The view regarding this measure for management students and aerospace executives was "in some areas" and "in many areas" respectively. Although appearing to be contradictory, this can be explained by the fact that several of the aerospace executives had much project management experience and were therefore less likely to learn further from the experience.
Kim (1993) describes the concept of double-loop learning in which the learner selects what is to be learnt next based upon existing knowledge. Therefore, a knowledgeable individual is less likely to learn new material within a subject area.

However, there was much less discussion of project management learning within the reflective accounts relative to other topics which was probably due to less emphasis being placed upon this topic within the exercise. Some participants (around 30 percent) stated that they had recognised similarities between the project management aspects within the simulation and those of real-life. For example, both within the simulation and real-life there is necessity to decide which projects have prior access over shared resources (RR0603). One participant commented that,

"The simulation experience where late delivery of machinery and breakdown caused a substantial delay to new product introduction is an excellent example of the hazards faced in real-life" (RR0610).

Therefore, in conclusion, the questionnaire provided strong support for the proposition that attitudes regarding project management in the real world had been influenced by the simulation experience and therefore that the participants believed that simulation possessed external educational validity in this area. By implication, concerning theoretical proposition 2, there was external representational validity although, as has been shown, points made by participants in the reflective accounts were limited.

3.10 Influenced Attitudes Regarding Leadership and Teamwork

This analysis is based upon questionnaire results, descriptions provided within the reflective accounts, and perspectives drawn from the interviews.

3.10.1 Questionnaire

Table 12: Perspectives - Q. 25 *Have business deductions resulting from the simulation influenced your attitude regarding leadership in the real world?*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	In many areas	In many areas	In many areas	In some areas	No	In many areas
Aerospace Executives	In some areas	In many areas	In many areas	In some areas	No	In many areas

Table 13: Perspectives - Q. 26 *Have business deductions resulting from the simulation influenced your attitude regarding teamwork in the real world?*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	In many areas	In many areas	In many areas	In many areas	In some areas	In many areas
Aerospace Executives	In many areas	In many areas	In many areas	In many areas	No	In many areas

As leadership and teamwork are inter-linked they have been shown together in this section. It can be seen from "question 25" that there was strong support for the proposition that attitudes regarding leadership in the real world had been influenced with the view expressed most often being "in many areas". There was greater support for this amongst management students than aerospace executives who reported "average views" of "in many areas" and "in some areas" respectively. This was probably due to some aerospace executives already having knowledge and practical experience of leadership – in accordance with double-loop learning (Kim, 1993).
Interestingly, the issue of whether attitudes regarding teamwork within the real world were influenced received very strong support. The "view expressed most often" and the "most critical view expressed by the most positive 75 percent of respondents" both indicated that attitudes had been influenced "in many areas" for both management students and aerospace executives. Given that this was an involved and complex team exercise, the author observed that the resulting team dynamics and interactions were often fraught and intense and this would explain the strongly positive verdict recorded.

3.10.2 Reflective Accounts and Interviews

The reflective accounts and interviews yielded several examples of similarities between the simulation experience and the real world, and influenced attitudes. From the reflective accounts, the need for clear communication was identified by many participants as a feature of the simulation that is also pertinent to real-world business management. For example, a participant described how, within their organisation they need to clearly communicate sales orders between departments to avoid loss of business to competitors. The alternative is to choose to hold high stocks but this is expensive (RR0612). There is also a need to define and communicate business strategy and goals throughout the organisation so that all are working towards a common goal. A participant stated that;

"The simulation highlighted the interrelationship between business environment, the internal operational organisational complexities and the supply chain system, and

clearly illustrated the need for all these elements to align to deliver sustained business performance" (RR0609).

The simulation required the co-ordination of skills in order to achieve goals in a complex business environment. A participant summarised that;

"The business simulation provided a valuable insight into the interaction between individuals and teams when faced with complex business issues" (RR0607).

From interviews, several comments were made regarding behavioural issues and the dynamics of teams. More specifically, how peoples' personal characteristics affect their business behaviour (RRI6). For example, the fact that people cannot be trusted and can "take pleasure in controlling and influencing others". Therefore it is important to establish who you can and cannot trust within the peer group (RRI2). Also, building personal relationships is key within business success (RRI6). The importance of roles and contracts, to co-operate, to communicate, to maintain relationships, the need to share information within the supply chain but maintain mutual benefit (MSI1/2). The behavioural issues also extended to the supply chain as noted by one participant;

"The simulation has made me think about teams and how we act and how the relationships are with different suppliers" (RRI7). How easy it is to fall into certain behaviours such as getting "the best out of it for yourself as opposed to keeping a good relationship going that is strategically beneficial" (RRI7).

Structuring and planning the work of teams was mentioned. A participant noted that;

"It has given me insights and tips within the management of my team within my new environment...helping to think through strategy and assessing what to be done, where and how as a team in a structured way of thinking" (RRI1)

However, it was mentioned that these were not necessarily changes in attitude; maybe more a reinforcement;

"I wouldn't say that it has changed my philosophy but it has reinforced the fact that it is important to have a flexible team" (RRI7).

Hence, concerning theoretical proposition 3, the reflective accounts and interviews made participants think about leadership and team issues such as communication, co-ordination, relationships and trust that were seen to be relevant to the real world. The questionnaire produced strong evidence of influenced attitudes regarding leadership and very strong evidence regarding teamwork. This was supported by comments made within the reflective accounts and interviews. Therefore, in the area of leadership there is evidence that participants believe that the simulation had external educational validity. Regarding teamwork there is strong evidence that participants believe that the simulation had external educational validity. For theoretical proposition 2, the questionnaire results and examples of relevance to the real world also indicated the perception of external representational validity.

3.11 Influenced Attitudes Regarding General Management

The results indicate that the attitudes of participants were greatly influenced by the simulation experience in all areas for which an impact had been intended. From the questionnaire, the view that was expressed most often regarding strategy, marketing, finance, project management, leadership and teamwork was that their attitudes had been affected "in many areas". This was supported by the reflective accounts and interviews in which participants provided examples of how their attitudes had been, or could have been changed; given the relevance to real-world situations.

Taking the most critical view of the most positive 75 percent respondents, attitudes regarding teamwork was the only one that affected both management students and aerospace executives "in many areas". Marketing and leadership seems to have influenced attitudes "in some areas" for participants of both cases at this level of analysis. Concerning project management, the experienced aerospace executives were either greatly influenced or not influenced at all – given that the average view was "in some areas" and 75 percent of participants had rated their attitudes to project management as having been influenced "in many areas". This might coincide with the fact that several of the managers were already experienced in project management and

its issues. The attitudes of management students appear to have been influenced more than those of the aerospace executives in the areas of strategy management; given that the majority of respondents reported that their attitudes had been affected "in many areas". The researcher proposes that this may have been due to their relative lack of experience concerning the difficulties encountered when trying to devise and implement a business strategy. Interestingly, the majority of the aerospace executives were more influenced concerning financial management than the management students reporting that their attitudes had been affected "in many areas", compared to "in somes areas". Again, based upon the observations of the researcher, the prior financial knowledge of the aerospace executives was not as strong as that of the management students given that most of the former were from non-financial disciplines of management. By contrast, the management students had just completed finance modules as part of their degree courses.

Some participants supported their views on questions with additional voluntarily produced positive comments. One respondent stated that the simulation exercise had broadened perspectives in *"the use of strategy to properly drive business"* (RR7).

Considering teamwork, another respondent commented that *"the vast array of data that needs to be analysed and evaluated dictates a competent team in which you trust. The team needs to buy into the final decision before execution"* (RR4)

More generally, a comment made was that *"the knowledge and training acquired from this simulation will be very important for future use in the business field"* (SM0604).

Although a simplification of real-life, the general opinion was that the simulation illustrated many aspects of complexity within real business management.

"*Throughout the exercise we found ourselves sharing real events we had experienced, either as a point of reference or to use as an aid to help us solve problems. Obviously not everything can be covered in a simulation, but it has been very beneficial to take away simple examples to use logically in our working environment*" (RR0606).

Non-specific, largely positive, points were made concerning how broad the learning could be (in terms of changes in attitude), however this was dependent upon existing knowledge and the work functions for which a manager is responsible.

"It is a simulation which can offer learning on a number of levels and depending upon one's level of business experience you could take completely different sets of learning from the exercise as a whole" (RRI2).

Another interviewee stated that in his workplace he does not have all the dynamics of the simulation to deal with and does not really get involved with the areas of business that the simulation covered. Coming from an accounting background he also already possessed existing knowledge:

"I am already aware I guess of some of the levers and some of the aspects of the business that affect each other" (RRI7).

Some management students commented on how the simulation had helped them to understand more broadly management issues that they had covered in their management course.

"It gave us a macro view of the business...definitely a helicopter view of the company" (MSI1/2). The opportunity to *"combine the knowledge that we have learnt from every lesson that we have had this year...that was the most important thing for me because I never really thought how these things interact"* (MSI3).

One management student expressed how the simulation experience had boosted his team's confidence:

"I was really impressed by the way everything was combined. I needed this to happen because if we had just finished the programme (MSc) then something would be missing. This experience made us think differently ...definitely made us think differently.... it made us feel more confident" (MSI3).

This analysis has provided concrete substance to comments made by various authors. Elgood (1995) stated that, in the areas of communication and teamwork, the process of

discovering results associated with decisions can lead to learning that can be transferred back to the workplace and help participants recognise how components fit together. Wolfe (1976) describes business gaming simulation as transferring academic insights into useful and effective real-world orientations, perceptions, and business career practices. Similarly, Burns et al (1990) describes that the experiential learning effects can be generalised to real world cases. So from a general management perspective, taking all disciplines of management together it can be concluded that participant beliefs were strongly supportive regarding the theoretical proposition that the simulation influenced attitudes regarding business management in the real world, and therefore the simulation had external educational validity.

3.12 Shortfalls in External Representational Validity

Concerning external representational validity – theoretical proposition 2 - many examples have been provided of participant perceptions of similarities between the simulation and real-world business environments. However, over 80 percent of participants were of the opinion that, although a complex representation of the real-world, the simulation was definitely a simplification and did not include some key drivers that exist within other business environments. For example, a participant commented that;

"In the simulation we experienced problems which we have shown to exist in real-life, however we can be certain that in the real world there are many more and the situations are far harder to control with many more variables and uncertainty" (SM0603).

The common view amongst all participants was that the real world has more factors, greater complexity, more lines of communication, and more risk. For example, participants commented that the likely cost versus the benefit of developing a new product in real life makes it a harder direction to pursue than in the simulation. Some participants described the discrepancies between the characteristics of real businesses compared to those in the simulated business environment. For example, it was noted that the simulation did not consider the impact of external factors such as legislation and the cost of energy. The point was made that, in real businesses more information is

available on supplier quality, cost and delivery. Also, leadership is more involved due to a greater number of considerations, and teamwork is essential due to greater complexity. Some aerospace executives commented that the market was different in nature to their real world business where there are higher barriers to entry, sales are created more through personal contacts, and agreements with suppliers are longer-term.

Another difference commonly recognised by over 90 percent of participants was the fact that in the real world there is more time available when making significant decisions, and that these types of decisions are deliberated over with greater care and diligence. For example, it was stated that growth of real business is more controlled because greater attention is afforded to measures and monitoring business performance indicators. More effort is made to assess the consequences of decisions before they are enacted.

Hence, for theoretical proposition 2, although there was much evidence of external representational validity, equally there was also the recognition that the simulation was lacking in certain real-world aspects such as unrealistic time compression, a different emphasis on key business drivers to the market in which participants operate, and simplification of complexity. These views are shared by many authors who believe that the business world is probably too complex to be represented with perfect precision via mathematical computer programmes (Gold, 2003; Gold and Prey, 1990; 1997; 1998, Goosen, Jensen and Wells, 2001; Pidd, 1998; Teach, 1990). Norris (1986) therefore argues that business simulation designers should aim for verisimilitude – the perception of reality by users. There is a danger that if the shortfalls in realism are too significant then the simulation could be damaging to the non-suspecting participant. Machuca (2000) and Forrster (1973) argue that over-simplification can be misleading if it means that the simulation teaches messages about the real world that are inaccurate. Therefore, the author concludes that, in many respects, evidence has shown the simulation to have external representational validity, but with the proviso that participants are encouraged to actively reflect upon weaknesses in such a simulation model to avoid misleading conclusions. It is inevitable that, even a very realistic simulation will have shortfalls and it is the responsibility of the facilitator to make sure that participants are aware of these limitations so that there is accurate and valid learning.

3.13 Learning from differences

An interesting outcome from the activity of reflecting upon differences between the simulation and the real world is that some participants (20 percent) – both aerospace executives and management students - commented that they had learnt from this activity. For example, the absence of written contracts within the simulation highlighted the importance of contracts such that payment is secure and there is clear communication (SM0608). Considering teamwork within the simulation, a participant noted that the lack of hierarchy, of tension, and a culture of self-direction and local accountability that was achieved during the exercise might help real business to be more responsive (RR0611). Conversely, the absence of a leader highlighted the importance of strong leadership within an organisation; necessary to enforce strategic direction (RR0604).

Hence, even if a simulation does have shortfalls in external representational validity this can be turned into advantage through facilitation of the exercise. Participants can learn by reflecting upon those differences between the simulated environment and the real world, and appraising what procedures and policies would be most beneficial for the real-world organisation.

3.14 Summary for part 1 of section 2: External educational validity - When the simulation represents an industry in which the participants do not work

Part 1 has addressed theoretical propositions 2 and 3 from the perspective of participants for whom the simulation represents an industry in which they do not work. Theoretical proposition 2, that the simulation has external representational validity – represents a real-world phenomenon – was strongly, indirectly supported by the majority views of participants recorded through the questionnaire, and directly supported through qualitative viewpoints expressed in the reflective accounts. However some discrepancies between the simulation and the real world were also identified. The interviews also produced supportive perspectives. Concerning similarities, participants stated that they were able to connect the simulation experiences to the real world in many areas: communication, leadership and teamwork, forecasting demand, financial

analysis, customer satisfaction, supply chain issues, strategic and operational management, price wars, and project management. Supply chain issues were the most widely discussed. Some differences were also identified, although these were much fewer in number. Here, participants explained how, in the real world there is greater uncertainty, more variables and complexity, and greater care and time given to decision making. Interestingly, some participants described how they found the differences helpful because learning was assisted by reflecting also upon those differences. A useful perspective that was often expressed was that it was not so much the similarities and differences that contributed to understanding, but more the complexity of the simulation which helped participants to recognise that the real world is also highly complex in nature.

Theoretical proposition 3, that the simulation has external educational validity given that attitudes are influenced regarding business management in the real world, was also strongly supported concerning the management disciplines of strategy, marketing, finance, projects, leadership, teamwork, and general management. Direct evidence was obtained through the questionnaire supported by the reflective accounts and interviews. Given that the questions posed to the interviewees were open-ended, the interviews progressed in the directions that the interviewee chose; which were mainly concerning their attitudes on leadership and teamwork, performance measures, planning and the gaining of a holistic understanding of factors to consider when managing a company.

Therefore, concerning participants who used the simulation of an industry in which they did not work, there was strong evidence that, despite this fact and certain representational caveats and limitations that have been described, the participants believed that the simulation had external educational validity and external representational validity.

Part 2: When the simulation represents an industry in which participants work

The second part of the investigation into the external educational and representational validity examines the views of executives who participated in a simulation of their particular industry, and ascertains whether they believed it to provide a valuable learning experience that was representative of their real-world environment. This cross-case synthesis (Yin, 2003) may provide further data on the issue of extenal validity, given that executives from the same industry as the simulation can evaluate the simulation based upon their understanding of the industry. Two industries were examined using questionnaires and interviews: executives in the fast-moving consumer goods industry (Kraft Foods), and executives within commercial insurance (QBE Insurance).

3.15 Executives from the Fast-Moving-Consumer Goods Industry

Table 14: Perspectives - FMCG Executives

Issue	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
The course objectives were relevant	6 (6.33)	7	6	6	5	7
The course achieved its objectives	6 (6.0)	6	6	6	5	7
The examples and activities used to illustrate the content were helpful and clear	5 (5.2)	5	5	5	4	7
I was motivated by what I learned	6 (6.13)	6	6	6	4	7
The skills presented in the course will be useful in my present and future responsibilities	6 (5.93)	6	6	5	4	7
Overall, I found this to be a top quality course	6 (6.0)	6	6	5	5	7
I will recommend this course to others	6 (6.27)	6	6	6	5	7

1= no agreement, 2/3 = some agreement, 4/5 = mostly agree, 6/7 = complete agreement

It should be noted that a different questionnaire was used for Kraft Foods in compliance with their wishes. A seven-point rating scale was specified with ratings corresponding to: 1= no agreement, 2/3 = some agreement, 4/5 = mostly agree, 6/7 = complete agreement. It can be seen from the questionnaire results shown above that the course was rated very favourably by the FMCG executives with 6 aspects of the simulation course receiving an average rating of 6 or more out of 7, one receiving an average of 5. Taking the averages (shown in brackets), the relevance of the course objectives to their company was rated at 6.33 out of 7, the achievement of course objectives received 6.00, and motivation derived from the learning achieved was given 6.13. The overall quality of the course was rated at 6.00 and there was a rating of 6.27 regarding whether participants would recommend the course to others. Still highly rated, the clarity and helpfulness of accompanying material received 5.2 and the usefulness of skills presented in the course to their jobs was rated at 5.93 out of 7.

Participants were asked how they would apply what they had learned during the programme to their daily work. Answers commented on how their understanding of the broader business will be useful when making decisions in the future. For example, a participant stated that;

"I will be even more aware of the broader pictures regarding every day work with my customers. Also try to see more possibilities, not only limitations" (K13)

There will be greater consideration concerning the consequences of decision making and the impacts of decisions upon other parties within the work chain. As stated by another participant;

"I will further improve my understanding and co-operation with other functions to whom my area of responsibility has a relation" (K10)

Another question asked what participants had learnt as a result of participating in the programme; to which there were a variety of positive answers by all participants with varied emphasis upon different aspect. For example, the simulation had helped to understand the complexity of running a business, the need for communication,

forecasting and a clear strategy, that decisions have knock-on effects. It reinforced the importance of managing the supply chain and improved understanding of how the business functions integrate. It encouraged thinking beyond a manager's immediate business function and stressed the importance of understanding the market. The need to work across functions was recognised so that congruence is achieved between all the parts in line with corporate strategy. One participant summarised with the statement;

"*To see the big picture – to understand Kraft's business environment*" (K11).

Participants were asked to express their views on the simulation. A few (30 percent) proposed that, considering the complexity of the simulation, more time and feedback would have been useful. However, from all participants there was strongly positive support for the simulation, describing it as engaging, useful and motivating learning, providing a good overall picture, and that the competitive aspect had made it fun. Further comments were made concerning gaining holistic understanding of the interactions between business functions, as illustrated by a comment from one participant;

"*The course gave a good understanding of the whole process within a manufacturing company – How everything is linked together and how different factors affect the end result*" (K04).

Realism of the simulation was mentioned. One participant commented that;

"It highlighted the "working method when you were in a 'real market situation'. This simulation with many variables was good and it really gave a good picture of the business complexity" (K06).

Another participant concluded;
"A touch of real world even if it was a simulation" (K08).

Another participant added that this had been *"one of the best courses I've attended so far. Thanks!"* (K10)

The interviews were also very supportive. A Participant commented on how it had made her realise the need to be aware of the financial impacts of decisions, to implement measures to achieve customer satisfaction, and to work together closely within the team to attain goals (KI1). Others stated that the simulation had reinforced their attitudes rather than necessarily changed them. Examples were cited such as the need for customer satisfaction, maintaining a smooth supply chain, and planning (KI2), communication and co-ordination within the decision-making process (KI3).

Hence, for the Kraft executives working within the fast-moving-consumer-goods industry there was strong evidence that a simulation that purported to model their industry had delivered valid learning relevant to their particular industry. The only criticism was that more time to consider decisions would have been beneficial – a point highlighted by Moon (1999) and Malik and Howard (1996) - and that for some the learning was more of a reinforcement than a change of attitude. Hence, this part of the investigation provided further support for the propositions that participants believe that the simulation has external educational validity and external representational validity.

3.16 Executives from the Insurance Industry

Table 15: Perspectives on simulation as a learning tool - Insurance Executives

Issue	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Course run on 15th August, 2006	Good (3)	Good	Good	Good	Average	Very Good
Course run on 22nd August, 2006	Very Good (4.33)	Very Good	Very Good	Very Good	Very Good	Excellent
Course run on 28th August, 2006	Excellent (4.75)	Excellent	Excellent	Very Good	Very Good	Excellent
Over all three courses	Very Good (3.92)	Very Good	Very Good	Good	Average	Excellent

1= poor, 2= average, 3 = good, 4 = very good, 5= excellent

The questionnaire results in the table above show an interesting pattern. Over the three courses the average rating (shown in brackets) for the Zapos business simulation was 3.92 out of 5, or in words just below "very good". However, the second and third of the three courses showed a significant improvement in ratings when compared to the

previous course. The ratings show that the first course achieved an average rating of 3 out of 5 (or "Good"), the subsequent and penultimate course was rated 4.33 out of 5 (or "Very Good") and the final course rose to 4.75 out of 5 (approaching "Excellent"). Therefore, overall the attitude of the insurance executives towards the Zapos insurance business simulation was extremely positive and favourable. Proposed reasons for this improving trend are explained in detail in Section 3 – Design Validity where the design of the simulation is described and the impact that it appeared to have on the course effectiveness.

