An investigation of the relationship between student characteristics, the learning experience and academic achievement on an online distance learning MBA programme.

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Abstract

The main purpose of this study is to develop and test a conceptual framework of the antecedents of academic achievement for students studying online. The study is essentially exploratory in nature and an adaptation of Biggs' 3P (Biggs, 1993a) model provides the theoretical framework. A wide range of antecedent variables is considered, including individual student characteristics and behavioural aspects of studying online. Uniquely, the study positions developmental aspects of the student learning experience (deconstructed at course level using an eight level developmental hierarchy derived from Bloom's taxonomy (Bloom *et al.*, 1956)) as an intermediate outcome.

Regression models are calibrated to determine which factors influence both the student learning experience and academic achievement. Variation in the student learning experience (as an intermediate outcome) is explained by student satisfaction with course materials and certain individual student characteristics and behavioural aspects of online study. Disadvantaged students lack previous experience in the study of Economics; have certain learning styles (sensing and verbal); and in the online study context find it difficult both to interact with faculty and to work alone. In terms of academic achievement, the parsimonious model explains 48% of the variance in overall performance in the Economics exam. After student ability the next most important variables of significance relate to developmental aspects of the learning experience, specifically, the level of difficulty experienced both in applying theory to business problems and understanding numerical calculations.

The policy implications of the findings are considered and specific recommendations are provided for the enhancement of Edinburgh Business School course resources.

The research findings indicate that, in building a theoretical framework for online learning, there is merit in taking into account course-level developmental aspects of the student learning experience. As well as their significance in helping to explain variation in academic achievement, the insights gained on student learning facilitate the design and targeting of interventions to address specific educational needs. It is hoped that this approach may help to address some of the concerns that exist that, in education, technology is not always used in ways which enhance student learning.

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Chapter 1 Introduction To The Research

Edinburgh Business School is the graduate school of business of Heriot-Watt University and in 1997 pioneered distance learning study of its Masters of Business Administration (MBA) programme. Over the last 17 years the School has enjoyed much success and is now the largest international MBA programme in the world. Over 16,000 students from approximately 150 countries have graduated from the programme and active students presently number approximately 11,000.

Flexibility and convenience have been core aspects of the Edinburgh Business School offering. The MBA programme allows students to study core and elective courses anywhere in the world, at their own pace, and present for exam at any of over 350 exam centres located in 130 countries. Students may study for the MBA by distance learning (programmed self-study of the course materials), or by combining self-study with tuition either at Edinburgh Business School itself or with one of Edinburgh Business School's 20 Approved Learning Partners (ALPs) around the world. Approximately one-third of students on the MBA programme elect to combine self-study with tuition.

In 2002 the learning materials on the Edinburgh Business School MBA programme were supplemented by web-based interactive learning tools specific to each course on the programme. The content and structure of the course websites has changed little since then. However, recent developments in technology, including increases in bandwidth, higher internet speeds, and WEB 2.0 technology, offer new educational possibilities. This study seeks to provide direction to Edinburgh Business School on future development of educational resources and does so by taking a learner needs-based perspective.

This task is challenging because there is not a common theoretical framework which can be used as a point of reference in planning, undertaking and interpreting the findings of empirical studies in online learning. The purpose of this study is to develop and test a conceptual framework of the antecedents of academic achievement in the context of online management education. The framework proposed positions student needs at the heart of the model and a holistic approach is taken to developing an understanding of the causal factors which influence the student learning experience and

academic achievement. The model takes into consideration a wide set of antecedent variables, including those relating to student characteristics, the online study context and course context. Importantly, learning processes are considered in terms of a developmental hierarchy of understandings in relation to the study of a particular course.

It is hoped that the model will help improve our understanding of the factors which influence student learning in the online context and contribute to the development of a pedagogical framework around the use of new technologies to enhance student learning. The research draws on prevailing theories in the following fields: adult learning theory; pedagogy; e-learning; culture; and learning style.

In Chapter 2, the Literature Review provides insights on the growth of online education and the reasons behind this from a student perspective. While technology provides several potential benefits, it is noted that many technology enhanced learning interventions may be technology-led rather than reflective of student educational needs. A review is undertaken of learning theory in the context of online education and the diversity of students who choose to study online is highlighted as a particular challenge for educators. Sources of individual student difference are identified and their influence on learning and academic achievement is considered; a number of gaps in the knowledge are revealed. Several analytical frameworks which help to build a theoretical understanding of the factors which influence learning are reviewed.