Although not directly requested by QBE, some participants volunteered comments concerning learning achieved from the simulation. They liked the fact that it gave them a wider picture of the management of an insurance company. For example, one participant stated that;

"The simulation involved working as a team and understanding an insurance company and how it fits together" (Q3.2).

Another suggested that;

"It was very good for framing our thoughts around management thinking" (Q1.4).

Several remarked that they had found it enjoyable and interesting and would have liked to spend more time working with it.

On the whole, the interviews were also very supportive, although again the issue of insufficient time to think and too much complexity was raised. Seventy percent of participants explained that the simulation had improved their understanding of either certain aspects of the business, or the holistic nature of the business - how the components fit together and need to be aligned. For these, specific learning points concerned planning, customer satisfaction, team dynamics, information analysis, benefits from networking, decision-making under time pressure, the need to identify key success factors, the need to consider the financial impacts of decisions and to measure performance. More specifically, one participant commented that, concerning networking;

"I believe this may have even helped us to win a major piece of business and push out a competitor because several divisions worked together as teams" (QI1).

Concerning interactions, another participant stated that;

"It took me out of my work environment and enabled me to see the business from varied perspectives and to discuss the strengths and weaknesses...to see the business from the view of other departments and brokers" (QI2).

Another commented that;

"It made me realise the importance of understanding clearly the business environment that you are working in...even though it is complicated and sometimes difficult to understand...there are lots of issues and information to get your mind around and keep on top of" (QI5).

About 25 percent of participants explained that learning was more of a reinforcement rather than a change of attitude. Around 20 percent of interviewees were critical of the simulation, explaining that their potential learning had been hampered by insufficient time and too much complexity. One participant stated that;

"I found that the whole thing was hard to get my mind around...there was just too much complication and confusion in our team to really understand what was happening" (QI8).

This participant, and others who were critical, were on the first of the three simulation runs from which lessons were learnt and acted upon - there were no such comments during subsequent courses. These lessons are described in detail in Section 3 – Design Validity.

Hence, in conclusion, running a simulation of a commercial insurance business with commercial insurance executives provided further evidence of external validity

(Bryman and Bell, 2003) through case cross-synthesis (Yin, 2003). Apart from some initial implementation problems that were eradicated for subsequent courses, the participants beliefs were strongly supportive of the learning medium, providing further evidence of external educational validity – theoretical proposition 3 - and external representational validity – theoretical proposition 2.

3.17 Summary for part 2 of section 2: External educational validity - When the simulation represents an industry in which participants work

Part 2 has addressed theoretical propositions 2 and 3 from the perspective of participants for whom the simulation represents the industry in which they work. Although, due to restrictions on research instruments used that were enforced by the two organisations from which data was sourced – Kraft Foods and QBE Insurance, strong evidence was obtained supporting both propositions. Both the questionnaires and comments showed that learning had been achieved that was relevant to the business environment in which the participants were employed, indicating external representational validity (theoretical proposition 2), and external educational validity (theoretical proposition 3). There was evidence of validity concerning strategy formulation and implementation, the business environment, marketing, finance, success drivers, and team working. At QBE Insurance, there were some initially negative responses but the cause of these criticisms was identified and rectified for subsequent courses – as explained in the next section, Section 3 – Design Validity.

3.18 Conclusions for section 2: External educational validity

This chapter has analysed data to either support or refute theoretical propositions 2 and 3. Theoretical proposition 2 states that the simulation possesses external representational validity or in other words reflects or matches its real-world counterpart (Carvalho,1991; Dickinson and Faria, 1994). Theoretical proposition 3 is that the simulation possesses external educational validity because it influences attitudes regarding business management in the real world (Burns et al, 1990; Fernstein and Cannon, 2001; Wolfe, 1976). In part 1, the perspectives of those participants for whom the simulation represents an industry in which they do not work was examined. Subsequently, part 2 explored the perspectives of those participants for whom the simulation represents the industry in which they work. Research instruments were formulated to elicit answers to the research questions as directly as possible, although this was achieved moreso in part 1 where the author had complete jurisdiction over instrument design – Part 2 was under the auspices of client organisations. In summary, the participants from both parts provided strong evidence that they perceived that the simulations had external representational validity and external educational validity. In part 1, there was strong evidence that business management attitudes had been influenced regarding strategic management, marketing management, financial management, project management, leadership and teamwork, and the holistic management of all these disciplines together. It was recognised that the simulation model did have constraints and limitations but that there were also many similarities between the dynamics of its business environment and the real world. However, even where the differences existed, participants reported that they had learnt by reflecting upon these differences. Part 2 enabled further cross-case synthesis (Yin, 2003) by examining the views of executives within the fast-moving-consumer-goods industry and those within the commercial insurance industry concerning simulation models of their respective industries. Again there was strong quantitative and qualitative evidence of business management learning regarding their particular industries, although not all executives within the insurance industry were completely supportive due to implementation problems that were subsequently rectified.

However, the problem of measuring learning has been long documented and is certainly a limitation of this investigation. Moon (1999) explains that, because mental processes are covert and private, it is difficult to separate learning from thinking, or reflection from thinking. A subject within an experiment might be good at learning but poor at representing that learning in the required format. Hence it is probable that any instrument will have limitations; given the idiosyncratic and hidden nature of learning. There can be no certainty concerning learning achieved from a simulation, nor a direct method for measurement. There is not an established effective measurement device for validating the learning effectiveness of simulation (Fernstein and Cannon , 2001; Grossler, 2004; Goosen, Jensen and Wells, 2001). Traditionally, it has been difficult to 'concretise' learning variables and hence design a research instrument to capture learning (Gosen and Washbush, 2001; 2004). Researchers have deduced that simple measures such as performance during the simulation experience cannot be used to measure learning (Anderson and Lawton, 1990; Washbush and Gosenpud, 1993; Wellington and Faria, 1991; Faria and Whitely, 1990; Washbush and Gosen, 2001). Hence the author has implemented the wisdom of Moon (1999) and others, observing learning through a representation of learning – written and oral. Learning has been encouraged through a process of writing and debriefing leading to reflection (Moon, 1999; Boud et al, 1994; Hely and Jarvis, 1995; Jacques, 1995; Martin and Dunne, 1996). Given that there has been a wealth of feedback from participants, to this extent the research instruments have proved effective.

Gosen and Washbush (2001; 2004) believe that, regarding simulation, learning objectives need to be clearer so that learning constructs might be tied to learning goals and measured objectively. Through a thorough process of design, implementation and validation, the author has attempted to achieve congruence between learning objectives, simulation design and the validation of the learning effectiveness within this investigation. Consequently, a great volume of quantitative and qualitative data has been collected and triangulated (Denzin, 1978), which subject to the above limitation, has provided an in depth analysis of the theoretical propositions.

Hence, to conclude, the findings of this investigation appear to contradict those of past authors. Based upon participant perspectives, the findings are strongly supportive of the external educational validity of total enterprise simulation and, in many respects, the external representational validity of the medium. Separate studies by Norris and Snyder

(1980) and by Wolfe and Roberts (1986) tried to indirectly establish external representational validity and external educational validity. They conducted a longitudinal study of simulation participants to ascertain whether students who performed best (in terms of business results) within a total enterprise simulation were also more successful within their business careers. There results indicated that there was no relationship although a subsequent study by Wolfe and Roberts (1993) found that there was a relationship between career success and leadership abilities demonstrated within the simulation. This did not, however, measure the attributes of the simulation but more the team dynamics amongst individuals whilst using the simulation which was a limitation of the study. A study performed by Hely and Jarvis (1995) illustrated the problem of unclear learning relative to objectives and deduced that participants learn the exercise but cannot relate it to the real world. Therefore, the findings from this chapter indicate that, contrary to the negative conclusions drawn from past investigations, within this investigation total enterprise simulation has proved to be a credible and valuable medium for business management learning. In short, from the perspectives of participants, the total enterprise simulations used within this investigation possess external educational validity – theoretical proposition 3 - and subject to certain limitations that have been discussed, they possess external representational validity – theoretical proposition 2.

Section 3 – Design Validity

It was concluded within the literature review section of this thesis that the educational and representational validity of a total enterprise simulation is highly influenced by the quality of the design process employed to build the simulation. As proposed by Johnson and Stainton (2006), what is required is an integrated process in which the simulation objectives are first identified, from which a design for the simulation model, a design for the simulation implementation, and a design for simulation assessment and validation can be determined. This should not be seen as a set of isolated activities, but an integration of considerations such that congruence and alignment can be achieved; and hence the opportunity to attain validity and credibility is more likely. It has been said that simulation design is both a science and an art (Rolfe and Hamson, 2003), and therefore a diverse set of factors need to be considered during the creation of such a model. An exploration of design validity was therefore believed to be essential as part of the process of exploring simulation validity within this investigation. Identifying factors that contribute to effective design will enhance simulation validity. Hence this section assesses several characteristics of simulation design to establish their significance when attempting to create a valid simulation. Figure 19 shows theoretical proposition 4, that key design factors influence potential learning concerning business management. As has been explained, a questionnaire was completed by aerospace executives and management students immediately following the simulation exercise to assess their attitudes to these design factors. There are four main areas that are addressed: business management and knowledge, individual and team factors, personal activity during the simulation, and simulation design and usage. These factors were identified both as a result of the literature review but also based upon the past experience of the author in simulation design. The first factor - 1.1 Business management and knowledge - asks whether the understanding of business results that developed during the simulation was assisted by management theory and prior business experience and knowledge. Next - 1.2 Individual and team factors - considers whether there was learning about teamwork and the use of teamwork to learn. Team issues are considered such as: team effectiveness; a systematic working approach; personal motivation; effective use of information; and a planning, implementation, monitor, and control cycle. The third part - 1.3 Personal activity during the simulation - asks whether participants engaged in activities that are likely to encourage learning or help with

understanding during the exercise. More specifically, these are described as: analysis of the market; financial analysis; strategic management; searching for causes of results; and reflection on events. The last section - 1.4 Simulation design and usage - enquires whether learning was influenced by factors such as sufficient realism and content, encouragement and competitive pressure. These are defined more precisely as: facilitator support; the consideration of a multitude of business directions; relevance to real-world business issues; and competition between teams.

The findings from this questionnaire are explored in Part 1 of this section. Subsequently, in order to elicit further data that might triangulate (Denzin, 1978) the questionnaire findings, Part 2 describes the results of a simple complexity experiment that was conducted with executives from QBE Insurance. Here, certain aspects of design complexity of the simulation were varied between courses and the impact on learning effectiveness was ascertained.

Figure 19: Theoretical Proposition 4

Theoretical Proposition 4 – Key design factors influence potential learning concerning business management

Some suggested factors are:-
1.1) Business and Management Knowledge – understanding theory and relating to previous experience
i) The opportunity to apply management theory
ii) Prior business experience and knowledge

1.2) Individual and Team Factors – learning about teamwork, and using teamwork to learn
i) Team effectiveness
ii) A systematic working approach
iii) Personal motivation
iv) Effective use of information
v) A planning, implementation, monitor, and control cycle

1.3) Personal Activity During the Simulation – participating in activities that are likely to encourage learning
i) Analysis of the market
ii) Financial analysis
iii) Strategic management
iv) Searching for causes of results
v) Reflection on events

1.4) Simulation Design and Usage – sufficient realism and content, encouragement and competitive pressure
i) Facilitator support
ii) The consideration of a multitude of business directions
iii) Relevance to real-world business issues
iv) Competition between teams

Part 1: Questionnaire Results – Aerospace Executives and Management Students

This part of the investigation was based completely upon the questionnaire which invited views to be expressed using a Likert scale and provided the opportunity for participants to describe their perspectives more fully through open-ended questions. It was hoped that the open-ended questions might provide further evidence to triangulate findings. However, very few comments were made by respondents and therefore this analysis is based almost entirely upon the Likert scale responses. As explained in the literature review, designing simulation is a complex problem (Burgess, 1995; Fernstein and Cannon, 2001) and it is therefore not surprising that participants did not volunteer additional creative feedback on design issues given that they had no experience of simulation design.

3.19 Influence of Business and Management Knowledge

The first two questions in the questionnaire asked whether the participants' business and management knowledge was useful during the simulation in helping to understand the business developments that occurred. One question considered their application of management theory and the other posited that prior business experience and knowledge might be of assistance.

Table 16: Perspectives - Q. 1 *The application of management theory helped understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	V. Useful	Q. Useful	Extremely useful
Aerospace Executives	Useful	V. Useful	V. Useful	Useful	Not Used	Extremely useful

From the table, both cases confirmed that management theory had been useful although the management students tended to find theory more useful with both the average view as well as the view held by at least 75% of respondents being "very useful" compared to the "useful" view held by the aerospace executives. On reflection, this more positive view held by the management students may have been because they were nearing the

end of their management course whereas the aerospace executives were much further away from completion such that the theories were not so prevalent within their minds. Also, the management students would only have theory to assist them given that, unlike the aerospace executives, they were lacking in useful prior management experience

One management student specifically commented upon the role of management theory: "*Management theory was useful during reflection on simulation experiences*" (SMN16)

Hence, there is strong support for the proposition that participants believe that management theory is important within the process of understanding during a business simulation.

Table 17: Perspectives - Q. 2 *Prior business experience and knowledge helped understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	Useful	Q. Useful	Extremely useful
Aerospace Executives	V. Useful	V. Useful	V. Useful	Useful	Not Used	Extremely useful

In accordance with thoughts expressed for question 1, from the table, the experienced aerospace executives stated that prior business experience and knowledge was "very useful" as an average viewpoint and seventy five percent of respondents believed it to be "useful". Interestingly, the inexperienced management students also shared these perspectives. Applying theory from literature, Moon (1999) postulates that the meaningfulness of learning is idiosyncratic and denotes the relationship between the material of learning and the learner's existing understanding. Likewise, double-loop learning (Kim, 1993) suggests that future learning may be more productive and meaningful when a learner uses their existing knowledge to judge what should be learnt next. Therefore it might have been expected that the more experienced aerospace executives had found their prior experience and knowledge to be relatively more useful, although management students would have built up knowledge during their course.

3.20 Influence of Individual and Team Factors

The questionnaire also explored whether participants supported the notion that individual and team factors were notably useful within the process of understanding the business developments that occurred during the simulation. In accordance with perspectives obtained from the literature review, the questions appraised the contribution of: team effectiveness, a systematic working approach, personal motivation, the use of appropriate information and a planning cycle – given that these are all aspects of individual and team work.

Table 18: Perspectives - Q. 3 *Team effectiveness helped understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	Useful	Q. Useful	Extremely useful
Aerospace Executives	V. Useful	V. Useful	V. Useful	Useful	Not Useful	Extremely useful

From the table, typically, the average and the view expressed most often by both management students and aerospace executives was that teamwork played a "very useful" role within the process of understanding business developments. Half of the respondents believed that teamwork was "very useful" and 75 percent stated that it was at least "useful". From a theory perspective, this concurs with the views of Herzberg (1966) who describes the importance of the working environment as a motivator, which applied to this scenario might mean that effective team working practices are a motivator for learning. Also, Huang (2002) identifies team cohesion as a factor within adult learning.

Table 19: Perspectives - Q. 4 *A systematic working approach helped understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	Useful	Q. Useful	Extremely useful
Aerospace Executives	V. Useful	V. Useful	V. Useful	Useful	Q. Useful	Extremely useful

From the table, all participants acknowledged that in order to understand the developments that unfolded within the simulation it was necessary to adopt a systematic working approach. The most negative viewpoint recorded was "quite useful" and at least half believed that systematic working was "very useful".

Table 20: Perspectives - Q. 5 *My personal motivation helped me to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	Useful	Q. Useful	Extremely useful
Aerospace Executives	V. Useful	V. Useful	V. Useful	V. Useful	Q. Useful	Extremely useful

As illustrated in the table, there was complete agreement that understanding the developments within the business simulation necessitated a personal motivation amongst the participants. All participants stated that personal motivation was at least "quite useful", with 75 percent of the aerospace executives and management students expressing personal motivation to be "very useful" and "useful" respectively. Concerning the characteristics of learners and their mentality, there appears to be a link between motivation, skills and quality of reflection that might lead to learning. McGregor (1960) highlighted the need for people to have the appropriate attitude in order to be sufficiently motivated. Dewey (1933) proposed that skill and attitude will influence the quality of reflection. Similarly, Hullfish and Smith (1961) described how there should be appropriate sentiency, memory and imagination for reflective activity to occur. Kolb (1984) suggested that the quality of reflection is crucial to the depth and

progression of learning. Several authors have described the need for achievement as a strong motivator (Maslow, 1943; Alderfer, 1972; McClelland, 1961; Herzberg, 1966). Therefore it follows that if participants possess certain learning skills and are appropriately motivated to use them, then motivation should be strongly linked to understanding, as has been reported in this analysis.

Table 21: Perspectives - Q. 6 *The effective use of information helped me to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	Useful	Not Useful	Extremely useful
Aerospace Executives	V. Useful	V. Useful	V. Useful	Useful	Not Useful	Extremely useful

From the table, it was broadly agreed that effective use of information was important within the process of understanding, with 75 percent of respondents believing it to be at least "useful".

Table 22: Perspectives - Q. 7 *The cycle of planning, implementing, monitoring and controlling helped me to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	Useful	Not Useful	Extremely useful
Aerospace Executives	Useful	V. Useful	Useful	Useful	Q. Useful	Extremely useful

The table shows that the team planning process was seen to be particularly significant within the understanding of the business results that developed during the simulation exercise. The average view and view expressed most often tended to be "very useful" and the most critical view expressed by the most positive 75 percent of respondents was "useful". Within behavioural theory, Locke (1981) postulates that the setting of goals is an important motivational process, which concurs with the deduction from this analysis that the planning process helped to motivate participants to understand the reasons for business developments.

3.21 Influence of Personal Activity During the Simulation

This part of the questionnaire explores whether, when trying to understand the reasons for business results that developed during the simulation, some activities of participants were more useful than others. The areas of participant activity considered are: market analysis, financial analysis, strategic management, effort expended in searching for the causes of results, and reflection on the simulated events after they were experienced. These topics were included because they cover activities that are essential within the management of an organisation such as the analysis of markets, financial performance and the formulation and implementation of strategy. Other activites such as reflection and assessing cause-and-effect were also included because they form an essential part of the learning process as identified within the literature review section.

The questions considering management activities are analysed in the tables below.

Table 23: Perspectives - Q. 8 *Your analysis of the market helped you to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	Useful	Not Useful	Extremely useful
Aerospace Executives	V. Useful	V. Useful	V. Useful	Useful	Q. Useful	Extremely useful

Table 24: Perspectives - Q. 9 *Your financial analysis helped you to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	Useful	V. Useful	Useful	Q. Useful	Not Useful	Extremely useful
Aerospace Executives	Useful	V. Useful	V. Useful	Useful	Not Useful	Extremely useful

Table 25: Perspectives - Q. 10 *Your strategic management helped you to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	Useful	Not Useful	Extremely useful
Aerospace Executives	Useful	V. Useful	V. Useful	Useful	Q. Useful	Extremely useful

For questions 8, 9 and 10 there was strong support for the proposition that the activities of market analysis, financial analysis and strategic management played an important role within the understanding of business results that developed during the simulation. Typically, financial analysis was deemed to be "useful" on average whereas market analysis was "very useful". This would follow given that participants were forced to assess the marketing drivers within the business environment in order to determine which had caused the financial impacts upon the business. Proportionately more of the aerospace executives found financial analysis more useful relative to the management students with 50 percent believing financial analysis to be "very useful" (compared to "useful") and 75percent perceiving financial analysis as "useful" (compared to "quite useful"). This may have been due to their greater business experience which enforces the need to make profit in order to keep the shareholders contented with their investments in the business.

The tables below analyse the questions concerning learning processes.

Table 26: Perspectives - Q. 11 *Your search for causes of results helped you to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	Useful	Useful	Useful	Useful	Not Useful	Extremely useful
Aerospace Executives	Useful	V. Useful	V. Useful	Useful	Not Useful	Extremely useful

Table 27: Perspectives - Q. 12 *Your reflection on the events that you experienced helped you to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	V. Useful	Not Useful	Extremely useful
Aerospace Executives	V. Useful	V. Useful	V. Useful	Useful	Not Useful	Extremely useful

Encouragingly, learning activities such as searching for cause-and-effect relationships and reflection on events were regarded as important during the process of deciphering and understanding the reasons for business developments during the simulation exercise. Reflection was seen to be more useful with the typical or average view being recorded as "very useful" for both management students and aerospace executives compared to the view that searching for causes of results was "useful". This may have been due to the format of the simulation timetable given that participants were actively encouraged to reflect on certain issues during defined periods of time during the agenda. There was strong support for these activities within the process of understanding with the most critical view expressed by the most positive 75 percent of respondents being "useful" or "very useful".

Some participants specifically commented on the usefulness of writing the reflective accounts as part of the learning process:-

"*Writing an essay about the experience helped to formulate ideas*" (SMN9)

"*It was a very insightful experience and a good way to look at the work we had done over the year and apply it. This was particularly evident when we did our essay*" (SMN16)

Hence, it can be concluded that the advice sought through the literature review section on learning has proved helpful and insightful regarding the learning processes adopted here. Searching for causes of results in the simulation is all part of experiential learning, an active learning process utilising the senses to build or construct learning by experiencing problems and issues and reflecting upon those experiences in order to clarify understanding (Gentry, 1990; Biggs ,1999; Spector, 2000; Lainema and Hilmola, 2005; Duffy and Cunningham, 1996). As in the simulation, there is a perpetual learning cycle as new experiences are analysed and deductions form the basis of more experiences (Kolb, 1984), a process of assimilation and accommodation (Moon, 1999). Searching for causes of results in the simulation is also similar to the concept of problem-based learning introduced by Biggs (1999). Authors regard problem-based learning as a technique that can facilitate deep learning (Moon, 1999) because it is active and hence induces higher level cognitive processes within students (Biggs, 1999; Hacker and Niederhauser, 2000).
Also, in accordance with findings, reflection is considered to be the key learning activity within experiential learning. Authors (Boud, Keogh and Walker, 1994; Dewey(1933); Kolb(1984)) describe the activity of reflection as learning by thinking about experiences. Reflection occurs both as a group and individual process (Boud et al, 1994; Grundy, 1982).

Therefore, in conclusion, the evidence obtained from this analysis largely concurs with the theoretical stances that have been related in this section. It is significant within the process of understanding and learning that, during a simulation exercise, participants are encouraged to search for causes of results, to be confronted with challenging problems and to reflect at length upon experiences and reasons for developments in business results.

3.22 Influence of Simulation Design and Usage

The questionnaire also considered the importance of simulation design and implementation in enabling a business simulation to be delivered effectively. More specifically, and in accordance with issues raised during the literature review and related in this section, aspects to be considered were: facilitator support, a diversity of content and business directions, relevance to the real world, and competition between teams.

Table 28: Perspectives - Q. 13 *Support received from the facilitator helped you to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	V. Useful	Useful	Extremely useful
Aerospace Executives	V. Useful	V. Useful	V. Useful	V. Useful	Q. Useful	Extremely useful

From the table, both management students and the aerospace executives stated very strongly that the support received by the facilitator helped their understanding of the business developments occurring during the simulation. Of the respondents, 75 percent believed that facilitator support was "very useful" and the most negative viewpoint was "useful" for the management students and "quite useful" for the aerospace executives.

A management student reinforced this perspective by commentating that:-

"*Generally - the tutorial sections were very useful & more time allowed to use these would have been nice*" (SMN2).

This concurs with the views of Moon (1999) and Malik and Howard (1996) who posit that quality reflection is required within the learning process, necessitating time and space, facilitation, and the appropriate environment.

Other authors have commented on the importance of a facilitator within reflection (Moon, 1999; Gosen, 2004; Stretch, 2000). Gentry (1990) proposes that feedback is essential to provide positive reinforcement and clarification of learning points. Hall (2004) describes how the facilitator can provide guidance concerning parameters and boundaries.

Table 29: Perspectives - Q. 14 *The assessment of many business directions helped you to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	Useful	Q. Useful	Extremely useful
Aerospace Executives	Useful	Useful	Useful	Useful	Q. Useful	Extremely useful

From the table, there was strong support for the complexity of the simulation. There was broad agreement that the many business directions that needed to be assessed in order to understand the business developments that occurred during the simulation had contributed to understanding. The most negative view expressed was "quite useful" by both management students and aerospace executives, with 75 percent of both believing that having many business directions to assess was at least "useful" as part of the understanding process.

This conflicts with the stance taken by those authors who state that too much realism leads to an unusable level of complexity (Alessi, 1988; Hely and Jarvis, 1995; Norris 1986) and reduces the transparency of cause-and-effect relationships (Grossler, 2004). The simulation exercise was complex and based upon a goal to create a realistic representation of the business world. The fact that the findings in the last sections concerning the external educational and external representational validity of the simulation showed that participants perceived the simulation to be an effective learning medium provides a further contradictory view relative to these authors. However, this is a matter of interpretation given that realism will inevitably mean further complexity and a reduction in user-friendliness. It is therefore necessary to identify the appropriate balance (Pidd , 1998; Hely and Jarvis, 1995; Trauth, Farwell and Lee, 1993; Forrester, 1973; Stretch, 2000). As concluded by Rolfe and Hampson (2003), determining requirements and what to include within a simulation is the 'art' of simulation design. In

conclusion, findings concur with the view of Elgood (1995), that a realistically simulated complex environment can generate a great feeling of interest and excitement; and in this case, understanding of reasons for business results.

Table 30: Perspectives - Q. 15 *The relevance to real world business issues helped you to understand business developments during the simulation. This was...*

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	V. Useful	V. Useful	Useful	Q. Useful	Extremely useful
Aerospace Executives	V. Useful	V. Useful	V. Useful	Useful	Not Useful	Extremely useful

From the table, there was strong support for the proposition that understanding of business developments was assisted because the simulation was relevant to the real business world; with 75 percent of respondents believing this aspect to be at least "useful". The view that was expressed most often was "very useful" in both cases indicating that a realistic simulation environment is important within the learning process.

Some students elaborated with further comments:-

"*This simulation is very effective in reflecting the real business experiences*" (SMN4)

"The b*usiness simulation helped gain insight into the real management world*" (SMN7).

Hence, achieving a realistic business environment within the simulation is an important factor in helping participants to understand the reasons for business results. Duffy and Cunningham (1996) stress the need for a relevant real-world context within learning media. However, studies conducted by Goosen et al (2001) and Keys and Biggs (1990) revealed that business simulations often overly-simplify the real world that they purport to model. Goosen et al (2001) also express concern that the teaching impact of a business simulation may also be constrained by the limited knowledge and bias of the

designer. Similarly, Grossler (2004) believes that the validity of the simulation exercise depends on the modeller's ability, knowledge, experience, world view and access to data. Hence, from theory and this analysis it can be concluded that a realistic simulation model is significant within understanding and learning, but is difficult to achieve. Evidence shows from this analysis, and the discussion of external representational validity in the last section, however, that participants believed that this simulation was realistic in many respects and the realism had helped them to learn.

Table 31: Perspectives - Q. 16 ***The competition between teams helped you to understand business developments during the simulation. This was...***

Case	Average View	View expressed most often	Most critical view expressed by the most positive 50% of respondents	Most critical view expressed by the most positive 75% of respondents	Most critical View	Most positive view
Management Students	V. Useful	Extremely Useful	V. Useful	V. Useful	Useful	Extremely useful
Aerospace Executives	V. Useful	V. Useful	V. Useful	V. Useful	Not Useful	Extremely useful

Conclusively, from the table, the competitive aspect between teams in the simulation seems to have widely contributed to understanding. For both management students and aerospace executives 75 percent of respondents believed that competition between teams was at least "very useful". In fact, the view expressed most often amongst the management students was "extremely useful". From observing the simulation exercises, the researcher can recall that certainly the competitive forces between companies – and therefore teams – did appear to keep people motivated, and this appears to have helped in the learning process. The Hawthorne effect (Mayo, 1933) may account for this finding given that participants may have been motivated to understand due the fact that they were each observing each others activities and performance.

3.23 Summary for part 1 of section 3: Design Validity - Questionnaire Results for Aerospace Executives and Management Students

In summary, all of the factors believed to affect the validity of design were found to be influential and most could be linked to theory. Therefore, theoretical proposition 4 – that key design factors influence potential learning concerning business management has been strongly supported in terms of the beliefs expressed by participants. Understanding of the results within the total enterprise simulation was strongly aided by key design factors concerning knowledge and teamwork such as: participant knowledge and experience of business management; team effectiveness and working processes; and personal motivation. Further significant factors relating to participant activities were: appropriate planning and use of information; active participation in areas such as strategic, marketing and financial management; experiential learning activities such as experiencing and reflecting upon problems. From a design perspective, factors were: facilitator support; a sufficiently complex and realistic representation; and competitive forces – which was the most strongly supported factor of all. The only contentious area concerned the well-debated issue of whether understanding might be hindered by too much complexity within the simulation. In this analysis, complexity was found not to jeopardise learning and was in fact seen to be beneficial. Therefore, to triangulate (Denzin, 1978) this finding a complexity experiment was conducted in Part 2.

Part 2 - Complexity Experiment – Insurance Executives

As explained within the research methodology chapter, a complexity experiment was conducted in which three distinct sets of insurance executives participated in three commercial insurance simulation workshops using a complex and representative simulation model of the insurance business. The complexity of the simulation was decreased between consecutive workshops. In the first workshop participants were required to manage up to 288 target markets, and received no facilitator feedback concerning business decisions. In the second workshop the number of potential target markets was reduced to 144, but still no facilitator feedback was provided. In the third workshop, the number of potential target markets stayed at 144, but this time facilitator feedback on decisions was provided. At the end of each workshop, the participants were asked to rate the simulation as a learning medium and to optionally make comments. The results are illustrated below.

3.24 Experiment Results

Table 32: Experiment Results

How would you rate the Zapos business simulation (as a learning medium)?						
	Poor	**Average**	**Good**	**Very Good**	**Excellent**	**Average Rating**
Course run on 15th August, 2006	0% (0)	20% (1)	60% (3)	20% (1)	0% (0)	3
Course run on 22nd August, 2006	0% (0)	0% (0)	0% (0)	66% (2)	33% (1)	4.33
Course run on 28th August, 2006	0% (0)	0% (0)	0% (0)	25% (1)	75% (3)	4.75
Over all three courses	0% (0)	8% (1)	25% (3)	33% (4)	33% (4)	3.92

From the table, the ratings show that the first course achieved an average rating of 3 out of 5 (or "Good"), the subsequent and penultimate course was rated 4.33 out of 5 (or "Very Good") and the final course rose to 4.75 out of 5 (approaching "Excellent"). Therefore, although all ratings were positive concerning the learning attained from the

"Zapos" insurance business simulation, it can be seen that ratings improved as the level of complexity for the participants was reduced, either by taking out target markets to manage or by providing further facilitator support.

In the first course participants commented that there were too many decisions to consider within the time available.

"The business simulation was too detailed and complex to understand within the time limit provided. The idea of it was good however maybe on a smaller scale" (Q1.1).

Hence, although these decision areas still existed in the second and third courses, about half of the decisions were disenabled for the subsequent courses and consequently the workload halved. As a result (given that no other factors had changed), the average rating increased to 4.33 ("Very Good"). At this stage, inversely, a participant commented that greater complexity might improve the exercise, showing that this was always going to be a contentious issue.

"Involve more people so that more than one business segment is open to increase decision making" (Q2.2).

In the final course, more support was provided to the participants to assist their reflection upon developments and the relevance of theory. This was achieved by displaying flip charts around the room summarising developments that were occurring within the simulation over time, their causes, effects and helpful business thinking. The final course again showed a marked improvement in rating which rose from 4.33 to 4.75, or approaching "Excellent".

In conclusion, this experiment was very simple and by no means rigorous enough to enable definitive deductions concerning complexity issues to be formulated. It was conducted because a window of opportunity was provided enabling the researcher to do so. Hence it was possible to obtain further evidence that might triangulate (Denzin, 1978) the findings from the questionnaire concerning the issues of complexity and realism within a total enterprise simulation. It was discovered that, in accordance with the findings of the questionnaire in part 1, complexity and realism of the simulation

model was beneficial in terms of facilitating the learning of participants. However, too much complexity might have enhanced the real-world representation but also proved detrimental to learning. This concurred with the views of authors – (Alessi, 1988; Hely and Jarvis, 1995; Norris 1986; Grossler, 2004) but also reaffirmed the perspective that simulation design is as much an art (Rolfe and Hampson, 2003) as a science.

3.25 Conclusions for section 3: Design Validity

This chapter shows that there are many factors that should be considered when designing a total enterprise simulation that aims to provide internal and external educational validity, and external representational validity. There is strong support for theoretical proposition 4 – that key design factors influence potential learning concerning business management. From the responses it has been evident that the simulations considered have been able to fulfil participant expectations and needs sufficiently for a high degree of satisfaction concerning learning outcomes to be reported. The study of andragogy (Knowles, 1980) highlights the importance of established goals and satisfying needs within adult learning.
Part 1 addressed design factors through a questionnaire and part 2 utilised a complexity experiment to examine the effect of complexity and realism in more detail. Part 2 concluded that realism and complexity can assist learning, but in careful moderation so as to avoid over-complication and confusion. In part 1, this chapter has analysed evidence and deduced that certain key factors need to be considered during simulation design. Hence, a set of 5 design recommendations - based upon the researcher's interpretations of these results and experience – that may enhance the validity of total enterprise simulation has been deduced, as listed below. The number in brackets indicates the part of theoretical proposition 4 from which this recommendation was sourced.

1) Clear goals - The simulation satisfies goals and participant needs (Knowles, 1980)
2) Opportunity to apply skills (1.1) - It can enable management theory (1.1i), knowledge and past experience (1.1ii) to be applied by participants
3) Team working (1.2) - Participants can work together effectively within their team (1.2i) applying a systematic working process (1.2ii). Participants should be

personally motivated (1.2iii). They should employ information from the simulation effectively (1.2iv). They might engage in a planning cycle in which they are encouraged to plan, implement, monitor and control their decisions (1.2v).

4) Active participation (1.3) - Participants actively engage in personal activities during the simulation. These may be the analysis of the market (1.3i), assessing financial performance (1.3ii) or thinking about strategic management (1.3iii). Experiential learning is significant and participants should have challenging problems that need to be explored and reflected upon (1.3iv, 1.3v, 1.4ii). Facilitator support and feedback is important (1.4i).
5) Sufficient realism (1.4) - The simulation is sufficiently – but not overly - complex such that there is a multitude of business directions to explore that create interest (1.4ii) and challenge and provide a sufficiently realistic representation of the real-world business environment and its issues (1.4iii). Competition between teams can add realism, excitement and the motivation to learn (1.4iv).

This chapter has stressed the importance of design within simulation validity. The design process of planning, designing, establishing boundaries, programming, testing and verification is an essential part of validation (Oakshott, 1997; Fernstein and Cannon, 2001). However, as stated by Hall (2004), such a process will be limited by resources and hence a judgement needs to be made about the level of content complexity and realism necessary to achieve learning objectives cost-effectively.

Conclusions for Chapter 3: Data Analysis-Results

This investigation has aimed to employ a rigorous and reliable research methodology to explore the validity of business simulation, - and more specifically total enterprise simulation. Many have expressed that business simulation validity is an ongoing topic of concern that needs to be tackled conclusively (Gosen and Washbush, 2004; Malik and Howard, 1996; Fernstein and Cannon, 2001; Faria, 2001; Grossler, 2004). Yet, through an integrated process of design, implementation and validation the author has managed to address the issues and draw constructive conclusions that provide good evidence of validity.

However, researchers should not overstate their findings and the author remains cautious; cognisant of the caveats. Any investigation of this kind is difficult because there are several unknowns on which the researcher needs to make a considered judgement. Decisions need to be made concerning simulation objectives, design, testing, format for implementation, and how to measure learning. Authors such as Moon (1999) and Biggs (1999) have explained that direct measurement of learning is impossible because it is covert and hidden. Therefore designing valid and reliable research instruments to measure learning is difficult (Fernstein and Cannon , 2001; Grossler, 2004; Goosen, Jensen and Wells, 2001). To help make an informed judgement, the author has drawn upon the learning literature to try to define learning and hence design research instruments accordingly. Moon (1999) describes deep learning occurring when the cognitive structure acts as an adaptable network to guide, organise and assimilate new ideas based on current knowledge. It is a process of connecting and relating to what is already known. Other authors have also defined deep learning as the concept of connecting together interrelated parts (Moon, 1999; Hacker and Niederhauser, 2000; Marton and Saljo, 1997; Entwistle, 1988). At the extreme of learning there might even be a change in attitude , and this has been described as transformative learning (Moon, 1999; Habermas, 1971; Mezirow, 1990). Hence, the concepts of deep and transformative learning have formed the basis for the research instruments used within this investigation. Even so, there is no means of tangible measurement without being able to directly read the human mind (Gosen and Washbush, 2001; 2004). Therefore, this investigation has based much of its findings

upon a representation of learning induced through reflective activity of participants (Moon, 1999). The representation of learning has been written in the form of reflective accounts and oral through interviews. The results have demonstrated abundantly that participants have been able to interrelate different business drivers and theories, and hence explain reasons for business performance within the simulation. What's more, there has been strong support for the proposition that the simulation has induced a change of attitude, and hence transformative learning. It has not been difficult to collect data, once judgements had been made concerning the appropriate research instruments to employ. Much effort has been exerted by respondents to provide full answers to issues raised. Questionnaires have been completed without any missing data entries and there has been a multitude of descriptions and comments recorded. However, in summary, the intangible nature of learning means that the researcher must always remain reflexive and cautious of any learning measures used, a fact that must be recognised as a limitation of this type of research.

Section 1 demonstrated that the total enterprise simulation used in this analysis had achieved internal educational validity (Fernstein and Cannon, 2001) – that participants could understand cause-and-effect relationships within the simulation model - in several respects.

Within the questionnaires, relationships were classified as "apparent" regarding all the key management disciplines – marketing, finance, project management, leadership and teamwork. Although both cases of participants were very supportive, overall the responses of the management students were more positive than those reported by the aerospace executives. The author has suggested that this trend might be attributed to factors such as team dynamics, experience and maturity - The management students demonstrated greater camaraderie, and the management experience of the aerospace executives meant that they had greater awareness of the concept of business uncertainty concerning the implications of decision making. Considering the viewpoints of 75 percent of participants, the most critical view across the key management disciplines - marketing, finance, project management and team issues - was that relationships were "largely apparent", except for aerospace executives in the areas of market developments and team effectiveness where they were perceived to be "sometimes apparent". Therefore, overall, participant perceptions from the questionnaires provided strong support for theoretical proposition 1; that participants are able to learn about business management from simulation because they show understanding of the reasons for

business results. The questionnaires showed that participant perceptions strongly supported the internal educational validity of the total enterprise simulation used within this analysis.

The reflective accounts provided further in-depth supportive evidence to triangulate (Denzin, 1978) the findings from the questionnaire. There was a noticeable pattern that the effects of marketing and strategic management provided a focus for discussion, and to a lesser extent finance and team issues. More specifically, issues within strategic management, pricing, customer focus and satisfaction, product strategy, supply chain strategy, promotional activity, service strategy, financial performance, and effectiveness of leadership and teamwork.

In summary, contrasting with experiments conducted to show participant understanding of internal relationships within a simulation (Faria and Wellington, 2004; Whiteley, Ledue and Dawson. 2004; Dickinson, Whiteley and Faria, 1990; Dickinson and Faria, 1994; Wolfe and Jackson, 1989) and expanding further on the views of Wolfe (1997), Section 1 has demonstrated that, based upon participant responses, the total enterprise simulation within this investigation demonstrated internal educational validity regarding the business management disciplines of strategic management, marketing, finance, team dynamics, and the dynamic complexity (Senge, 1992) of business.

Section 2 provided strong support for the external educational validity and external representational validity for total enterprise simulations - modeling the fast-moving-consumers goods business environment and the commercial insurance business.

The analysis was conducted from the perspectives of those for whom the simulation represents an industry in which they do not work, and those who do work in the same industry as the simulation. This approach enhanced external validity of the investigation through cross-case synthesis (Yin, 2003).

Concerning theoretical proposition 2 - that the simulation has external representational validity i.e. reflects or matches its real-world counterpart (Carvalho,1991; Dickinson and Faria, 1994) – a questionnaire issued to aerospace executives and management students after participating in a simulation of the fast-moving-goods industry provided strong evidence that participants believed that their attitudes had been influenced regarding key disciplines of business management in the real-world. More specifically, changes in attitude were reported in: strategic management, marketing management, financial management, project management, leadership and teamwork. This provided

supportive evidence that, from a learning perspective, the simulation represented a real-world phenomenon; and interviews also yielded further support. In terms of design, reflective accounts of participants drew comparisons between the simulation and the real-world supporting the perspective that the simulation was realistic; but also had certain limitations. Similarities were identified in the areas of communication problems, implementing effective leadership and teamwork, and the uncertainties of forecasting and dealing with demand. Other parallels were noted concerning the need for financial analysis, achieving customer satisfaction, maintaining an efficient and effective supply chain, problems and issues within strategic and operational management, the pros and cons of price wars, and project management. However, the limitations of the simulation were that the real world has greater uncertainty, more variables and complexity, and that managers are more personally responsible for decisions; allocating greater care and time to the decision-making process. Analysis of participants working in the same industry as the business simulation produced similarly supportive evidence of external representational validity. Interviews in conjunction with questionnaires completed by executives from Kraft foods – concerning their experience of the fast-moving-consumer goods simulation – and by executives from QBE Insurance – concerning their experience of the commercial insurance simulation – reported that they had learnt more about business management within their industry. This provided further supportive evidence of the external representational validity of these simulations from a learning perspective.

There was strong support for theoretical proposition 3 - that the simulation possesses external educational validity because it influences attitudes regarding business management in the real world (Burns et al, 1990; Fernstein and Cannon, 2001; Wolfe, 1976). The results of questionnaires, reflective accounts and interviews show that attitudes were influenced regarding strategic management, marketing management, financial management, project management, leadership and teamwork. The total, holistic management of all these disciplines together and how factors can be utilised to drive success was a common theme. Due to accessibility constraints, the analysis of participants for whom the simulation did not represent their industry produced a greater volume of considerations and perspectives, although all data proved useful and conclusive. Previous studies of external educational validity have been inconclusive and have not provided a detailed analysis of the precise learning outcomes relevant to the real world (Norris and Snyder, 1980; Wolfe and Roberts, 1986; 1993). By contrast, this chapter has shown that, in terms of participant understandings of the simulation that

have been expressed, specific learning has occurred concerning real-world business management, and hence that the total enterprise simulations exhibited external educational validity.