In Chapter 3 – the Literature Synthesis - the findings of the literature review are considered and a holistic analytical framework is proposed, based on an adaptation of Biggs 3P model, to build a theoretical understanding of the factors that influence the student experience and academic achievements in the online context. The framework is situated at course (not general) level. At the heart of the model is the student learning experience and this is deconstructed using an eight level hierarchy of understandings (derived from Bloom's taxonomy), from the lower level challenges of building knowledge, through to higher order complex problem solving in Economics.

Chapter 4 - Research Aim, Objectives, Hypotheses & Methodology - provides a detailed explanation of the research design. The main focus of the research is the study of Economics on the Edinburgh Business School online distance learning MBA programme. This course is a core course on the MBA programme and combines both

abstract and definitional constructs which present different learning challenges to students. Economics was also chosen as the focus of the research as this thesis draws on the findings of a wider research study (conducted among both online distance learning and taught students) which examines the learning challenges students perceive in the study of Economics and their attitudes towards, and use of, new technologies. The main intention in this study is to build a theoretical framework of the antecedents of academic achievement at the course-level (Economics), however, to provide a point of comparison , the antecedents of academic achievement are also considered with reference to six other core courses on the MBA programme, namely Organisational Behaviour, Marketing, Finance, Accounting, Project Management and Strategic Planning). However, this analysis was undertaken with a more limited set of variables and, notably, factors relating to the course-specific student learning experience were not included (see Chapter 6).

The research is based on a random sample of 255 online distance learning students (no classroom-based tuition), each of whom completed an online self-completion questionnaire on the learning challenges perceived in the study of Economics and also the Felder & Solomon's Index of Learning Styles (ILS) questionnaire. All participants had studied Economics in the English language (Edinburgh Business School offers its courses in five different languages) and used the same course resources. The adapted Biggs 3P model is used to provide insight on the interactive relationships at work between various antecedent factors, the student learning experience and academic achievement.

The choice of antecedent variables included in the study is informed by the literature review and *a priori* reasoning. The antecedent variables included: various student characteristics; satisfaction with Edinburgh Business School course resources; and a range of behavioural items associated with online study. The wide range of antecedent variables included in the research, and the detailed consideration given to the student learning experience (across eight different levels in a hierarchy of understandings), are key features of the study in terms of its contribution to the knowledge.

In Chapter 5 Econometric Analysis. Multivariate regression analysis is used to identify the factors which are significant in the study of Economics, first in influencing the student learning experience, and second in influencing academic achievement (exam performance). In each case preliminary and parsimonious models are calibrated.

In Chapter 6 Econometric Analysis – Other Core Subjects. In the absence of insights on the student learning experience in other core subjects, multivariate regression analysis is restricted to identifying the factors which are significant in influencing academic achievement only.

In Chapter 7 - Interpretation and Policy Implications - the policy implications of the findings are discussed and a range of enhancements to Edinburgh Business School course resources, several of which leverage developments in new technology, are recommended.

Chapter 2 Literature Review

In this Chapter insights are provided on the factors behind the growth in online education, and the concerns that technology enhanced learning may be technology-led rather than based on identified educational needs. A review is undertaken of learning theory in the context of online learning and the challenges of meeting diverse student needs are discussed taking into account the influence of individual student characteristics on learning and academic success.

2.1 Management Education

Management education is a subset of higher education and is mainly provided by university schools of business and management (Fox, 1997).

2.2 Distance Education

Distance education is an instructional delivery system that allows students to participate in an educational opportunity without being physically present in the same location as the instructor (Zapalski & Brozik, 2006).

2.3 Online Education

Online education is a sub-set of distance education, which also encompasses technologies, including correspondence courses, educational television and video conferencing (Means *et al.*, 2009). Online education may be referred to as online learning, e-learning or web-based learning and the term 'online' refers to computer mediated communication (Finch & Jacobs, 2012). Online learning is defined as learning that takes place partially or entirely over the internet and excludes print, video or any stand-alone instructional software that does not have a significant internet-based instructional component (Means *et al.*, 2009). It is characterised by almost instantaneous communication and access to resources between many different sites with the course itself resident in a central location facilitating regular up-dating and modification of course content (Cook, 2005).