In Section 3, design factors that might enhance the learning effectiveness of total enterprise simulation were explored. It was concluded that, according to theoretical proposition 4, there are certain key design factors that influence potential learning concerning business management. Concerning perceived participant understanding from the simulation, the results of a questionnaire highlighted key design factors within the areas of business and management knowledge, the individual and team, personal activity during the simulation, and simulation design and usage. More specifically, understanding of the business results that emerged during the simulation was reported to be related to participant knowledge and experience of business management as well as team effectiveness and efficiency of working processes. Personal motivation was seen to be influential as were participant activities such as appropriate planning, the effective use of information, and strategic, marketing and financial management. Experiential learning activities were regarded as significant involving experiencing problems and reflecting upon them. From a design perspective, facilitator support, a sufficiently complex and realistic representation of the business world; and competitive forces were important. Interestingly, competition between teams was seen to have relatively more influence which, as proposed by the author, might be attributed to the Hawthorne Effect (Mayo, 1933). The design of a simulation is recognised to be an art (Rolfe and Hampson, 2003) as well as a science. This is particularly evident when judging the appropriate level of realism to build into the simulation without making the exercise too complicated for learning to be possible (Alessi, 1988; Hely and Jarvis, 1995; Norris 1986; Grossler, 2004). This predicament was tested within this investigation via an experiment at QBE Insurance from which it was concluded that realism of the simulation model was associated with learning, however too much complexity in the exercise is detrimental to the learning effectiveness of the exercise. Section 3 concludes by proposing a 5-point list of aims when attempting to achieve a valid simulation design: 1) Clear goals, 2) Opportunity to apply skills, 3) Team working, 4) Active participation, and 5) Sufficient realism.

In conclusion, this results and analysis section has assessed the validity of two total enterprise simulations according to a structured process of design, implementation and validation. This chapter has demonstrated that, by designing for validity within this investigation, participants have perceived that total enterprise simulations can have external representational validity, and in particular, internal and external educational validity.

Chapter 4: Conclusions For Investigation

Within this concluding chapter, section 4.1 provides an overview of the research aims and findings. Linked to this, section 4.2 describes how this thesis has contributed to existing knowledge. Section 4.3 explains the limitations of this kind of investigation and section 4.3 proposes some areas for future research connected to this project.

4.1 Research aims, directions and findings

The research aims and findings of this thesis have been formulated and developed within three chapters - covering literature review, research methodology, and data analysis and findings – which are summarised below.

Chapter 1 reviewed the literature concerning the validation of total enterprise simulation. In Section 1 business simulation was defined and it was discovered that there is no established taxonomy for simulation. Therefore, the author compiled a taxonomy, proposing the term Business Management Development Simulation to describe the category of simulation used within this investigation. The taxonomy defined two main categories of simulation - Business Process Simulation and Business Gaming Simulation. The latter, Business Gaming Simulation, was sub-categorised into Total Enterprise Simulation and Behavioural Simulation. It was established that Business Management Development Simulation was most similar to Business Gaming Simulation and Total Enterprise Simulation. Hence, In Section 2, literature on the validity of Business Gaming Simulation was explored to research how, and the extent to which Total Enterprise Simulation has been validated. It revealed that the educational and representational validity of Total Enterprise Simulation have not been confirmed conclusively, and that the investigation of validity has been hindered by two main difficulties: the establishment of reliable and valid measures of learning, and the effective design of business simulation. Consequently, Section 3 researched the topic of experiential learning and proposed approaches concerning how it might be achieved and measured. Likewise, Section 4 explored literature on design issues and highlighted important considerations for design and implementation. Therefore, Chapter 1 usefully

defined simulation for this investigation and provided guidance based upon literature concerning how it might be validated, highlighting the limitations of past studies.

In chapter 2, a research methodology was formulated and explained for this research project, based upon research methodology literature and past simulation experience of the researcher. In Section 2.1, the research question was defined along with theoretical propositions that provided criteria against which the research question could be assessed. Section 2.2 considered the paradigm stance to be adopted, arguing a strongly an interpretivist epistemology and constructionism regarding ontology. In Section 2.3, the research design and methods were rationalised, proposing a multi-case study design and how to design and implement simulation and research instruments within case organisations. Approaches were related to paradigm stance and issues of attaining validity, reliability and dealing with bias were considered. The difficulty of gaining access to case organisations was described and the process explained. Subsequently, section 2.4 covered the approaches used to analyse both the qualitative and quantitative data generated by the research instruments. In this way, Chapter 2 mapped out and justified the research strategy and plan adopted by this project.

Chapter 3 analysed the validity data in order to address the theoretical propositions. Examining theoretical proposition 1, Section 1 demonstrated that Total Enterprise Simulation used in this analysis appeared to achieve internal educational validity. Participants believed, and showed that they could understand cause-and-effect relationships within the simulation model in several respects. This finding contrasts with other research (Faria and Wellington, 2004; Whiteley, Ledue and Dawson. 2004; Dickinson, Whiteley and Faria, 1990; Dickinson and Faria, 1994; Wolfe and Jackson, 1989) and expands further on the views of Wolfe (1997). Notably, participant perspectives supported internal educational validity regarding the business management disciplines of strategic management, marketing, finance, team dynamics, and the dynamic complexity (Senge, 1992) of business.

In Section 2, participant views provided strong support for the external educational validity (theoretical proposition 3) and external representational validity (theoretical proposition 2) of the total enterprise simulations. Concerning these theoretical propositions, the perspectives of management students and aerospace executives strongly suggested that attitudes had been influenced regarding key disciplines of business management that were relevant to the real-world. More specifically, changes in

attitude were reported in: strategic management, marketing management, financial management, project management, leadership and teamwork. In support of theoretical proposition 2, participants were able to identify similarities between the simulation and the real world, although it was readily acknowledged that representational validity was constrained by certain limitations. The analysis of participants working in the same industry as the business simulation produced similarly supportive evidence of external educational and representational validity, who reported that they had learnt more about business management within their industry. These findings contrast with previous studies of external educational validity which have been inconclusive (Norris and Snyder, 1980; Wolfe and Roberts, 1986; 1993).

Section 3 explores design factors that might enhance the learning effectiveness and validity of total enterprise simulation – theoretical proposition 4 - and concludes by proposing a 5-point list of design aims: 1) Clear goals, 2) Opportunity to apply skills, 3) Team working, 4) Active participation, and 5) Sufficient realism.

Therefore, Chapter 3 has established that, according to participant perspectives, all four theoretical propositions were, in the main, strongly supported. There has been strong support for internal and external educational validity, and evidence of external representational validity in several respects, subject to limitations. However, validity is influenced by design issues, many of which have been recognised within this investigation.

4.2 Contributions to existing knowledge

Within the chapters described in Section 4.1, this investigation has successfully contributed to existing knowledge in four respects. Three contributions concern the development of frameworks: Contribution 1) A reference framework for simulation validity; Contribution 2) A research methodology framework for simulation validity; and Contribution 3) A design objectives framework for simulation validity. In addition, as Contribution 4), this investigation has produced evidence to strongly support the validity of total enterprise simulation. These contributions to existing knowledge are described below.

Contribution 1) A reference framework for simulation validity. Chapter 1 provides a reference framework of necessary considerations when assessing the validity of total enterprise simulation. It comprises: i) a taxonomy of business simulation, ii) published research on the validity of total enterprise simulation, iii) experiential learning applied to total enterprise simulation validity, and measures of learning to test for validity, and iv) simulation design factors affecting validity.

i) The taxonomy is a detailed comparison of types of business simulation used for management education. It compares business process simulation with business gaming simulation highlighting general stances regarding nature, purpose, techniques, medium, decision making, business model and algorithm characteristics. Further comparisons are made between total enterprise simulation and behavioural simulation. This taxonomy is useful because it enables simulation designers to compare their designs against others. In this way, the author could define the simulations used within this thesis as an extension of existing simulation categories; comprising the elements that define a total enterprise simulation, but also some features of behavioural and business process simulation. The author categorises this "new" type of simulation as business management development simulation. Hence, Chapter 1formulates and demonstrates the usefulness of a simulation taxonomy.

ii) Chapter 1 defines and assesses the validity of total enterprise simulation using established publications. It demonstrates that evidence of representational and educational validity is limited and inconclusive such that there is a need for further investigation. Hence it highlights the need for validity research in order to establish credibility for total enterprise simulation.

iii) Considering learning, Chapter 1 explains how experiential learning processes can be applied to business gaming simulation. It explains how motivational theories can provide a further basis for nurturing learning within the simulation context. The measurement of learning through a "representation of learning" is also proposed. Hence, it links together literature advising how to facilitate and measure experiential learning within a total enterprise simulation.

iv) Finally, design issues are investigated providing guidance on factors to consider when striving to design valid total enterprise simulations.

Therefore Chapter 1 provides a contribution to existing knowledge through a reference framework of validity considerations applied to total enterprise simulation.

Contribution 2) A research methodology framework for simulation validity. Making a further contribution to knowledge, Chapter 2 proposes a research methodology framework that offers a sound basis for validating total enterprise simulation. It is based upon validity literature applied to simulation, learning, and research methodology, combined with the researcher's simulation experience. The framework addresses research validity, research reliability, research design, simulation design and implementation, research instruments and data analysis approaches.
Therefore Chapter 2 provides a contribution to existing knowledge by proposing and testing a research methodology framework for validating total enterprise simulation.

Contribution 3) A design objectives framework for simulation validity. Chapter 3 proposes a framework of objectives for valid simulation design that is based upon literature formulated within previous chapters and the findings of Chapter 3. These are: 1) Clear goals; 2) Opportunity to apply skills; 3) Team working; 4) Active participation; and 5) Sufficient realism. These objectives have been justified, substantiated, and described in detail within Chapter 3. Therefore Chapter 3 provides a contribution to existing knowledge by deriving a design objectives framework for validating total enterprise simulation.

Contribution 4) Evidence to strongly support the validity of total enterprise simulation. Chapter 3 contributes to existing knowledge because, in contrast to many previous studies, Chapter 3 provides strong evidence that participant perspectives support the internal and external educational validity of the total enterprise simulations used within this investigation. The results have demonstrated abundantly that participants have been able to inter-relate different business drivers and theories, and hence explain reasons for business performance within the simulation. What's more, there has been strong support for the proposition that the simulation has induced a change of attitude, and hence transformative learning relevant to the real world. Views have also shown that participants have recognised the external representational validity of the total enterprise simulations in several respects, subject to certain limitations. The validity evidence has been described in detail in Chapter 3. Therefore Chapter 3 provides a contribution to

existing knowledge by providing strong evidence that participant perspectives support the validity of the total enterprise simulations used within this investigation.

4.3 Limitations

Inevitably, this investigation has limitations – i) the researcher's influence; ii) the nature of learning; iii) participant characteristics; iv) access, budget and time constraints; v) external validity; and vi) simulation design.

i) As a substantive enquiry conducted by a single researcher, the simulation design and learning outcomes were highly dependent upon the researcher's attitudes, perceptions, understandings and activities. Although knowledge was solicited from senior managers within industries, the simulations were designed and built solely by the researcher based upon his management experience and understanding. The researcher was also responsible for facilitating the simulation exercises and therefore his approach to facilitation will have undoubtedly influenced the outcomes. When analysing the qualitative data, the deductions were based upon the researcher's interpretation. An investigation of this kind will always be influenced by the researcher's perspectives, traits and abilities. It is therefore essential for the researcher to remain reflexive throughout.

ii) The nature of learning is idiosyncratic and covert. Therefore, defining measures of learning that are reliable and possess complete construct and measurement validity is currently impossible. Until technology can enable the researcher to read the human mind, there will not be an infallible measure of learning. Consequently, this research has been based upon representations of learning that elicited participant perceptions and attitudes. The measures involving reflective accounts necessitated considerable time input from respondents which limited their applicability.

iii) Participant characteristics will influence an investigation of this kind. It necessitates that participants apply themselves both during the simulation exercise and after when providing feedback via the research instruments. Results will be adversely affected if participants are not sufficiently motivated or are lacking in ability.

iv) This research was subject to significant constraints. Progress was blocked by barriers and hurdles that the researcher needed to negotiate. It was highly dependent upon securing access to case organisations, negotiating budgets to pay for simulation development, and justifying participant time investment in the simulation exercise and in providing feedback. Research instruments to investigate thinking processes proved to be time intensive for participants. Hence, constraints of this nature could easily hinder and limit the success of this kind of investigation.

v) Researchers must be cautious when generalising and relating the findings of this type of investigation to other contexts. In order to analyse perspectives in depth, it was necessary to conduct a substantive investigation based upon four case organisations. Therefore, the external validity of this investigation needs to be considered carefully.

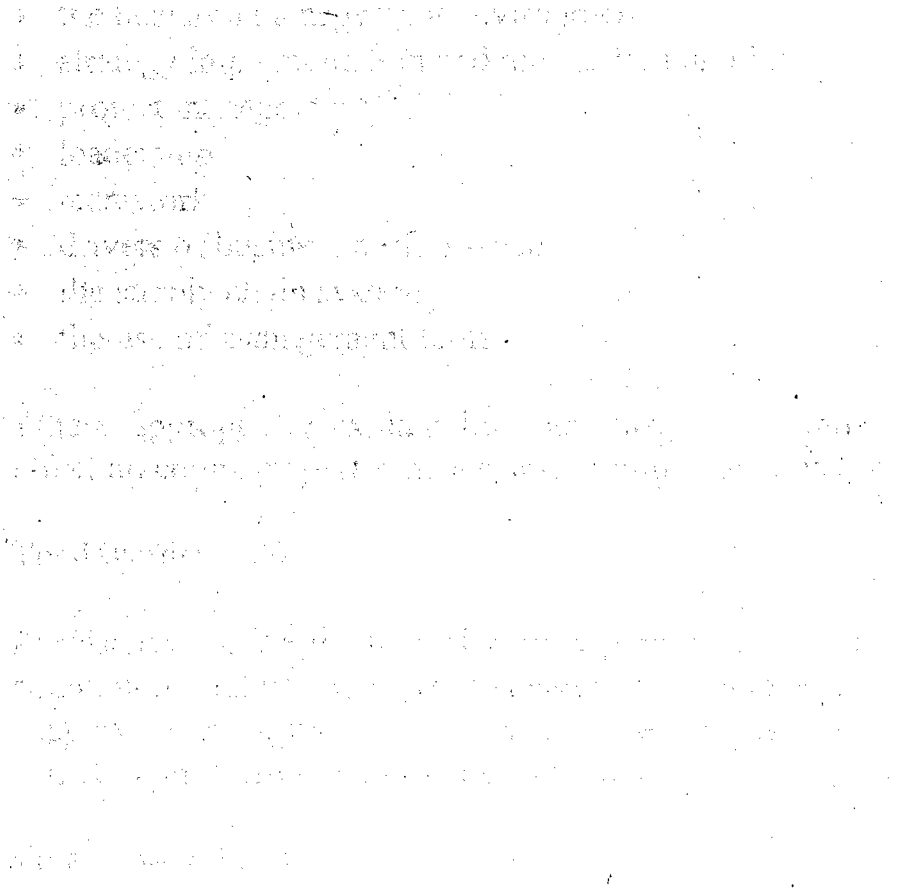
vi) The final limitation concerns the difficulties confronted when designing simulation. There are the problems of soliciting industry information and the associated time of busy executives. Formulating and programming credible, reliable, and valid algorithms is dependent upon the designer's knowledge and understanding, and is costly and time consuming. Therefore, producing a simulation design that is powerful enough to achieve quality objectives will be challenging.

4.4 Further Research

Although a substantive investigation, this thesis has created a foundation for simulation validation that can now be employed within other contexts. The author believes that it would be advantageous to apply the research methodology framework to validate and enhance the credibility of other total enterprise simulations and behavioural simulations, and also other experiential learning exercises. Also, it would be possible to apply the simulation design frameworks to benchmark the validity of behavioural and total enterprise simulations.

It might be possible to conduct a more longitudinal approach where effects from the simulation are judged over time. For example, the employers of companies might be

questioned in order to ascertain whether they have noticed any changes in attitude or in behaviour of staff who have experienced a total enterprise simulation. Alternatively, the performance of the "real-life" companies for which participants work and the effectiveness of their departments could be monitored over time.



Appendices

Appendix 1 – Open-ended Questions for Reflective Accounts

1) Describe and analyse the management successes and failures experienced by your company during the business simulation. Refer to issues such as :-

- the business management environment
- strategy implementation and the marketing mix
- project management
- leadership
- teamwork
- drivers of business performance
- the supply chain system
- the use of management tools.

Where appropriate, explain how and why developments occurred, their effect on company performance, and resulting actions taken.

Total words: 2000.

2) Discuss the degree to which management experiences of the business simulation reflect real-life management complexity. Where possible, support your argument with real-life examples taken from referenced sources and/or from your own experience.

Total words: 1500.

Appendix 2 – Liaise simulation timetable

This appendix describes the mechanics of the simulation exercise in terms of the activities that participants undertake within the timetable shown below.

As can be seen, the simulation commences with an "Introduction" session which covers an overview of business goals and objectives that participants should strive to achieve during the exercise. Participants are encouraged to actively partake in the process of reflecting upon experiences that emerge during the exercise and relate relevant theory. Attention is given to the need to develop reflective thinking processes based upon structured questions that will facilitate the potential understanding of cause-and-effect i.e. what happened to our company performance and why did this happen? There is also a technology hurdle that must now be crossed. The simulation is delivered via a computer medium made up of reports, charts, graphs and decision screens. Hence, as such, at this stage the computer could be regarded as a nuisance! The aim of the exercise is to enable participants to experience and reflect upon management issues so that they might learn from them, however, these experiences must originate from the interactions that emerge via the computer technology. Therefore, the facilitator must focus strongly upon enabling participants to interact and use the computer interface as quickly, and effortlessly as possible. In this way the exercise becomes one of management thinking rather than a task of understanding a computer interface.

With participants able to interact with the interface, the process of management within the exercise can commence. The participants are required to "Analyse the complex business environment", working in teams and using their dedicated computers – allocated one per team and networked to a central computer. The objective of this phase is to encourage participants to explore the significant and pertinent variables and boundaries that comprise the simulation model. Also, in this way, the participants are actively forced to examine the computer screens that represent the performance and decision histories of their companies. This session ends with a group discussion on "The Business Management Environment" in which teams explain to each other their understanding of the industry and their company – for example, product areas, competitors, customer types, market strengths etc.

The facilitator now relates this business environment to strategic theory in a session on "Strategy and the Marketing Mix – Dynamic Complexity". This is followed by an important "timeout" in the form of a short break after

which participants are asked to begin formulating their missions and strategies, working in teams and using the management reports available on their team computers. It may be that some teams are not ready to devise a strategic plan at this point in time given that senior managers within large organisations can take months to formulate sound business directions, especially if they are new to the organisation which is the case within this virtual environment. Therefore some teams may decide upon a more emergent strategy approach rather than an intended one.

A process of plan, implement, monitor and control now commences in which participants are required to make business decisions concerning marketing, leadership, financial and project issues relating to a period of simulated time and implemented within a specified deadline – for example "Month 1" by 13:00 hours. When the deadline arrives, a button is pressed on the central computer which automatically collects the business decisions from the team computers via the network, processes the algorithm and distributes results back to the team computers. In this way, simulated time progresses from month 1 to month 2 and participants are confronted with a new set of results to analyse; which have been influenced by their decisions – and those of their competitors. As results are returned to teams, participants are required to actively reflect (within their teams) upon the causes of results. The facilitator also contributes to this process by circulating between teams and offering advice – cognisant of the need not to over-influence thinking processes and thereby limit the participants "journey of self-discovery".

Hence, participants within their teams move through a cycle of experience. reflections, conceptualisation and implementation similar to that proposed by Kolb (1984). As can be seen from the timetable, the process repeats as a sequence of decision periods that culminate in a total simulated period of two years – although this can be varied by simulation. It can also be noticed that "virtual" time moves forward faster as the exercise progresses and participants become more proficient with their management thinking. At regular intervals there are breaks to encourage participants to relax and escape from what can, at times, become a frenetic business working environment - as participants become entrenched within the exercise through a desire to compete and succeed. There are also further theory, reflection and discussion sessions conducted by the facilitator as a group – rather than within teams. These sessions focus upon topics such as project management, people management, financial analysis, the drivers of performance, and supply chain management.

Complexity Management – Recognising and Dealing With Complexity in a Simulated Business Environment (Day 1)

Time	Session
8:45	Introduction
9:00	LIAISE – An FMCG Business Simulation Andrew Stainton, Management Consultant, School of Management, Southampton University
9:30	Analysing the Complex Business Environment (team assignment No. 1)
10:15	Group Discussion – The Business Management Environment
10:30	Strategy and the Marketing Mix – Dynamic Complexity
11:00	Break
11:30	Formulation of Mission and Strategy (team assignment No. 2)
12:00	Month 1 Decisions
13:00	Lunch
14:00	Month 2 Decisions
15:00	Project Management Complexity (team assignment No. 3)
15:30	Break
15:45	Month 3 Decisions
16:45	Month 4 Decisions
17:30	Month 5 and 6 Decisions
18:30	End of Day 1

Appendix 2 (cont.)