Over the last ten years online delivery of education has increased exponentially because of "rapid growth in educational technology accompanied by increases in bandwidth, higher internet speeds, WEB 2.0 technology, portable devices and a generation of tech-savvy users" (Ladyshewsky & Soontiens, 2013, p.4). According to Nemanich, Banks

and Vera (2009, p.123): "Universities are rushing to utilize the internet as a tool for innovative education in order to reduce costs, expand geographic reach, and enhance capabilities." The expansion of new communications technology has brought distance education within reach of millions of potential distance learners around the world (Moore & Kearsley, 2011), and over the last twenty years online education has moved from being an emerging sector to a multi-billion dollar market (Kopf, 2007; Means *et al.*, 2009). According to a recent report the worldwide market for self-paced eLearning products and services reached US$35.6 billion in 2011. The five-year compound annual growth rate is 7.6% and revenues are expected to grow to $51.5 billion by 2016 (Adkins, 2012).

It is predicted that by 2014, in the US alone, 22 million students will be taking at least some of their classes online (Nagel, 2009). Globally, there is a growing population of students studying programmes online at universities in India, the UK, Canada, Spain, and China as well as rapid adoption of e-learning in developing economies such as Vietnam, Azerbaijan, Malaysia, Romania and Thailand, each with an expected five year growth rate over the period 2011-2016 in excess of 30% (Adkins, 2012).

The quality of online education has been questioned on the basis that it is perceived to be of inferior quality compared to face-to-face teaching (Drago *et al.*, 2005; Redpath, 2012). However, a comparison of learning outcomes demonstrates that online education is an effective mode of teaching and learning that produces equal or superior learning outcomes in comparison to the traditional face-to-face learning environment at both the graduate and undergraduate levels in business education (Kotey & Anderson, 2006; Arbaugh *et al.*, 2009; Means *et al.*, 2009; Allen & Seaman, 2010).

A meta-analysis comparing distance learning to face-to-face learning in university and college education in the US from 1990-2009 found that students (graduate and undergraduate) taking courses by distance, in 70 per cent of cases, outperformed students taking their courses in the face-to-face environment (Shachar & Neumann, 2010; Means *et al.*, 2009).

Behind the growth in online education lie several key advantages to students, namely having the flexibility and convenience of studying at their own pace, in their own space and time (Marks, Sibley & Arbaugh, 2005; Kock, Verville & Garza, 2007). These

benefits are especially compelling in postgraduate education, where many students are in full-time employment and need to balance the time demands of work, travel and family commitments (Ladyshewsky & Soontiens, 2013). According to Hodgson, technology provides added 'capacity to represent and communicate information, and ultimately construct knowledge' and it also offers the opportunity for interaction between people over any distance and at any time (1997, p.215). Potential drawbacks include: lack of personal interaction; the elimination of a sense of community; and perceptions of lower quality (Terry, 2007).

Whilst there has been significant growth in the use of technology within higher education, there are concerns in relation to whether technology is used in an effective way to improve the student learning experience (Kirkwood & Price, 2005; Price & Kirkwood, 2008; Laurillard, 2002a; Laurillard, 2009; Kirkwood & Price, 2012). According to Zapalski (2006, p.325), care is required to ensure that new technology is used in a positive way and not just "because we can". Zapalski also remarks: " …while technological innovation is necessary to the development of distance education, it is not sufficient to assure that distance education is effective" (*ibid,* p.325).

The term technology-enhanced learning (TEL) is used to describe the application of information and communication technologies to learning and teaching (Kirkwood & Price, 2014). In their critical review of research on technology for teaching and learning in higher education, Kirkwood and Price (2012) found that there are inconsistencies in both the way the concept of enhancement of teaching and learning is conceived by teachers, and in the form of evidence used to support enhancement. They discovered that many TEL interventions were technology-led, and did not stem from 'an identified educational need or aspiration.'(2012, p.25). Laurillard also recognises the need to design learning in a way which embodies technology effectively and productively (2008; 2012). Furthermore, she highlights the potential of new technology to facilitate and move from the transmission model of university teaching to one which supports students in the generic skills of scholarship (2002a). The transmission model is a teacher-focused theory of teaching in which knowledge is 'transmitted from expert teacher to inexpert learner'(Biggs, 2012, p.43). The focus is on what the teacher does. In student-focused theories of teaching, however, the emphasis is on changing the way students understand the world and it is what they student does to achieve that understanding that is the most important aspect (Prosser & Trigwell, 1999).