Complexity Management – Recognising and Dealing With Complexity in a Simulated Business Environment (Day 2)

Time	Session
9:00	Discussion of People Management Issues
9:30	Quarter 3 Decisions
10:45	Break
11:00	Financial Analysis
11:30	The Drivers of Business Performance (team assignment No. 5)
12:00	Quarter 4 Decisions
13:00	Lunch
13:45	Quarter 5 Decisions
14:45	Supply Chain System Review (team assignment No. 6)
15:15	Break
15:30	Quarter 6 Decisions
16:30	Quarter 7, 8 Decisions
17:30	End of Day 2

Appendix 3 - Questionnaire

Concerning the simulation:

1) To what extent did the following factors help you to understand reasons for the business developments that occurred during the simulation? – ranging from "Not Used/Useful" to "Extremely Useful".

i) Your business and management knowledge

	Not Used	Quite Useful ◄——►			Extremely Useful	Any recommendations?
Your application of Management theory						
Your prior business experience and						

ii) Individual and team factors

	Not Useful	Quite Useful ◄——►			Extremely Useful	Any recommendations?
The effectiveness of your team						
A systematic working approach						
Your personal motivation						
Effective use of information						
Planning, implementing, monitoring and						

iii) Your activities during the simulation

	Not Useful	Quite Useful ← →			Extremely Useful	Any recommendations?
Your analysis of the market						
Your financial analysis						
Your strategic management						
Your search for causes of results						
Your reflections on the events that you experienced						

iv) Simulation design and usage

	Not Useful	Quite Useful			Extremely Useful ← →	Any recommendations?
The assessment of many business directions						
Support received from the facilitator						
Relevance to "real-world" business issues						
Competition between teams						

2) The reasons for your business results were "always unclear"... "apparent always":-

	Always Unclear		Apparent Sometimes ⟷		Apparent Always	Any recommendations?
Causes of market developments						
Financial impact of decisions						
Project issues						
Impact of team effectiveness						

3) Have any of your business deductions resulting from the simulation influenced your attitudes regarding business management in the "real world"?

	No		In some areas ⟷		In many areas	Any recommendations?
Strategy						
Marketing						
Finance						
Project management						
Leadership						
Teamwork						

4) Any further comments concerning changes in your attitudes that have been influenced by the simulation.

Appendix 4 – Theoretical Propositions

Theoretical Proposition 1 – Participants are able to learn about business management from simulation. They are able to understand the reasons for business results (internal educational validity):-

5. *The reasons for market developments*
6. *The financial impacts of decisions*
7. *The effects of project issues*
8. *The impact of team effectiveness*

Theoretical Proposition 2 – The simulation possesses external representational validity

Theoretical Proposition 3 – Participants are able to learn about business management from simulation. Attitudes are influenced regarding business management in the real-world (external educational validity)

vii) Regarding strategic management
viii) Regarding marketing management
ix) Regarding financial management
x) Regarding project management
xi) Regarding leadership
xii) Regarding teamwork

Theoretical Proposition 4 – Key design factors influence potential learning concerning business management

Some suggested factors are:-

1.1) Business and Management Knowledge – understanding theory and relating to previous experience

i) The opportunity to apply management theory

ii) Prior business experience and knowledge

1.2) Individual and Team Factors – learning about teamwork, and using teamwork to learn

i) Team effectiveness

ii) A systematic working approach

iii) Personal motivation

iv) Effective use of information

v) A planning, implementation, monitor, and control cycle

1.3) Personal Activity During the Simulation – participating in activities that are likely to encourage learning

i) Analysis of the market

ii) Financial analysis

iii) Strategic management

iv) Searching for causes of results

v) Reflection on events

1.4) Simulation Design and Usage – sufficient realism and content, encouragement and competitive pressure

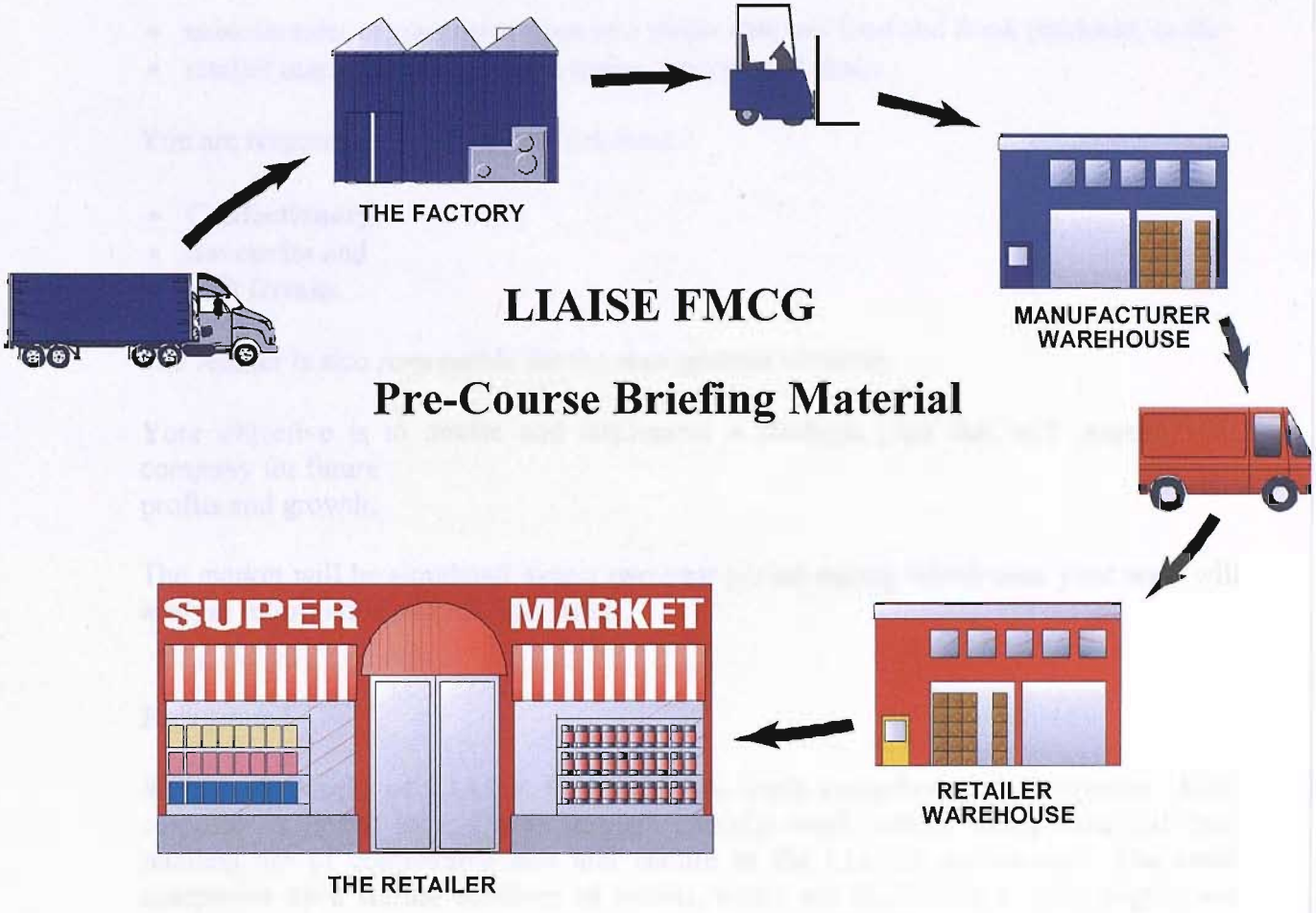
i) Facilitator support

ii) The consideration of a multitude of business directions

iii) Relevance to real-world business issues

iv) Competition between teams

Appendix 5 – LIAISE FMCG pre-course briefing



Introduction

LIAISE is a business simulation model of a manufacturing and retail market producing and selling food and drink products. The marketplace is both dynamic and highly competitive.

You have just been recruited into either the

- manufacturer management team of a major national food and drink producer, or the
- retailer management team of a major supermarket chain.

You are responsible for three product areas –

- **Confectionery,**
- **Savouries** and
- **Soft Drinks**.

The retailer is also responsible for the management of stores.

Your objective is to devise and implement a strategic plan that will prepare your company for future
profits and growth.

The market will be simulated over a two-year period during which time your team will analyse information and take decisions.

Background

Within the world of LIAISE there are five main manufacturing companies. Each company is linked to and sells through specific retail outlets. Companies and their retailers are of comparable size and stature in the LIAISE marketplace. The retail companies have similar numbers of outlets, which are situated in popular high street locations and out-of-town complexes. Traditionally Retailers A and B have been orientated towards the wealthier customer categories but all companies are dependent upon volume markets with relatively low margin sales.

In recent years there has been moderate corporate investment with focus upon the maintenance of profit. Marketing activities have been limited and the largest companies have developed market share by aiming to provide services to the mass population.

The Main Board is now looking to you and your colleagues to shape the future of your company. You have four main areas of work on which to concentrate. Depending upon the size of your team, individuals might be allocated specific functions or positions, or you might choose to share work tasks. You must also appoint a leader. You will also need to decide for what length of time the leader will lead - Each course delegate will at some time lead during the course.

Position 1	**Position 2**	**Position 3**	**Position 4**
Marketing	Finance	Operations	Research
Responsibilities: - Market analysis - Strategy formulation and implementation through the five P's - Strategy appraisal - Budgeting - Sales and profitability forecasts (Margin and What-if analysis) - Financial appraisal and Ratio analysis - Maintaining human capabilities and capacities through benchmarks - Production scheduling, orders and stockholding - Communications, internally and with suppliers or distributors - Product development - Project management			

You will be required to undertake the following tasks.

1. **Assimilate** - Understand the current environment and historical trends.
2. **Plan** - Draw up strategic plans.
3. **Implement** - Take decisions so those plans are carried out.
4. **Monitor** - Assess performance resulting from decisions.
5. **Control** -Take further decisions to keep your company on track.

After each year of management you will be asked to present and justify your progress to the Main Board.

How Will Success Be Achieved?

There are a number of basic steps that each team needs to undertake to run their company. These are explained below but first it is necessary to become familiar with the market structure now explained.

Market Structure

- **Customers.** To assist with market analysis, customers have been defined according to four customer types: **Wealthy, High Income, Moderate Income** and **Low Income**.

- **Companies**

There are five manufacturers (A to E) which are distributing their products through five retailers (A to E). At present, Manufacturer A is supplying Retailer A exclusively, B is supplying B, C is supplying C and so on, but there are possibilities for expansion into other channels ie. Manufacturer A may decide to supply Retailer B. It is up to you to decide if you want to do this. If you do, you will have to negotiate with other companies.

Manufacturer E and Retailer E are called ROW, which means Rest of World. Course participants do not manage these companies. Their function is to compete against other teams. The management of company E is simulated within the computer and historically has focussed on service and promotion.

Each retailer currently has a particular market orientation. ie. A and B have been pitched more towards higher income customers, C and D more towards middle/low income customers.

- **Products**

There are three product areas: **Confectionery, Savouries and Soft Drinks**.
Each manufacturer is capable of producing four varieties of products in each product area.
Product 1 and Product 2 are mature, established products. However, Product 3 and Product 4 are yet to be developed. If the manufacturer wishes to invest resources in product development in order to launch Product 3 or Product 4, it must set up and manage projects. Information on running projects is available within the simulation

Product Areas	Products		Companies
Confectionery			
	Product 1	Already Launched	**Manufacturer A**
	Product 2		**Manufacturer B**
			Manufacturer C
			Manufacturer D
			Manufacturer E (ROW)
	Product 3	To be developed	
	Product 4		
Savouries			
Soft Drinks			

- **Distribution Channels, and operational preferences.**

Retailer A Retailer B	Retailer C Retailer D	Retailer E (ROW)
⇒ Higher Income Customer Orientation	⇒ Medium/Low Income Customer Orientation	⇒ Promotion
⇒ Quality	⇒ Choice	⇒ Volume
⇒ Choice	⇒ Volume	⇒ Service

Steps to Take

Step one

- **Apply Strategic Marketing**

Marketing has been expressed as human activity directed at satisfying needs and wants through exchange processes. More simply, we could say that marketing is a business philosophy that puts the customer at the centre - no customer, no sales!

The right information is used to get the right products to the right people through the right distribution channels at the right time and the right price with the right publicity and promotion.

This definition is sometimes referred to as the *'Five P's'*: ***Product***, ***Price***, ***Place***, ***Promotion*** and ***People***.

- **Analysis of the Marketing Mix**

Product

Issue	Where to Look in System
What markets are growing?	*Market Growth Rates*
Which markets have the greatest growth potential?	*Market Potential*
What are current customer needs and to what extent are companies satisfying them?	*Market Segmentation*
In which markets are we most dominant?	*Market Shares*
Which markets are most profitable?	*Profitability trends*
What new product solutions should we develop?	*Project Management - Develop new produc*
Are our production and warehousing capacities sufficient to cope with demand?	*Project Management - Enhance capacities*

Price

Issue	Where to Look in System
Have we been pricing profitably in the past?	*Historical Profit Assessment*
How competitive are our prices?	*Pricing - Competitor Analysis*
How should we price in the future and what might be the impacts on our profitability?	*Pricing Decisions and What-if*

Place

Issue	Where to Look in System
Which retailers currently have highest appeal to customers?	*Consumer Attitudes Towards Retail Outlets*
How can retailers maintain customer loyalty?	*Project Management - Set up loyalty cards, Logistics, Enhance checkout efficiency*
Are products being allocated enough shelf space?	*Shelf Space Allocation*

Promotion

Issue	Where to Look in System
Has our local product marketing spend affected our growth and profitability?	*Historical Trends – Promotion*
Have we been spending competitively to support sales effort?	*Competitor Analysis – Promotion*
How much should we spend?	*Theory/Statistical Assessment*
Do we need to enhance our corporate image and recognition?	*Competitor Analysis – Promotion*
What corporate identity should we be portraying to our customers?	*Consumer Attitudes Towards Retail Outlets, Market Segmentation*

People

Issue	Where to Look in System
How hard are we pushing our Staff?	*Service Levels - Efficiency, Headcount, Pa Staff Competence*
Are our staff sufficiently compensated?	*Service Levels - Efficiency etc*
How well do our staff perform their jobs?	*Service Levels - Efficiency etc*
How well are the departments supporting our projects?	*Project Management - Gantt Charts*

Step two

- **Create a Mission Statement**

Prior to the start of the course, you should have assessed the information provided. This helps you to compose a mission statement for your company when you get together with your team and start using the simulation.

The mission statement provides an overall direction, which your company should strive to achieve. It should summarise concisely the reasons for the company's existence in terms of the market, target customers and their requirements, e.g. "we wish to maintain our status as the number one provider of snack food products to higher socio-economic customers through quality, competence, service and good value".

A good mission statement should:

⇒ Motivate
⇒ Be Feasible
⇒ Be Measurable
⇒ Have Market Orientation

Step three

- **Describe goals, and set strategies to achieve them,**

Some examples are listed:

Goals	*vs.*	**Strategies**
• Keep costs to a minimum		• A rigorous procedure of self assessment
• Maintain an efficient distribution network		• Keep pay levels competitive • Ensure adequate staffing • Maintain stock levels
• Keep products innovative and competitive		• Affordable pricing • Vigilant research

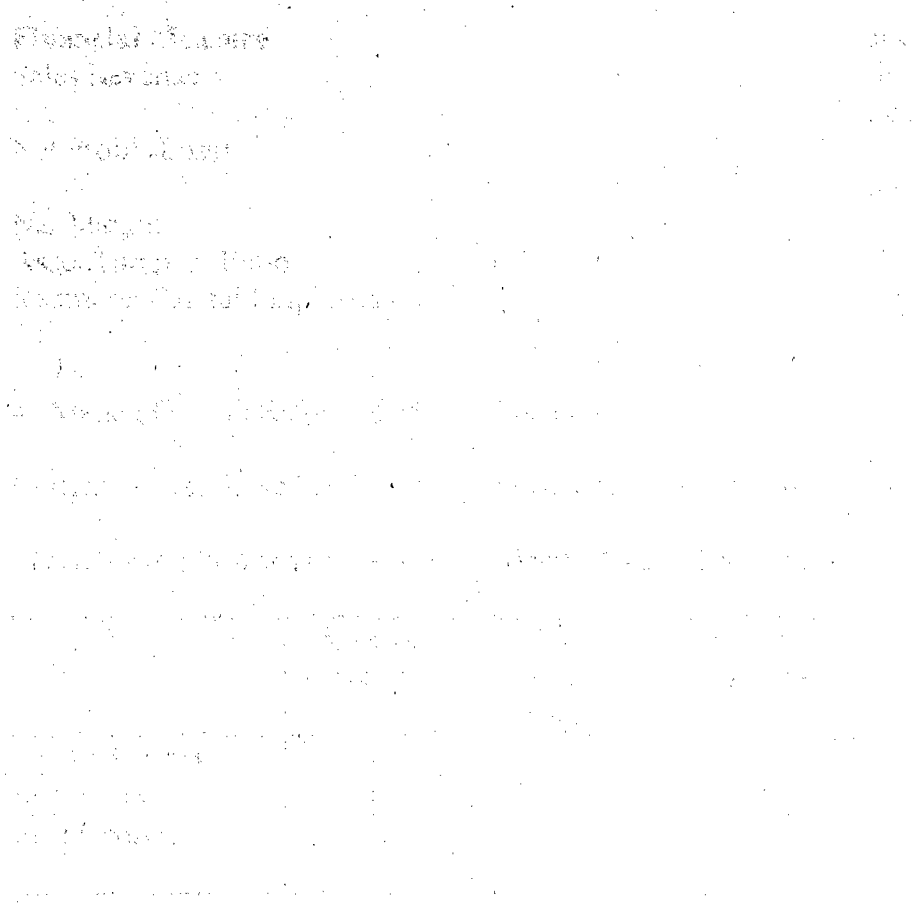
- **Define quantitative target values for market share and profit.** This will help the assessment of success.

Step four

- **Manage**

Use the simulation to implement decisions, monitor the outcomes and control your company to try to achieve the desired goals.

There is an old Jewish saying - *"If you want to make God laugh, tell him your plans"*. Problems are bound to occur, from both the internal and external environments. However, there are no hidden surprises or "nasties" within the simulation.



Historical Trends

- Financial Summary

Company performances have recently been within the following ranges:

Retailers

Financial Measure	**Range**
Sales Revenue	40 to 90 million per annum
Net Profit (Loss)	1 - 4 million per annum
Net Margin	5 - 10% per month
Asset Turnover Ratio	10 - 20% per month
Return on Capital Employed (%)	0.5 to 1.5% per month

Manufacturers

Financial Measure	**Range**
Sales Revenue	30 - 70 million per annum
Net Profit (Loss)	1 - 3 million per annum
Net Margin	2 - 5% per month
Asset Turnover Ratio	5 - 10% per month
Return on Capital Employed (%)	0 to 1 % per month

- Market Growth Rates and Market Potential

Certain markets have been growing at faster rates than others, as is illustrated below.

Market growth last year (H=High, M=Moderate, L=Low, D=Slight Decline)

	Wealthy Customers	**High Income Customers**	**Moderate Income Customers**	**Low Income Customers**
Confectionery	L	M	M	H
Savouries	L	L	M	H
Soft Drinks	L	L	M	M

- Customer Requirements and Product Development

For the purpose of market analysis, customer requirements and sales trends have been identified at four customer levels - **Wealthy, High Income, Moderate Income and Low Income.**

Customer requirements have been classified in terms of product features required e.g. presentation, nutrition, health qualities, texture, taste. It has been deduced that the lower income customer types are currently adequately satisfied with products on offer, but there is a great deal of dissatisfaction among the wealthier customers.
At present, product variety is limited and there is broad scope for product development. Product development costs have been estimated to be in the range £20 000 to £100 000 per product but each manufacturer has resources to develop up to 1 or 2 products only in each product area within the next two years.

The life-cycle stage for the product portfolio of each manufacturer is summarised below:

Product Area	**Products**	
Confectionery		
	Product 1	Mature, established leading brands
	Product 2	
	Product 3	Need to be developed before they can be launched
	Product 4	

- Marketing Activity

On the whole, recent marketing activity has been very limited, as companies have held down spending levels in order to enhance profitability. Higher amounts have been spent on national advertising as companies attempt to enhance their corporate image and consumer recognition.

None of the product areas are currently being sold as own-label through retailers i.e. the packaging displays the manufacturer's brand name rather than that of the retailers. There are opportunities to broaden product range and offer own-label products in addition to the brands.

- Manpower

Service has been adequate although there is regularly insufficient staffing during periods of higher demand.

- Distribution Channels - Stockholding and production

Care has been taken to maintain communication between suppliers and retailers such that stocks are held at adequate levels. Manufacturers have been keen not to over produce and hence minimise stockholding costs.

Company SWOT Analysis (general)

Strengths

- Stunning new leader!
- Dynamic new management team
- Established distribution network with dedicated retailers
- Strongly branded products
- Financial security from company size

Weaknesses

- No market dominance
- Insufficient resources for thorough product development
- Lack of experience of the emerging market and its potential competitors
- Service is not acceptable in all areas and human capabilities need to be maintained

Opportunities

- Economy provides potential for market development
- Scope for product development to improve customer satisfaction

Threats

- Increased competition may lead to losses
- Retailers may broaden product range through new suppliers

Appendix 6: Zapos – A Commercial Insurance Simulation

Introduction to the Marketplace

Welcome to Zapos, a computer simulation model of the commercial insurance business that simulates the dynamics within a competitive insurance market. Within the virtual world of Zapos you will be making decisions concerning many business drivers and will explore how these drivers impact upon and shape corporate success.

You have just been relocated to a country called Zaponia, where you have assumed a top management position within a leading insurance company. However, do not fret, the risk-free environment of the simulation means that 'learning by making mistakes' is permitted, unlike in the real-world! In addition, the climate within Zaponia has been very stable during recent years with attractive investment returns and steady claims trends.