It is relevant at this point to make reference to Massive Open Online Courses (MOOCs) which are considered by some to be a disruptive innovation to university education. There is much discussion around the student experience, quality assurance, and assessment in relation to MOOCs, never-the-less they are considered to be a potential threat to MBA courses, in particular those courses offered online where there is limited contact and interaction between faculty and students. This highlights the need for online MBA providers to carefully manage quality and identify opportunities to add value to their programmes through technology-enhanced learning (Ladyshewsky & Soontiens, 2013).

2.4 Synchronous and Asynchronous

There are two approaches to online learning: synchronous and asynchronous. The synchronous approach is instructor-led and features simultaneous interaction between instructors and students whereas the asynchronous approach is self-paced and instructors and students do not interact simultaneously. According to Comer and Lenaghan (2012, p.262) asynchronous learning provides 'the opportunity to create a learner-centred environment that fosters rich communication between instructor and students' and that it 'can engender more meaningful participation and interaction than we find in many traditional face-to-face classrooms.' Students put more thought into online comments and also take time to reflect on their online engagement.

2.5 Learning Theory and Online Learning

A learning theory is a conceptual framework that describes how information is absorbed, processed, and retained. Several disciplinary traditions contribute to the field of e-learning, including education, psychology, and computer science, however, there is no single model to explain how e-learning actually works (Oliver & Conole, 2003) and no single theory of learning is used exclusively in the design of online learning materials (Anderson, 2008).

The behaviourist approach to learning was behind the design of early computer systems (Anderson, 2008). Influenced by Thorndike (1913), Pavlov (1927) and Skinner (1975), the behaviourist school ignores issues of meaning and claim that learning is seen through observable changes in behaviour. In the mid-twentieth century, learning and teaching approaches based on behaviourist theories centred on establishing appropriate

stimulus-response connections and "'programmed learning' and 'teaching machines' were in vogue" (Ericsson, 2006, p.45).

Cognitive learning theory grew out of Gestalt psychology and according to this theory, learning is an internal process which involves memory, motivations, and thinking. Learning is seen from an information processing perspective; information is first acquired through the senses, transferred to short-term memory and, if successfully processed and assimilated (changed to fit into existing cognitive structures), it is then transferred to long-term memory. When an existing cognitive structure is changed to incorporate the new information this is referred to as accommodation. In long-term memory, information is thought to be stored in nodes which connect to form relationships or networks (Anderson, 2008). Gestalt psychologists focused on the importance of meaningfulness and Wertheimer (1959) applied this approach to learners in building their own structured organisation of a situation. The pedagogical focus is thus on the processing and transmission of information through communication, explanation, and having meaningful problems to solve.

In social learning theories, social interactions are taken into account, but mainly from a psychological perspective. Social cognitive theory recognises the power of human agency, both individual and collective, in performance accomplishment. Of relevance here is perceived self-efficacy which relates to an individual's belief in terms of whether a certain academic outcome can be achieved (Bandura, 1977). Bandura also highlights the importance of self-reflection (meta cognition) to verify the soundness of one's thinking as well as self-regulation (Bandura, 2001). In terms of pedagogy, emphasis is placed on interaction and modelling.

Constructivism builds on the work of Piaget (1950) and Bruner (1963; 1966; 1996). It is a theory of learning which places importance on students constructing knowledge for themselves, how they think with it, and develop their own understandings (Biggs, 2012). Constructivism recognises that real-life learning is messy and complex and tries to emulate this in the classroom. Learning is regarded as a constructive process and the primary responsibility for learning lies with the student. An important aspect is that students require metacognitive skills to help them direct the educational process. The emphasis in a learning framework which is constructivist in nature is to encourage students to make their own discoveries; the pedagogical focus is task oriented and based

on self-directed activities. Instructors should engage students in an active dialogue; also the use of visual representation is recommended to help students build their own meaning and mental models (Bruner, 1990). According to Anderson (2008, p.19), 'learners learn best when they can contextualise what they learn for immediate application and personal meaning'. It is in this context that use has been made of 'the programmable, simulation and modelling properties of technology' (Laurillard, 2009, p.3)

Social constructivism, which is very much influenced by Vygotsky's work, applies constructivism in social settings (1962). The process of sharing each person's point of view in a social context, referred to as collective elaboration (Van Meter & Stevens, 2000), results in individual learning. Vygotsky (1978, p.24) also highlighted the convergence of the social and active roles of learning; '… the most significant moment in the course of intellectual development, which gives birth to the purely human forms of practical and abstract intelligence, occurs when speech and practical activity, two previously completely independent lines of development, converge.' The term 'proximal learning' is used by Vygotsky to describe the process through which individual experience is transferred into group knowledge through conversation (1978). According to Jones et al: 'A group of individuals can learn from each other by engaging in discussion, by reflecting on their experiences and exploring their reasons for differences of judgment (in relation to some task).'(2006).

Of interest in relation to social constructivism is the Community of Inquiry framework (Garrison, Anderson & Archer, 2000) which identifies three key overlapping elements in the experience of learning online: social presence; cognitive presence and teaching presence (see Figure 2.1).

Community of Inquiry
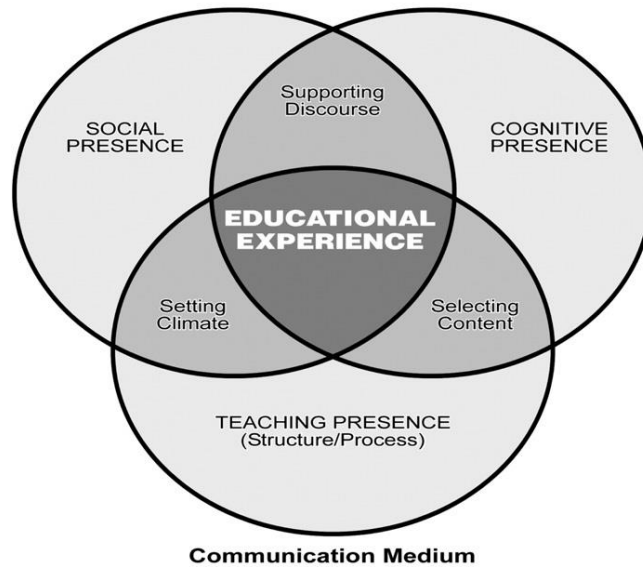
Fig. 2.1. Community of Inquiry framework.

In terms of social presence both the instructor and students can contribute by creating a welcoming and supportive environment and three dimensions have been defined: identifying with the community; communicating purposefully in a trusting environment; and developing interpersonal relationships (Garrison, 2009). Cognitive presence is primarily led by the instructor and relates to deep conversation and reflective practice with the aim of building knowledge and learning (Garrison, Anderson & Archer, 1999) and teaching presence refers to the design, facilitation and direction of learning (Garrison, Anderson & Archer, 2010).

All of these elements contribute to the sense of community and connection between instructors and students (Ladyshewsky & Soontiens, 2013). A balance is required, for example a balance of social and cognitive presence is required to ensure a course does not become a social setting (Arbaugh, 2010b). Comer and Leneghan (2012) see the instructor's role as one of creating an online presence which shows interest and guidance, without dominating the discussion, and also being characterised by the instructor's natural teaching style.

The literature reveals that a distinction may be drawn between modern and post-modern social-constructivism: the modern perspective takes social interaction into account, but essentially sees learning as a rational process that takes place only in the

mind; the post-modern view does not accept the individual-centred nature of learning, but instead sees learning as 'a social process in which an amalgam of interpersonal and intrapersonal means are used in conversation with one's self and in joint action with others' (Holman, 2000, p.206). Collaborative learning is the term used to describe activities that promote learning through social interaction (Sharples, Taylor & Vavoula, 2007). Learners have an opportunity to 'share and discuss the actions they take' and integrated technologies are used to support both (Laurillard, 2009, p.10).

Many educators consider conversation or dialogue to be very important, and even potentially transformative. According to Dewey (1916, p.4): '…any social arrangement that remains vitally social, or vitally shared, is educative to those who participate in it.' Conversational learning is: 'a learning process whereby learners construct meaning and transform experiences into knowledge through conversations' (Baker, Jensen & Kolb, 2002, p.207). Learning as conversation relates very much to the work of Pask (1976a) and in conversation theory a key principle is 'teach back', which aims to achieve understanding through guided conversation which is usually led by a teacher (Pask, Kallikourdis & Scott, 1975).