Markets in Zaponia have been buoyant, characterised by moderate growth in both technical and non-technical profits. Five dominant financial service providers have gradually emerged and established a firm footing within the industry. Through a process of mergers, acquisitions and investment, these companies now hold the principal market share within many segments of the marketplace. Undoubtedly a booming economy has helped to shape developments accompanied by sound management policy which has resulted in gains at the expense of other insurers. An interview held with senior executives from a leading insurer established that focused marketing strategies were believed to have formed the basis of their success. Emphasis had been placed upon achieving favourable selection of target customers in clearly defined markets, in conjunction with high service standards provided by dedicated teams of competent personnel. Strategic alliances with national brokers were also seen to be a key factor.

However, future prosperity is by no means guaranteed. From an ecological perspective there is always the thret of claims volatility and the problems of claims prediction. Regarding the market, recent research has emphasised the need to maintain customer satisfaction and many customers currently feel that existing policies offer inadequate coverage of risk issues. Although it is widely believed that the need for improved coverage provides great opportunity for market development, there is a danger that the industry will soon be swamped with many new products competing in similar markets, and this may affect profitability.

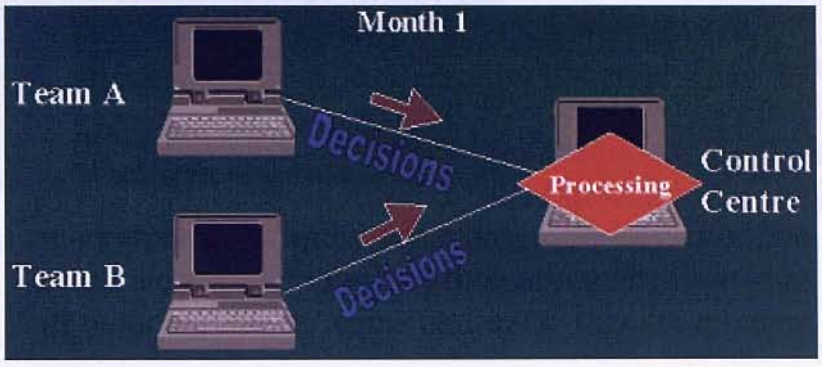
As the new top management of one of the 'big five' insurers, you are required to implement innovative directions to achieve future growth and maintain the confidence of the shareholders. During the next year the business will undoubtedly face intensifying competition and a target growth in Written Premium of 15% has been set together with a target ROE of 12%.

This is now your challenge – good luck and have fun!

The importance of Teamwork

In order to achieve management objectives, it will be important to work closely with other members of your management team - sharing responsibilities, co-ordinating activity and communicating. Team activity will revolve around the analysis of market research and financial performance data followed by planning, decision-making and review. It will be crucial to question where the business currently stands, where it should be and how it will get there.

Time Goes By



Each team will be responsible for the management of separate insurance companies; which compete against each other within the dynamic marketplace. Monthly decisions and analysis of business data is achieved using a computer interface that, at regular time intervals, collects all the decisions from the teams and sends them to a 'central computer' where they are processed. Results for that month are then returned to the teams and the cycle moves on to the next month. In this way, delegates are required to manage their companies for a period of one year, monitoring and controlling performance in response to market developments.

The Market

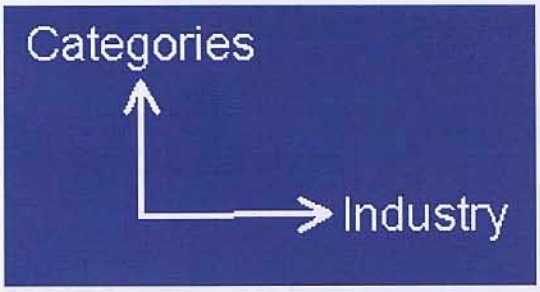
Four different product areas (or lines of business) are available in Zaponia:

Workers' Compensation (Accident and Illness)
Insurance covering benefits payable to an employee by his employer required by law in the case of injury, disability, or death as the result of occupational hazards.

General Liability
An insurance policy covering the costs incurred by the company for its liability arising from property damage or personal injury caused to a third party.

Commercial Auto (Motor Fleet)
Transport insurance which covers the cost of repairs and legal costs incurred by the policyholder and third party, resulting from an accident between the policyholder's vehicle and a third party vehicle. One policy covers several cars or commercial vehicles.

Property
Insurance covering the cost of damages to buildings and replacement costs of contents (e.g. goods, machinery, etc.).



In order to define target markets, customer types have been classified within 16 'cells' or segments – Manufacturing, Emerging, Service and Public Service inwhich there are four categories of industry. You will be responsible for the Manufacturing and Service industries:-

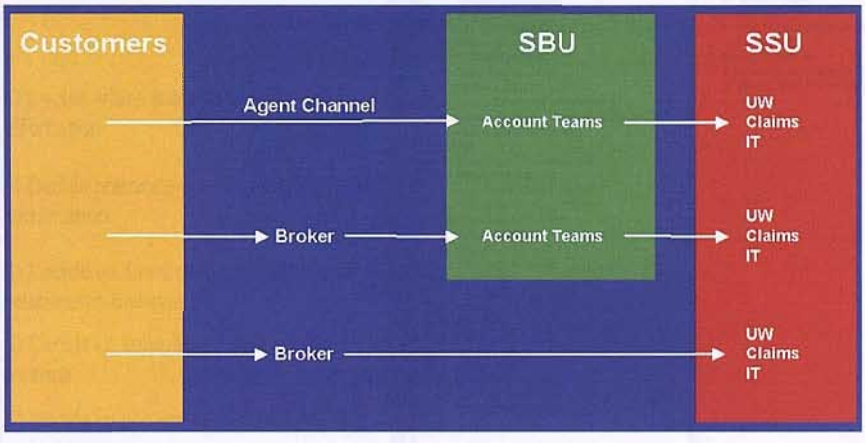
Manufacturing Industry

- Construction companies (e.g. building and road construction)
- Chemical and pharmaceutical companies
- Food and beverage producers (e.g. breweries, bakeries, etc.)
- Engineering companies (electrical and mechanical engineering)

Service Industry

- Tourism (e.g. hotels, travel agencies, etc.)
- Wholesale/Retail (e.g. chain stores)
- Financial services (e.g. banks, credit institutions, etc.)
- Consultancy (e.g. consulting and accounting companies)

For each industry type and product area, there is a 'solution 1' which is a well established existing product within the market. During the simulation it will be possible to compliment the product portfolio and lauch new solutions, '2' and '3', which can be specially designed to meet customer needs.



In Zaponia, customers can be reached via two different distribution channels – agent and broker. Agents work exclusively for the insurance company and receive salaries as well as commission (which is paid mainly to agents). The national broker offers independent advice and has tended to provide the customer with greater choice.

Hence, in Zaponia it is necessary to consider which customers to target, in what markets, with what solutions and through which channels.

Roles

Within your team there are two Market Segment Managers and a CEO/General Manager who is responsible for overall leadership. The areas of responsibility for these roles are listed below - and where to access these decisions within the simulation interface.

Roles for Market Segment Managers

1) Decide which new products to develop

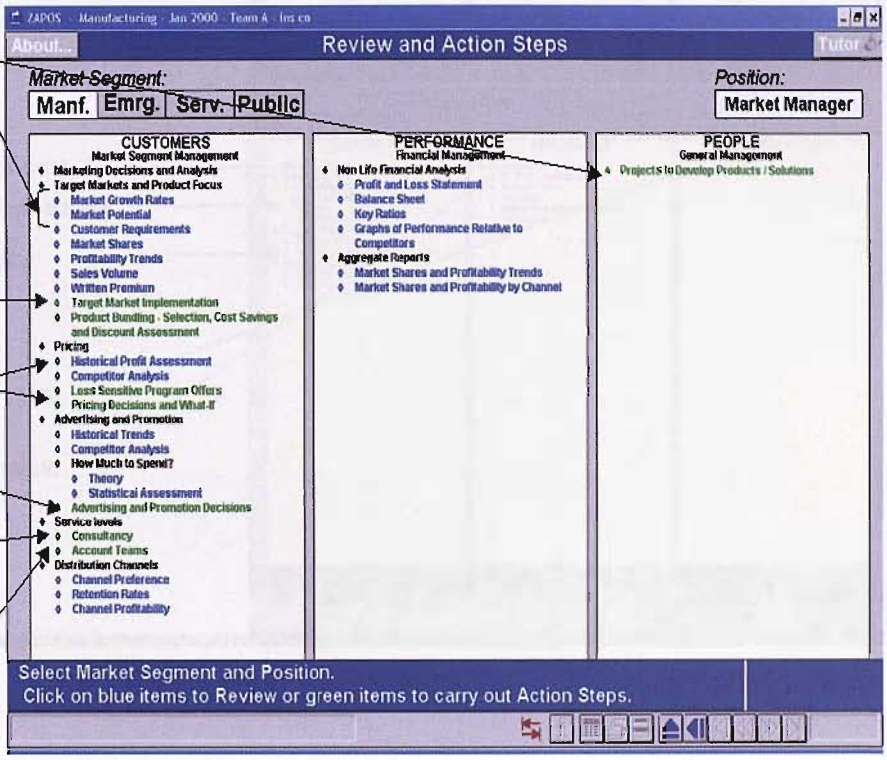
2) Decide which markets to focus sales effort upon

3) Decide premiums and intermediary commission

4) Decide on direct mail, promotion and relationship marketing

5) Decide on consultancy staffing and training

6) Decide on account team focus, staffing and training



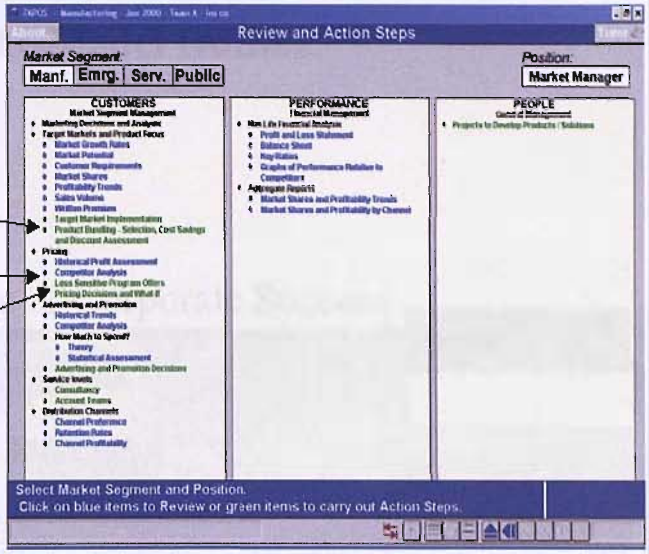
Roles for CEO/General Manager

Responsible for leadership. Some additional roles are:-

1) Decide whether to offer product bundles

2) Decide whether to set up any loss sensitive programs

3) Negotiate deals with the National Broker



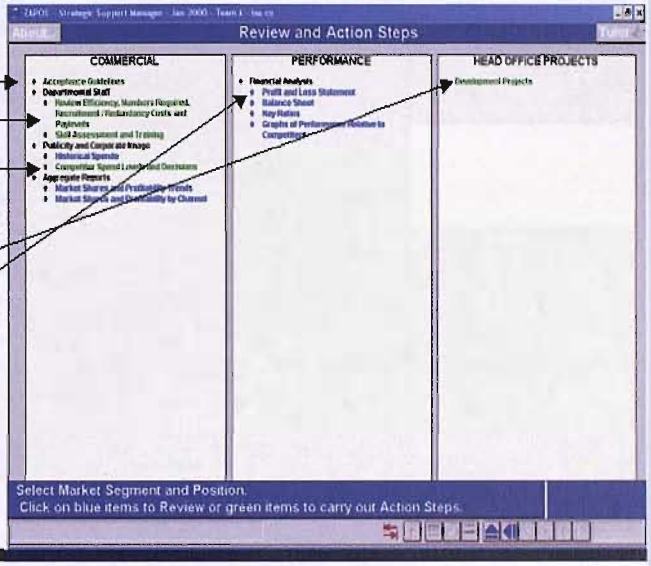
4) Set underwriting guidelines

5) Set head office staff and training

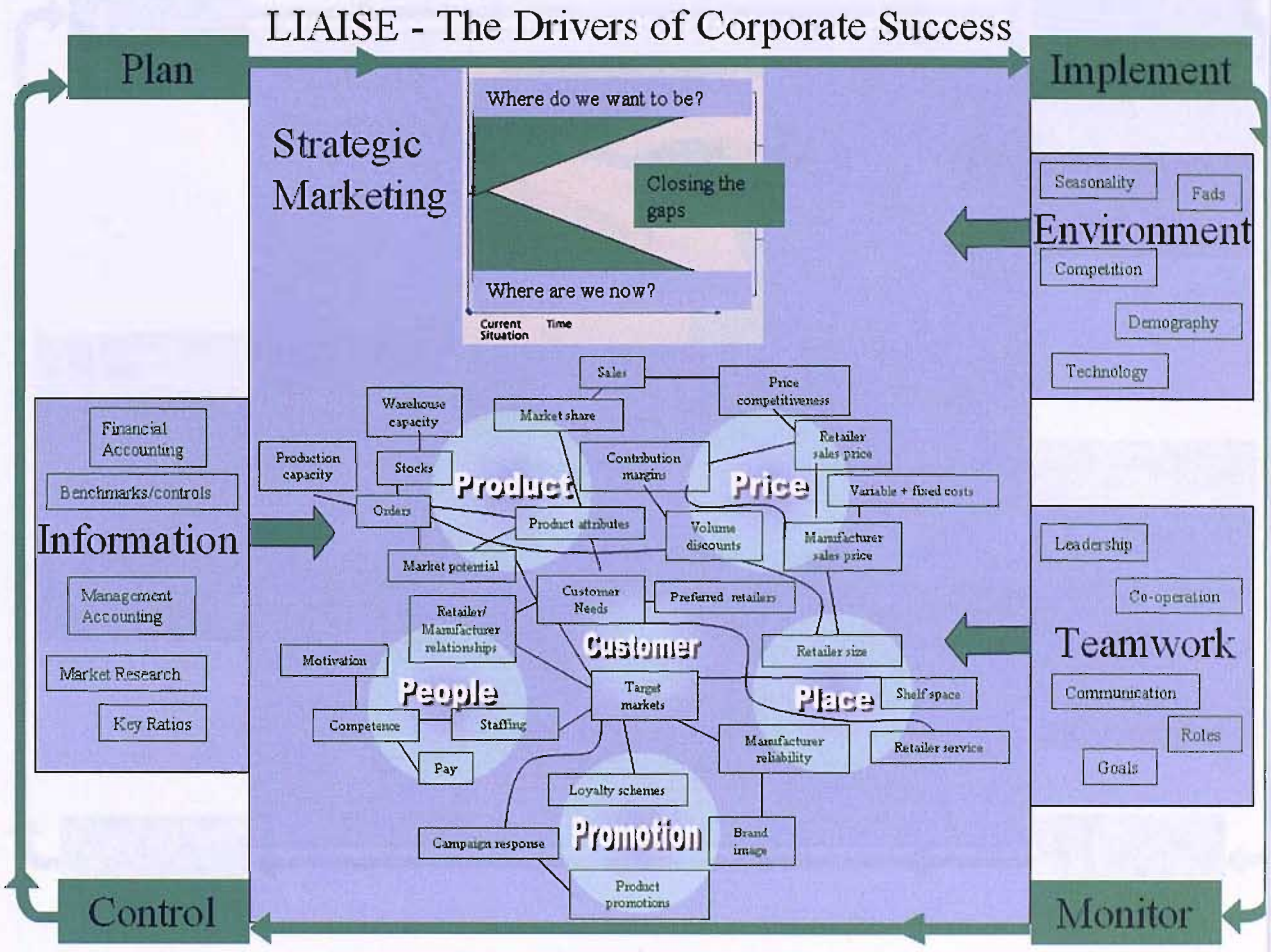
6) Set national advertising

7) Set up head office projects

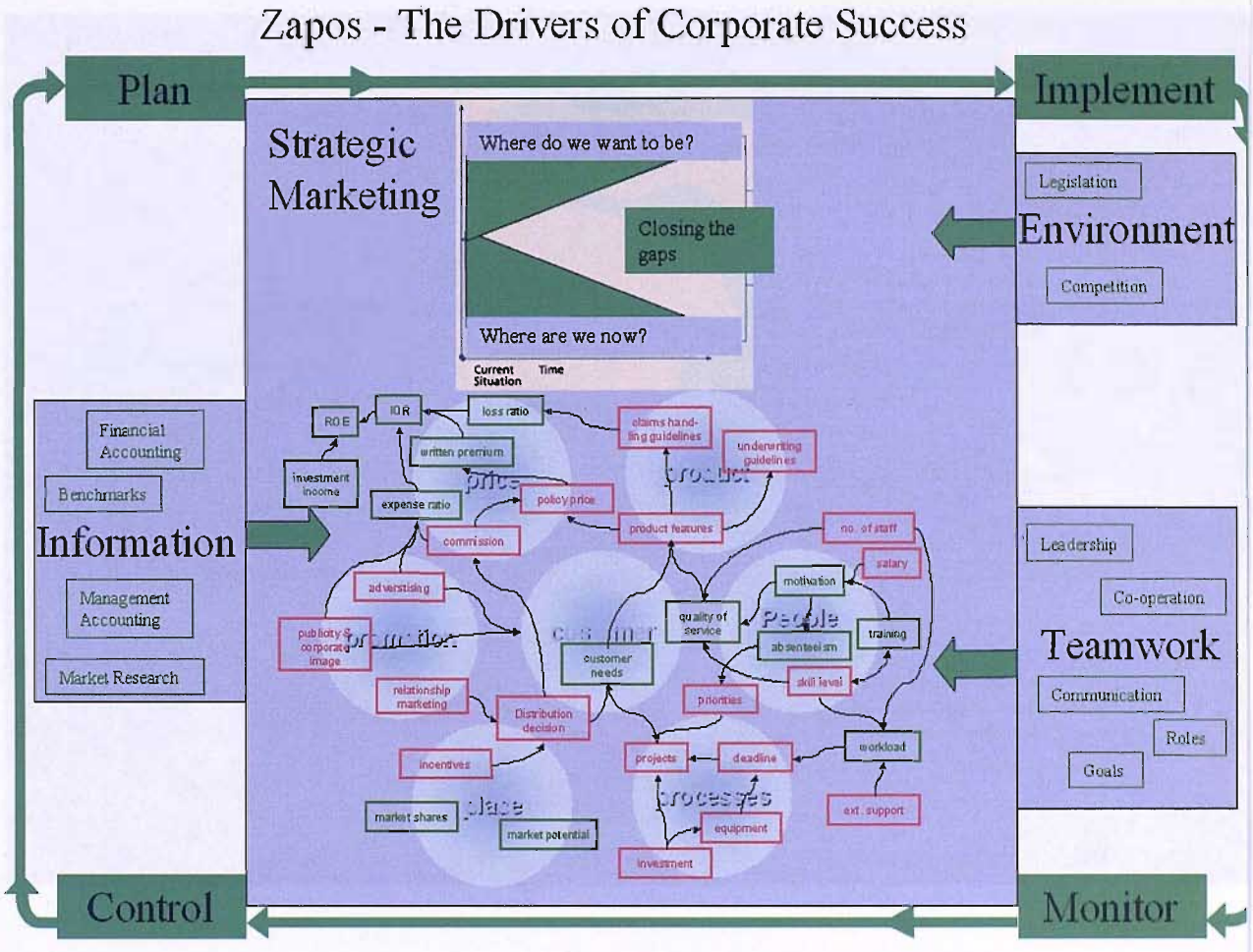
8) Monitor financial position



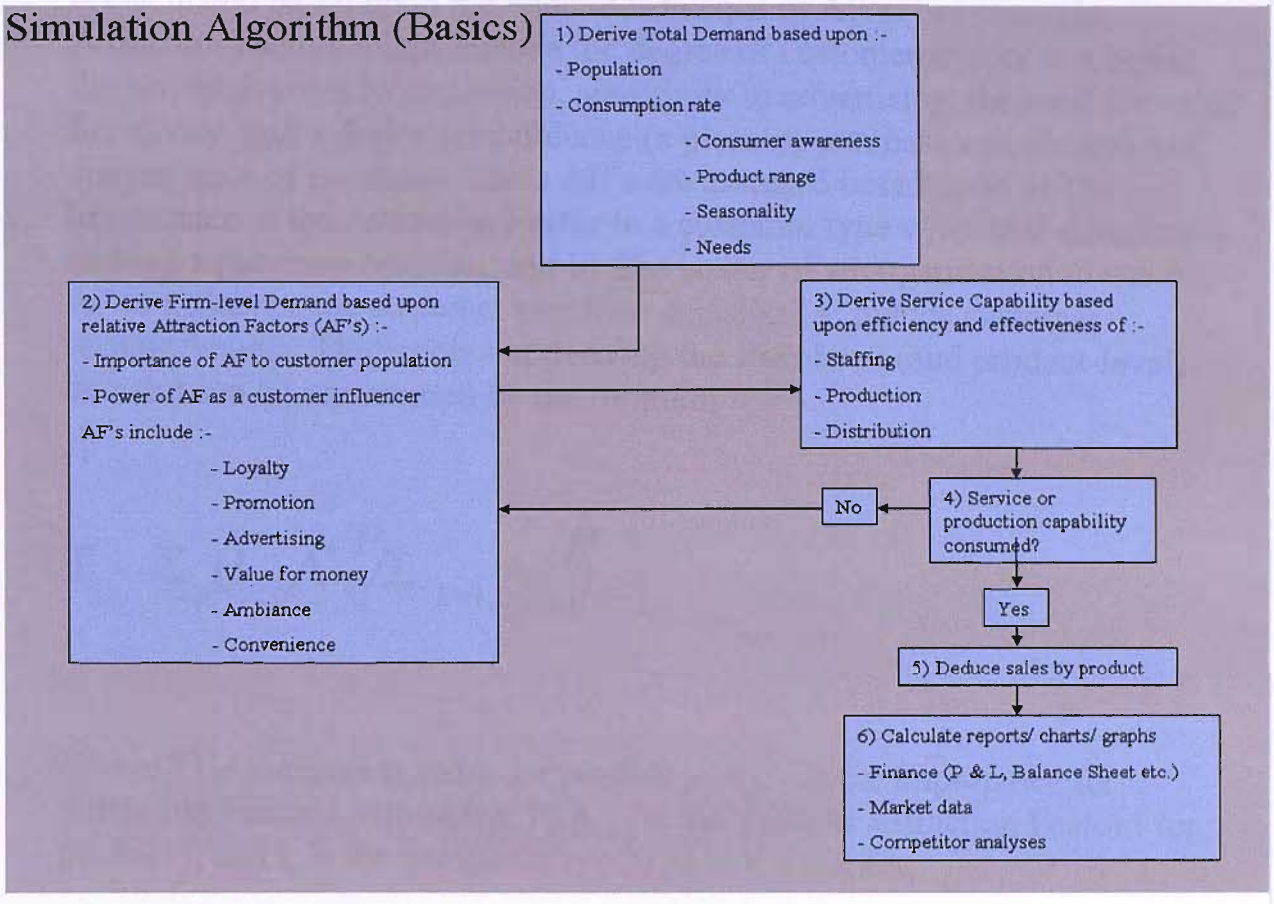
Appendix 7 – LIAISE FMCG – The Model Outline



Appendix 8 – ZAPOS Commercial Insurance Simulation – The Model Outline



Appendix 9 – Simulation Algorithm Basics



The flow chart provides a schematic summary of the rationale behind the central simulation algorithm. The algorithm was written using low-level code - Microsoft Visual Basic - to represent the interrelationships that model consumer buying behaviour. The logic was formulated by the author based upon his knowledge of market factors and their likely influences upon demand and sales. An iterative method was applied to split market demand between competing products. From the chart,

1) Derive Total Demand. The starting point is to derive a measure of the total market demand. This is calculated for a diverse range of customer types by socio-economic category based upon demographic aspects such as population, and the expected consumption rates. Demand – and the rate of consumption - for a given customer type is dependent upon factors such as the extent to which advertising has enhanced consumer awareness, and the spending power of consumers. Similarly, seasonality and product range may have an influence.