In conversational learning, it is important to draw a distinction between explicit and tacit knowledge. Explicit knowledge refers to information-based knowledge or 'knowing what' and tacit knowledge is 'knowing how'; the interplay between the two becomes clear as individuals find meaning through conversation (Baker, Jensen & Kolb, 2002).

The online conversational environment provides an opportunity for interaction which is an 'entirely different kind of venue for interpersonal interaction from the traditional same time-same place medium.' (Baker, Jensen & Kolb, 2002, p.166). Some of the characteristics of a technology-based learning environment which are conducive to critical reflection include its ability to provide a complete and permanent record of a discussion as well as offering participants in a discussion the opportunity to consider the comments of others before posting their own contribution. According to Ravenscroft (2000), successful learning is realised when the learner is in control of the activity, when they are able to test ideas by performing experiments, to ask questions, collaborate with other people, seek out new knowledge, and plan new actions.

The role of the group in facilitating individual cognitive processes has been considered by a number of researchers. In postgraduate education a key aim is to develop student ability to think critically (Jones *et al.*, 2006). Small tutorial groups provide an opportunity to learn based on dialogue and one approach to learning based on dialogue is 'The problem-posing model' (Freire & Shor, 1987, p.11). According to Stepian and Gallagher (1993), the distinct characteristics of problem-based learning are: the problems do not test skills but rather assist in the development of skills - the problems are used to drive the curriculum; problems are ill-structured, with minimal presentation of information – gathering information, perceiving the problem and developing the solution are part of an iterative process; students (who may work in small groups) solve the problems and the role of the teacher is one of facilitator; and assessment is authentic and performance-based. In tutorials students become active, rather than passive, participants in the discussion and can gain self-esteem. Some difficulties may arise, however, through lack of participation; individual students dominating the discussion; maintaining focus; and assessing student understanding (Jones *et al.*, 2006). Exposure to difference(s) can encourage interactions and stimulate learning as the conversation progresses, creating opportunities for single- or double-loop learning as appropriate (Argyris, 1999). Group process technology may be used to support social dimensions of learning (Jones *et al.*, 2006, p.392).

According to Anderson (2008, p.39) each of the behaviourist, cognitivist and constructivist theories have made a contribution to the development of online learning materials: "Behaviourist strategies can be used to teach the facts (what); cognitivist strategies, the principles and processes (how), and constructivist strategies to teach the real life and personal applications and contextual learning". Laurillard sees each theorist focusing on different aspects of the learning process, however, and maintains that contrasting theories can be considered as complimentary rather than oppositional – '…where each offers a different kind of insight into what it takes to learn.' (2012, p.63).

Pask's Conversation Theory (1976a) has been applied by Laurillard (2002a) and by Sharples (2003) to examine the ways people learn through technology. In her 'Conversational Framework' for learning, Laurillard suggests that the exchanges between teacher and student can be classified on two levels: (1) the discursive level where articulation and discussion of theory, ideas, concepts and forms of representation take place; and (2) the experiential level which is the domain of experimentation,

learning by doing, and practice on goal-oriented tasks. In this framework (see Figure 2.2) bridging between the two levels takes place as each participant engages in the process of adaptation (practice in relation to theory) and reflection (theory in light of practice). For learning to be realised both levels of operating have to be connected (2009; 2002a).

Laurillard suggests that the Conversational Framework can be used as a point of reference against which new uses of technology to support learning can be tested. She notes that 'the continually iterative dialogue between teachers and students is essential if the students are to be sure that they have understood the teacher's concept.' (2002a, p.144-145). In the Conversational Framework the interplay between theory and practice is seen to be key in moving from abstract concepts to concrete learning. Conversations can take place at either the level of actions (experiential level) relating to performance of an educational activity to reach a shared understanding of the phenomenon ('what's happening here?', or 'what do we do next?'). At the level of descriptions (discursive level), the conversation focuses on the implications of the actions to make sense of the activity by proposing and re-describing theories and supporting explanations ('why did that happen?', 'what does this mean?'). As well as these external conversations, individual learners have a continuous internal dialogue, endeavouring to make sense of the concrete activity by mental abstraction and by forming theories and testing them through actions in the world.