2) Derive Firm-level Demand. The next step is to derive firm-level demand by splitting the total market demand between competing companies. Each product solution offered by each competitor is allocated demand based upon the extent to which that product satisfies customer values. To achieve this, the customer values are defined as a set of Attraction Factors (AF's) and demand is calculated based upon the relative influence of AF's. For example, Attraction Factors might include the degree of customer loyalty to a brand, the responsiveness to promotion, sensitivity to advertising, the need for value for money, and a desire for ambience (a pleasant purchase experience) and convenience of purchase. These AF's are assessed based upon a) The importance of the Attraction Factor to a customer type when that customer is making a purchase decision, and b) The power of an organisation to use the AF to influence the customer purchase decision i.e. induce customer responsiveness. The process of deriving the firm-level (and product-level) demand can be represented by the formula;

$$T_j = \Sigma_{i,p}\left(I_{i,p} A_{i,j}^{P} / \Sigma_{k=1,L} A_{i,k}^{P}\right)$$

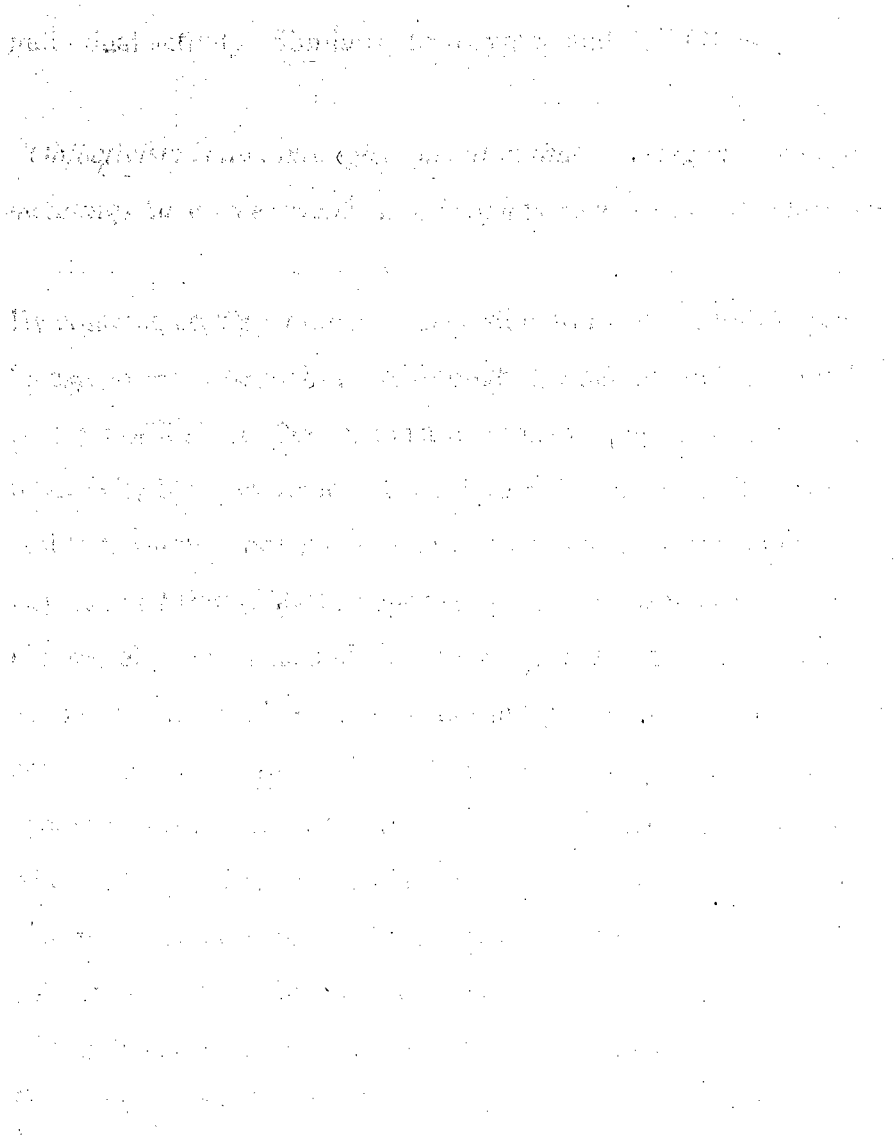
Where T_j is the market share for product j, $I_{i,p}$ is the importance for Attraction Factor i with power P, $A_{i,j}$ is the value of Attraction Factor i for product j, and L is the number of products in the market.

More specifically, values for the AF's are derived based upon decision rules formulated by the author. When calculating the Loyalty AF decision rules might consider issues such as past sales, the size of a retailer's customer base, or whether there are loyalty schemes set up. For the Promotion AF, different categories of in-store "enticements" to buy might be significant. The Advertsing AF may have a sensitivity in which responsiveness of demand is dependent upon spend levels according to an s-shaped curve. The Value for Money AF needs to consider the degree to which products meet customer requirements and the sensitivity of customer types to pricing in relation to this. Ambience and convenience AF's may consider store layout, size, product range, location amongst others.

3), 4) and 5) Derive Service and Production capability – Then Deduce Sales. The algorithm now moves into an iterative cycle in which the service capability of competing companies is compared against demand. Product sales are calculated based upon product demand, unless there is a shortfall in service or production/ orders. In this case, demand is reallocated on an iterative basis such that customers are permitted to purchase their second,

third …choice product based upon which products are still in stock and which companies have service capability. In this way, factors such as insufficient staff productivity or inadequate manufacturing and distribution capability or underestimated orders will lead to service deterioration, insufficient stocks and hence lost sales as customers purchase second choice, third choice or other brands.

6) Create Management Reports. Having derived sales by product, management reports and charts are calculated showing financial, market and operational information.



Appendix 10 – Paradigm Applied to This Research

Silverman (2000: pp 77-79) describes a paradigm as a model that provides an overall framework for how we look at reality ontologically and epistemologically. For Burrell and Morgan (1979), ontology in social science categorises "reality" to be investigated as either external to the individual – an objective, "given" that it imposes itself on individual consciousness – or the subjective product of individual consciousness, cognition, or mind developed through personal experience and insight (p.1). In other words, ontology considers the nature of social entities from two opposing stances: objectivism and constructionism. Robson (2002) explains that, within objectivism, social phenomena are external facts over which people have no influence. An organisational social entity may have rules and regulations that people are required to abide by, constraining and inhibiting individual activity. Similarly, for Bryman and Bell (2004);

'Objectivism is an ontological position that asserts that social phenomena and their meanings have an existence that is independent of social actors' (p.19).

By contrast, constructionism - according to Robson (2002) - regards the social world and its categories as being built up through interaction, and are therefore not external to people (p.21). For Robson (2002), constructionism argues that reality is socially constructed; objectivity being extremely difficult to achieve. Research is based upon the construction of reality through interviews and observations leading to multiple perspectives. Likewise, Bryman and Bell (2004) categorise constructionism as an ontological position that asserts that social phenomena and their meanings are continually being accomplished by social actors (p.19). Social reality is a constantly shifting emergent property of an individual's creation and is constructed by interactions between individuals (p.25).
From the theoretical propositions described in 2.1, the aim of this project is to assess whether total enterprise simulation has internal and external educational validity, and external representational validity. Also it is important to identify design factors that can enhance validity of this medium. Therefore, this project must focus upon the understanding of human perspectives concerning the development in participant knowledge resulting from participation in a total enterprise simulation exercise. Hence, ontologically, this project is based upon constructionism in that many of the thinking processes of participants are socially constructed through interaction with others. The simulated reality is a product

of the participants' minds. Objectivism does not apply because the development of human knowledge is a result of human activity – it is not independent of human activity.

Considering epistemology, a definition proposed by Johnson and Duberley (2000) is;

'the study of the criteria by which we can know what does and does not constitute warranted, or scientific knowledge' (p.3).

Similarly, Bryman and Bell (2003) state that epistemology is concerned with the identification of acceptable knowledge in a discipline.
As with ontology, there are two contrasting epistemological stances: positivism versus interpretivism (explained by many authors such as Hussey and Hussey (1997), Miles and Huberman (1994), and Easterby-Smith, Thorpe and Lowe (1991), Bryman and Bell (2003)). For Bryman and Bell (2003) positivism advocates the study of social reality should employ methods used within the natural sciences. More specifically, knowledge must be confirmed through the senses. There will be deductive research in which a hypothesis is formulated based upon theory and subsequently tested, but equally induction may occur as knowledge is used to formulate laws. However, research must be value free and objective (p.14). Likewise, Burrell and Morgan (1979) define positivism within the social world as searching for regularities and causal relationships between constituent elements. Authors (Bryman and Bell, 2003; Johnson and Duberley, 2000) tend to associate positivism more with the deductive - as opposed to the inductive - approach. A positivistic aspect of this project was that theoretical propositions (Yin, 2003) were formulated using theory and prior experience of the researcher. However, the objective, value-free empiricism of positivism was unlikely given that deriving precise measurements of learning is an impossibility (Moon, 1999; Biggs, 1999). Although quantitative data obtained through questionnaires provided an objective measure of attitudes, the attitudes were subjective relative opinions and therefore lacking in comparative scales for measurement. Objectivity was limited because much evidence was established through the qualitative analysis of student perspectives based upon the researcher's subjective interpretations of viewpoints. Further bias within the qualitative data might arise through conventionalism and relativism. For Johnson and Duberley (2000), a conventionalist believes that any observer, implicitly or explicitly, will influence what is observed due to prior beliefs, sentiments, theories, background knowledge and expectations (p.67). In a similar vein, relativism is a doctrine that no absolutes exist – *'the truth is always relative*

to, or conditioned by issues such as epoch, place, culture and paradigm' (p.75). Therefore, viewpoints of participants resulting from the simulation might be influenced by existing knowledge, expectations and environment. Another conflicting aspect of positivism was that knowledge could not be confirmed through the senses because of the covert nature of participant thinking processes. Robson (2002) is critical of the usefulness of positivism within a social context. He proposes that the standard view of science in which explanation is a central aim through the conformity to a general law is inappropriate for social settings. For example, in physics a constant relationship can be observed between two variables such as the physical state of water changing from ice to water to steam as temperature increases. Positivism fits well within the natural world where it is possible to achieve controlled experimental conditions, but not in the study of people where *'a constant conjunction in a strict sense is so rare as to be virtually non-existent'* (p.21). Psychology and social science have not yet produced any scientific laws and therefore, by definition, positivism cannot directly apply to social environments (p.21). Regarding this project, capturing the complex phenomenon of human understanding through a single scientific measure was unrealistic. Also, the simulation environment was too socially complex to generate a universal law; only substantive theory through theoretical propositions (Yin, 2003).

Denscombe (1998) suggests that, in contrast to positivism, interpretivism is an approach based upon subjectivity, description, interpretation and agency. This is opposite to the structured, objective analysis and measurement orientation of positivism. Unlike positivism, interpretivist approaches are not seeking one universal explanation, but the possibility of multiple realities, given the human disposition of varied and multiple perspectives. Interpretations are, however, shared at the group, cultural or society level rather than taken on an individual basis. Likewise, Burrell and Morgan (1979) define interpretivism as relativistic, based upon view points of individuals (p.5). For Bryman and Bell (2003), interpretivism requires the social scientist to grasp the subjective meaning of social action. Similarly, Robson (2002) describes interpretivism as an approach regarding reality based upon subjectivity rather than objectivity. Social phenomena are interpreted in the minds of people in terms of their ideas about the world, the meanings that they attach to what is going on around them, their motivations and conceptual systems. For Denscombe (1998), interpretivism deals generally with people's perceptions or meanings, attitudes and beliefs, and feelings and emotions; making it a useful research strategy in health, education

and business where the onus is upon understanding the thinking of people and personal experiences. It is *'an approach that focuses on how life is experienced'* (p.97). It does not explain causes but describes first hand experiences. It is based upon people interpreting and creating order from their experiences, rather than there being a pre-ordained, pre-programmed perception within the human mind. It aims to provide "faithful to the original" descriptions of authentic experiences covering the true complexity of the situation. Essential parts of the human experience are described in depth and detail, covering contradictions and inconsistencies as well as that which conforms to the norm. It is not just concerned with happenings but also the interpretation placed upon them (p.105). Consistent with this project, an interpretivist characteristic was the subjectivity of participants' understanding, deduction, explanation and learning. It aimed to clarify human experiences derived from the simulation, covering the true complexity of situations. There was the possibility of multiple perspectives.

Some authors (Bryman and Bell, 2003; Johnson and Duberley, 2000) propose that interpretivism is more likely to be an inductive approach, rather than deductive. It is based upon a cycle of induction and verification (Johnson and Duberley, 2000) where the emphasis is upon generating theory from data (Bryman and Bell, 2003).

For Johnson and Duberley (2000);

'social science research must entail analysis of human action generated inductively from an 'a posteriori' understanding of the interpretations deployed by the actors who are being studied' (p.34).

This characteristic of interpretivism relates to this project given that the theoretical propositions were formulated based upon substantive, disjointed theory combined with personal experience of the researcher in simulation design and implementation. Therefore, the research needed to proceed on an open-minded basis so that further induction was possible as more extensive evidence emerged.

There are other similarities between interpretivism and this research project. For Denscombe (1998), it is important to recognise that generalisations from findings may be difficult to justify (in terms of grand or mid-range theories), given that studies are small-

scale, substantive and focused. Issues such as the 'self' of the researcher, decontextualisation of meaning, over simplification, and lack of generalisability need to be addressed. This research necessitated extensive time commitment from the researcher whilst designing, implementing and validating total enterprise simulations. The simulations had to be designed with quality and effectiveness as major goals. Therefore, care was taken not to over simplify. Likewise, the validation process needed to be rigorous and this required much time commitment from respondents. Also, the influence of the perspectives and attitudes of the researcher on simulation design and implementation was unavoidable – given his past experience in this area. Care was taken, however, not to influence the perspectives of respondents and to analyse data carefully and truthfully. Hence, this was a small-scale, substantive investigation in which only analytic generalisation (Yin, 2003) was possible; from one case to another. It is common (Denscombe, 1998; Hussey and Hussey, 1997; Miles and Huberman, 1994) that interpretivism is associated with rich qualitative data, and this was also the case within this investigation.

Burrell and Morgan (1979) define two other polarised concepts: human nature and methodology. For them, human nature is either determined by situations that cause a response (determinism) or through meanings derived during sense-making (voluntarism). They describe methodology as either nomothetic – employing scientific methods – or ideographic – uncovering the internal logic of humans. Within this project, the stance adopted concerning human nature was voluntarism in that attitudes and values determine the meanings derived from the simulation. For example, if participants are not motivated to learn then they are unlikely to produce useful data for the investigation. Methodology was considered to be ideographic because it aimed to uncover the internal logic of participant thinking within the simulation – termed 'verstehen' by Bryman and Bell (2003).

In summary, authors (Hussey and Hussey, 1997; Silverman, 2000) explains that the two contrasting paradigms of positivism and interpretivism exist along a continuum such that a research project may tend more towards one paradigm or the other dependent upon the circumstances. Likewise, Johnson and Duberley (2000) suggest that indisputable epistemic standards do not exist and that all that epistemology really means is more conscious attention to reflexivity (p.4). This means systematically criticising our epistemological pre-understandings and therefore the exploration of alternatives (p.5). The research process is iterative, revisiting different stages of research in light of the latest developments

(Saunders et al, 2003). Similarly, Burrell and Morgan (1979) state that epistemology concerns the dichotomy of separating what is true from what is false. For Johnson and Duberley (2000), a fundamental tenet shared by both positivism and interpretivism is the researcher's ability to observe the 'truth';

'the researcher is construed as a neutral conduit of sense-data who can objectively elucidate and present the "facts" of a cognitively accessible empirical world and/or the dimensions of actors' subjectivity' (p.35).

Consequently, on balance, epistemologically the research paradigm within this project tends mainly towards interpretivism, and ontologically the position is constructionism.

References

Alderfer, C.P. (1972) *Existence, Relatedness and Growth.* New York: Free Press.

Alessi, S. (1988). Fidelity in the design of instructional simulations. *Journal of Computer-Based Instruction,* 15(2), pp. 40 – 47.

Anderson, P. and Lawton, L. (1990) The relationship between financial performance and other measures of learning on a simulation exercise. *Developments in Business Simulation and Experiential Learning,* 17, 6-10. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Anderson, P. and Lawton, L. (2004) Simulation exercises and problem based learning: Is there a fit? *Developments in Business Simulation and Experiential Learning,* 31, 183-189. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Bakken, B.,Gould, J. and Kim, D. (1994) *Modelling for Learning Organisations.* Portland: Productivity Press.

Biggs, J. (1993) From Theory to Practice: A Cognitive Systems Approach in: *HE Research and Development,* 12, pp. 73-85.

Biggs, J. (1999) *Teaching for Quality Learning at University.* Buckingham: Open University Press.

Bloisi, W (2003) *Management and Organisational Behaviour.* Maidenhead: McGraw-Hill.

Borodzicz, E. (2004) The missing ingredient is the value of flexibility. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 35(3),414 - 426. London: Sage Publications.

Borodzicz, E.P. (2005) *Risk, Crisis and Security Management.* Chichester: Wiley and Sons.

Boud, D., Keogh, R. and Walker, D. (1994) *Reflection: Turning Experience Into Learning.* London: Kogan Page.

Bourque, L. and Fielder, E. (1995) *How to conduct self-administered and mail surveys.* London: Sage Publications.

Bryman, A. and Bell, E. (2003) *Business Research Methods.* Oxford: Oxford University Press.

Burgess, T. (1995) Business Gaming: an historical analysis and future perspective. In: Saunders, D. (1995) *The International Simulation and Gaming Research Yearbook, Volume 3, Simulations and Games for Strategy and Policy Planning.* London: Kogan Page.

Burgess, T. (1999) Strategy support during a business game using an expert system In: Saunders, D. and Severn, J. (1999) *The International Simulation and Gaming Research*

Yearbook, Volume 7, Simulations and Games for Strategy and Policy Planning. London: Kogan Page.

Burns, A., Gentry, J. and Wolfe, J. (1990) A cornucopia of considerations in evaluating the effectiveness of experiential pedagogies. In Gentry, J. *Guide to Business Gaming and Experiential Learning.* London: Kogan Page.

Burrel, G. and Morgan, G. (1979) *Sociological Paradigms and Organisational Analysis.* Aldershot: Ashgate Publishing Ltd.

Carvalho, T. A. (1991). Evaluating Computerized Business Simulators for Objective Learning Validity. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research*, 22(2), 328-347. London: Sage Publications.

Coyle, R.G. (1977) *Management System Dynamics.* Chichester: Wiley & Sons.

Curran, K. and Hornaday, R. (1987) An investigation of the relationships between formal planning and simulation team performance and satisfaction. *Developments in Business Simulation and Experiential Learning,* 14, 43 - 46. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Curran, K. and Hornaday, R. (1988) Formal planning, simulation team performance and satisfaction: A replication. *Developments in Business Simulation and Experiential Learning,* 15, 138 - 141. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Denscombe, M.(1998) *The Good Research Guide: for small-scale social research projects.* Buckingham: Open University Press, ISBN 0-335-19085-8.

Denzin, N.K. (1978) *The research act: A theoretical introduction to sociological methods* (2nd ed.). New York: McGraw-Hill.

Dewey, J. (1933) *How We Think.* Boston: D C Heath.

Dibb,S. Simpkin, L. Pride, W. and Ferrell, O. (1997) *Marketing Concepts and Strategies.* 3rd Ed. (1997) Boston: Houghton Mifflin Company.

Dickinson, J. and Faria, A. (1994) A Random-strategy Criterion for Validity of Simulation Game Participation *Developments in Business Simulation and Experiential Learning,* 21, 35-39. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Dickinson, J. , Whiteley, R. and Faria, A. (1990) An empirical investigation of the internal validity of a marketing simulation game. *Developments in Business Simulation and Experiential Learning,* 17, 47-52. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Duffy, T.M. and Cunningham, D.J. (1996) Constructivism: Implications for the design and delivery of instructions. In: Jonassen, D.H. *Handbook of Research for Educational Communications and Technology.* New York: Macmillan.

Easterby-Smith, M., Thorpe, R. and Lowe, A.(1991) *Management Research: An Introduction.* London: Sage.

Elgood, C. (1993) *Handbook of Management Games.* 5th Ed. (1993). Aldershot: Gower Press.

Entwistle, N. (1988) *Styles of Learning.* Edinburgh: David Fulton.

Faria, A. (2001) The changing nature of business simulation/ gaming research: A brief history. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 32(1),197- 111. London: Sage Publications.

Faria, A. and Wellington, W. (2004) A survey of simulation game users, former-users, and never-users. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 35(2),178 - 207. London: Sage Publications.

Faria, A. and Wellington, W. (2004) Validating business simulations: Does high market share lead to high profitability? *Developments in Business Simulation and Experiential Learning,* 31, 332 - 336. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Faria, A. and Wellington, W (2005) Validating Business Gaming: Business Conformity With PIMS Findings, *Simulation and Gaming,* 36 (2), pp259 – 273.

Forrester, J. (1973) *Industrial Dynamics.* Cambridge: MIT Press.

Forrester, J. and Senge, P. (1980) Tests for building confidence in System Dynamics Models. In: Legasto, A., Forrester, J. and Lyneis, J. (1980) *TIMS Studies in the Management Sciences, Volume 14, System Dynamics.* Oxford: North-Holland Publishing Co.

Feinstein, A. and Cannon, H. (2001) Fidelity, Verifiability, and Validity of Simulation: Constructs for Evaluation. *Developments in Business Simulation and Experiential Learning,* 28, 57 - 67. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Gentry, J. (1990) What is experiential learning. In Gentry, J. *Guide to Business Gaming and Experiential Learning.* London: Kogan Page.

Gibbs, G. (1999) Learning How to learn Using a Virtual Learning Environment for Philosophy, *Journal of Computer Assisted Learning,* 15, pp221 – 231.

Glomnes, S. (2004) Antecedents of game performance. *Developments in Business Simulation and Experiential Learning,* 31, 229 - 233. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Gold, S. and Prey, T. (1990) Modelling Demand in Computerised Business Simulations. In Gentry, J. *Guide to Business Gaming and Experiential Learning.* London: Kogan Page.

Gold, S. and Prey, T. (1997) Modelling Attributes in Demand Functions of Computerised Business Simulations: An Extension of Teach's Gravity Flow Algorithm. *Developments in*

Business Simulation and Experiential Learning, 24, 132 - 141. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Gold, S. and Prey, T. (1998) Technology Change and Intertemporal Movements in Consumer Preferences in the Design of Computerised Business Simulations With Market Segmentation. *Developments in Business Simulation and Experiential Learning,* 25, 156 - 167. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Gold, S. (2003) The Design of a Business Simulation Using a Systems-Dynamics-Based Approach. *Developments in Business Simulation and Experiential Learning,* 30. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Goosen, K., Jensen, R. and Wells, R. (2001) Purpose and learning benefits of simulations: A design and development perspective. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 32(1),21-39. London: Sage Publications.

Gosen, J. (2004) The Influence of Variables Easily Controlled by The Instructor/Administrator on Simulation Outcomes: In Particular, The Variable Reflection. *Developments in Business Simulation and Experiential Learning,* 31, 318 - 324. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Gosen, J. and Washbush, J. (2004) A Review of Scholarship on Assessing Experiential Learning Effectiveness, *Simulation and Gaming,* 35(2), pp270 – 293.

Gosenpud, J. and Meising, P. (1983) Determinants of performance in computer simulations. *Developments in Business Simulation and Experiential Learning,* 10, 53 - 56. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Gosenpud, J. and Washbush, J. (1991) Predicting simulation performance: Differences between groups and individuals. *Developments in Business Simulation and Experiential Learning,* 18, 44 - 48. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Gosenpud, J. and Washbush, J. (1993) The relationship between total enterprise simulation performance and learning. *Developments in Business Simulation and Experiential Learning,* 20, 141. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Gore, C., Murray, K. and Richardson, B. (1992) *Strategic Decision-Making*. London: Cassell.

Grossler, A. (2004) Don't let history repeat itself – methodological issues concerning the use of simulators in teaching and experimentation. *System Dynamics Review,*20, pp.263-274

Grundy, S. (1982) Three Modes of Action Research, *Curriculum Perspectives*, 2, 3, pp23-34.

Habermas, J. (1971) *Knowledge and Human Interests.* London: Heinemann.

Habermas, J. (1974) *Theory and Practice.* London: Heinemann.

Hacker, D. and Niederhauser, D. (2000) Promoting Deep and Durable Learning in the Online Classroom. *New Directions for Teaching and Learning,* 84, pp53 – 63.

Hall, J. (2004) Computer simulation: A design architectronic. *Developments in Business Simulation and Experiential Learning,* 31, 166-175. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Harrison, E. (1981) *The Managerial Decision-Making Process.* 2nd Ed. (1981). Boston: Houghton Mifflin.

Hays, R. and Singer, M. (1988) *Simulation Fidelity in Training System Design.* New York: Springer.

Hely, T. and Jarvis, N.(1999) *Students' expectations and realization levels of computer-simulated business exercises: a case study in service management* In: Saunders, D. and Severn, J. (1999) *The International Simulation and Gaming Research Yearbook, Volume 7, Simulations and Games for Strategy and Policy Planning.* London: Kogan Page.

Hemmasi, M. and Graf, L.(1991) Educational effectiveness of business simulation gaming: A comparative study of student and practitioner perspectives. *Developments in Business Simulation and Experiential Learning,* 18, 53 -56. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Henry, J. (1996) Meaning and Practice in Experiential Learning. In.Warner Weil, S. and Mcgill, I. (1996) *Making Sense of Experiential Learning: Diversity in theory and practice.* Buckingham: Open University Press.

Herzberg, F. (1966) *Work and the Nature of Man.* Cleveland: World Publishing.

Honey, P. and Mumford, A. (1986) *Using Our Learning Styles.* London: Honey Publications.

Hornaday, R. and Wheatley, W. (1986) Four factors affecting group performance in business policy simulations. *Developments in Business Simulation and Experiential Learning,* 18, 53 -56. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Hussey, J. and Hussey, R.(1997), *Business Research: A practical guide for undergraduate and postgraduate students.* Basingstoke: MacMillan Press Ltd.

Huang, H. (2002) Toward Constructivism for Adult Learners in Online Learning Environments, *British Journal of Educational Technology,* 33(1), pp27 – 37.

Hullfish,H. and Smith, P.(1961) *Reflective Thinking: The method for education.* New York: Dodd, Mead and Co.

Jaques, D. (1995) Games, simulations and case studies – a review. In: Saunders, D. (1995) *The International Simulation and Gaming Research Yearbook, Volume 3, Simulations and Games for Strategy and Policy Planning.* London: Kogan Page.

Johnson, P. and Duberley, J. (2000) *Understanding Management Reseacrh* London: Sage Publications.

Kemmis, S. (1994) Action Research and the Politics of Reflection. In: Boud, D., Keogh, R. and Walker, D. (1994) *Reflection: Turning Experience Into Learning.* London: Kogan Page.

Keys, J. and Biggs,W. (1990) A Review of Business Games. In Gentry, J. *Guide to Business Gaming and Experiential Learning.* London: Kogan Page.

Kim, D. (1993) The Link Between Individual and Organisational Learning. *Sloan Management Review,* 35(1), pp37 – 50.

Klabbers, J. (1999) *Three easy pieces: A taxonomy on gaming* In: Saunders, D. and Severn, J. (1999) *The International Simulation and Gaming Research Yearbook, Volume 7, Simulations and Games for Strategy and Policy Planning.* London: Kogan Page.

Knowles, M.S. (1980) *The Modern Practice of Adult Education: From Pedagogy to Andragogy* (2nd Ed.). New York: Cambridge Books.

Knowles, M.S., Holton, E.F. and Swanson, R.A. (1998) *The Adult Learner* (5th Ed.). Texas:Gulf.

Kolb, D (1976) Management and the Learning Process, *California Management Review,* 18,3, pp21-31.

Kolb, D.A. (1984) *Experiential Learning : Experience as the Source of Learning and Development* . New Jersey: Prentice-Hall.

Kotler, P. (1993) *Marketing Management.* New Jersey: Prentice-Hall.

Lane, D.C. (1995) On the resurgence of management simulations and games. *Journal of the OR Society,* 46, pp.604 – 625.

Leigh, E. and Kinder, J. (2001) *Fun and Games for Workplace Learning.* Sydney: McGraw-Hill.

Leigh, E. (2005) *A Practitioner Researcher Perspective on Facilitating an Open, Infinite, Chaordic Simulation.* PhD Thesis. Sydney: University of Technology.

Lainema, T. and Hilmola, O. (2005) Learn more, better and faster: computer-based simulation and gaming of production and operations. *International Journal of Business Performance Management,* 7(1), 34-59.

Leonard, T. and Leonard, N. (1995) Graduates' views on the use of computer simulation games versus cases as pedagogical tools. *Developments in Business Simulation and*

Experiential Learning, 22, 83-87. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Locke, E.A., Shaw, K.N., Saari, L.M. and Latham, G.P. (1981) Goal Setting and Task Performance, 1969-1980. *Psychological Bulletin,* 90, 125-152.

Machuca, J.A.D. (2000) Transparent-box business simulators: an aid to manage the complexity of organisations. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 31(2),pp 230- 239. London: Sage Publications.

Malik, D. and Howard, B. (1995) Investigating the use of computer simulation as an effective pedagogical tool for the application of a strategic model. *Developments in Business Simulation and Experiential Learning,* 22, 38-42. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Malik, D. and Howard, B. (1996) How do we know where we are going if we don't know where we have been: A review of business simulation research. *Developments in Business Simulation and Experiential Learning,* 23, 49-53. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Martin, J. and Dunne, R. (1996) Simulation in Professional Training: in *The Simulation and Gaming Yearbook Volume 4: Games and Simulations to Enhance Quality Learning* Eds. D. Saunders, F. Percival and M. Vartiainen. London: Kogan Page.

Marton, F. and Saljo, R. (1997) Approaches to Learning in: *The Experience of Learning* Eds. F. Marton, D. Hounsell and N. Entwistle. Eddinburgh: Scotish Academic Press.

Maslow, A. H. (1943) A Theory of Motivation. *Psychological Review,* 50, pp. 370 - 396

Mayo, E. (1933) *The Human Problems of an Industrial Civilisation.* New York: MacMillan.

McClelland, D.C (1961) *The Achieving Society.* New York: Van Nostrand Reinhold.

McGregor, D. (1960) *The Human Side of Enterprise.* New York: McGraw-Hill.

McLaughlin, F. and Bryant, G. (1987) A comparison of student perceptions with accepted expectations for business simulations. *Developments in Business Simulation and Experiential Learning,* 14, 135-137. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Merriam, S. (2001) Andragogy and Self-Directed Learning: Pillars of Adult Learning Theory, *New Directions for Teaching and Learning,* 89, pp3 – 13.

Mezirow, J. (1990) *Fostering Critical Reflection in Adulthood.* San Francisco: Jossey-Bass.

Miles, M.B and Huberman, A.M.(1994), *Qualitative Data Analysis,* 2nd ed. Thousand Oaks CA: Sage Publications Inc., ISBN 0-8039-5540-5.

Moon, J. (1999) *Learning Journals.* London: Kogan Page.

Moon, J. (1999) *Reflection in Learning & Professional Development: Theory and Practice.* London: RoutledgeFalmer.

Napier, H. and House, W. (1985) Congruency of Critical Performance Factors in Simulated and Real World Environments: An Exploratory Study. *Developments in Business Simulation and Experiential Learning,* 12, 11-13. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Napier, H. and House, W. (1988) A Comparative Study of Strategic Performance Factors in Actual and Simulated Business Environments. *Developments in Business Simulation and Experiential Learning,* 15, 50-55. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Napier, H. and House, W. (1990) *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 32(3),pp 281- 296. London: Sage Publications.

Norris, D. and Snyder, C. (1980) External validation of simulation games. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research, 13,* pp 73 - 85. London: Sage Publications.

Norris, D. (1986) External Validity of Business Games. *Developments in Business Simulation and Experiential Learning,* 13, 126-129. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Oakshott, L. (1997) *Business Modelling and Simulation.* Harlow: Pearson.

Pidd, M. (1998) *Computer Simulation in Management Science* (4th Ed.) Chichester: Wiley and Sons.

Pines, A., Fensham, P. and Garrard, J. (1985) Describing the cognitive structure of learners: in *Cognitive Structure and Conceptual Change,* Eds L.West and A.Pines. New York: Academic Press.
Ramsden, P. (1992) *Learning to Teach in Higher Education.* London: Routledge.

Robinson, S. (2004) *Simulation: The Practice of Model Development and Use* Chichester: Wiley and Sons.

Robson, C. (2002) *Real World Research.* 2nd Ed. (2002). Oxford: Blackwell.

Rolfe, J.M. (1992) Training transfer: the basis for validating effectiveness. *Simulation/ Games for Learning,* 22(4), 249-259

Rolfe, J. and Hampson, B. (2003) Flight Simulation – Viability versus liability, *The Aeronautical Journal of the Royal Aeronautical Society,* October 2003.

Saunders, M., Lewis, P. and Thornhill, A. (1997) *Research Methods for Business Students.* London: Pitman.

Saunders, M., Lewis, P. and Thornhill, A. (2003) *Business Research Methods for Business Students.* 3rd Ed. (2003). Harlow: Pearson.

Saunders, D. (1995) Introducing simulations and games for business. In: Saunders, D. (1995) *The International Simulation and Gaming Research Yearbook, Volume 3, Simulations and Games for Strategy and Policy Planning.* London: Kogan Page.

Scherpereel, C. (2003) The Impact of Business War Games: Quantifying Training Effectiveness. *Developments in Business Simulation and Experiential Learning,* 30, 69-82. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Schon, D.(1983) *The Reflective Practitioner.* San Francisco: Jossey-Bass.

Senge, P. (1992) *The Fifth Discipline : The Art and Practice of The Learning Organisation.* Adelaide: Griffin.

Shao, S. (2003) *Statistics for Business and Economics* (3rd Ed.). Columbus: Merrill Publishing.

Silverman, D.(2000) *Doing Qualitative Research: A Practical Handbook.* London: Sage Publications.

Snyder, S. (1994) An Assessment Framework for Determining the Effectiveness of Total Enterprise Simulations. *Developments in Business Simulation and Experiential Learning,* 21, 16-19. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Soukup, W. and Whitney, G. (1987) A powerful tool – for what?. *Developments in Business Simulation and Experiential Learning,* 14, 197 - 200. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Spector, J.M. (2000) System Dynamics and Interactive Learning Environments: Lessons learned and implications for the future. *Simulation and Gaming: An Introductory Journal of Theory, Practice and Research,* 31(4), pp. 528 – 535. London: Sage Publications.

Stainton, A. and Johnson, J. (2006) To What Extent Can Total Enterprise Simulation be Validated? *The International Simulation and Gaming Yearbook, Voume 14, pp.102 - 110.* Edinburgh: SAGSET. ISBN 0-9544676-1-2.

Stoner, J. and Freeman, R. (1992) *Management.* 5th Ed. (1992). New Jersey: Prentice-Hall.

Strauss, A. and Corbin, J.(1998) *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory,* 2nd ed. California: SAGE Publications Inc. ISBN 0-8039-5940-0

Stretch, D. (2000) Simulation Design in *The Simulation and Gaming Yearbook Volume 8: Simulation and Games for Transition and Change* Eds. D. Saunders, N. Smalley. London: Kogan Page.

Summers, G. (2004) Today's Business Simulation Industry. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 35(2),pp 208 - 241. London: Sage Publications.

Summers, I., Coffelt, T. and Horton, R.E. (1988) Work-group cohesion, *Psychological Reports,* October, pp. 627 – 636.

Teach, R. and Govahi, G. (1988) The role of experiential learning and simulation in teaching management skills. *Developments in Business Simulation and Experiential Learning,* 15, 65 - 71. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Teach, R. (1990) Demand Equations Which Include Product Attributes. *Developments in Business Simulation and Experiential Learning,* 17, 161 - 166. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Teach, R. (1990) Designing Business Simulations. In Gentry, J. *Guide to Business Gaming and Experiential Learning.* London: Kogan Page.

Teach, R. and Schwartz, R. (2004) Are business games really delivering what students are led to believe? *Developments in Business Simulation and Experiential Learning,* 31, 264-272. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Trauth, E.M., Farwell, D. and Lee, D. (1993) The IS expectation gap: industry expectations versus academic preparation. *MIS Quarterly,* September, pp. 293 – 307.

Tsuchiya, T. and Tsuchiya, S. (1999) *The unique contribution of gaming/simulation: towards establishment of the discipline* In: Saunders, D. and Severn, J. (1999) *The International Simulation and Gaming Research Yearbook, Volume 7, Simulations and Games for Strategy and Policy Planning.* London: Kogan Page.

Vroom, V.H. (1994) *Work and Motivation.* San Francisco: Jossey-Bass.

Warner Weil, S. and Mcgill, I. (1996) *Making Sense of Experiential Learning: Diversity in theory and practice.* Buckingham: Open University Press.

Washbush, J. and Gosen, J. (2001) An exploration of game-derived learning in total enterprise simulations. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 32(3),pp 281- 296. London: Sage Publications.

Washbush, J. and Gosenpud, J. (1991) Student attitudes about policy course simulations. *Developments in Business Simulation and Experiential Learning,* 18, 105-110. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Washbush, J. and Gosenpud, J. (1994) Simulation Performance and Learning Revisited. *Developments in Business Simulation and Experiential Learning,* 21, 83-86. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Wellington, W. and Faria, A. (1991) An Investigation of the Relationship Between Simulation Play, Performance Level and Recency of Play on Exam Scores. *Developments in Business Simulation and Experiential Learning,* 18, 111-114. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Wellington, W. and Faria, A. (1996) Team Cohesion, Player Attitude, and Performance Expectations in Simulation. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 27(1),pp 23- 39. London: Sage Publications.

Whiteley, T., Ledue, R. and Dawson, B. (2004) A cognitive investigation of the internal validity of a management strategy simulation game. *Developments in Business Simulation and Experiential Learning,* 31, 229 - 233. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Whiteley,T. and Faria, A. (1989) A study of the relationship between student final exam performance and simulation game performance. *Developments in Business Simulation and Experiential Learning,* 16, 78 - 82. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Williams, E. (1987) Business simulation in the policy course: A survey of american assembly of collegiate schools of business. *Developments in Business Simulation and Experiential Learning,* 14, 235 - 238. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Wolfe, J. (1976), Correlates and Measures of the External Validity of Computer-Based Business Policy Decision-Making Environments. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 7, 411-438. London: Sage Publications.

Wolfe, J. (1985) The teaching effectiveness of games in business collegiate courses. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 16(1),251-288. London: Sage Publications.

Wolfe, J. (1997) The effectiveness of business games in strategic management course work. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 28(4),360-376. London: Sage Publications.

Wolfe, J. and Box, T. (1987) Team cohesion effects on business game performance. *Developments in Business Simulation and Experiential Learning,* 14, 250 - 255. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Wolfe, J. and Crookall, D. (1998) Developing a Scientific Knowledge of Simulation/Gaming. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research,* 29(1),7-17. London: Sage Publications.

Wolfe, J. and Jackson, R. (1989) An investigation of the need for valid business game algorithms. *Developments in Business Simulation and Experiential Learning,* 16, 31 - 36. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Wolfe, J. & Roberts, C. R. (1986). The External Validity of a Business Management Game. *Simulation and Games : An Interdisciplinary Journal of Theory, Practice and Research,* 17(3), 45-59. London: Sage Publications.

Wolfe, J. & Roberts, C. R. (1992). Peer group indicators of the external validity of business games: A five year longitudinal study. *Developments in Business Simulation and*

Experiential Learning, 19, 194 - 198. Reprinted in *The Bernie Keys Library*, 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Wolfe, J. & Roberts, C. R. (1993). A Further Study of the External Validity of Business Games: Five Year Peer Group Indicators. *Simulation and Gaming : An Interdisciplinary Journal of Theory, Practice and Research*, 24, (1), 21-34. London: Sage Publications.

Yahr, M. (1995) Student and teacher perceptions of a management simulation course. *Developments in Business Simulation and Experiential Learning, 22*, 124 - 125. Reprinted in *The Bernie Keys Library,* 2nd Ed., Hugh M. Cannon (Ed.). [Available from http://www.Absel.org].

Yin, R. (2003) *Case Study Research Design and Methods* (3rd Ed.). London: Sage Publications.