The Conversational Framework captures many aspects of 'what it takes to learn' (Laurillard, 2008, p.140) and can be used to gauge the contribution of particular teaching methods or applications of technology. For example, in relation to teaching methods, constructionist approaches would prioritise learner activity in the practice environment (Figure 2.2.), whilst socio-cultural learning would place emphasis on the value of discussion with peers (Figure 2.3.) (Laurillard, 2002b).

As a point of reference for applications of technology the framework would show, for example, that podcasts support learning in a similar way to conventional books and lectures i.e. they are tools to present the teacher's conception (discursive level). According to Laurillard the Conversational Framework can bring together the main learning theories in a single depiction to reveal the way in which 'the iterative cycles required for robust learning work together' (2009, p.13).

Figure 2.2 Constructionism prioritizes the learner's activity in the practice environment, adapted by the teacher to their needs, where it provides intrinsic feedback on their action in relation to the task goal, enabling them to reflect on that internal relation in the light of their action adapted by their current understanding.
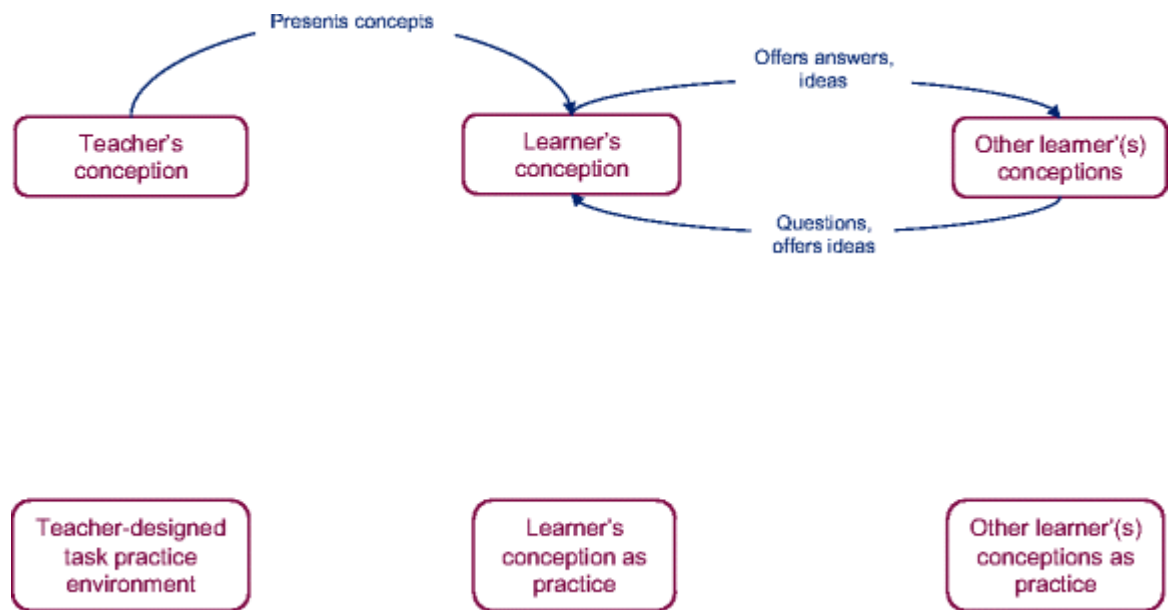
Figure 2.3. Social learning prioritizes the learner's exchange of ideas with a peer or peers, where the teacher's role is to initiate the topic for discussion

Laurillard recognises the potential of technology to deliver a different kind of learning which sits beyond the standard transmission model of university teaching '…the difference between a curriculum that teaches what is known and one that teaches how to come to know.' (2002a, p.141). The Conversational Framework endeavours to capture

aspects of learning beyond simple transmission to meet more progressive academic heights i.e. contribute to the development of higher level cognitive skills.

McLoughlin and Lee (2008) also perceive a need to rethink educational models, from those which conform to a 'student-as-information consumer' model in their design to a vision of pedagogy which emphasises learners as active participants and co-producers, and in which learning processes are participatory and social. McLoughlin and Lee (2008, p.15) refer to a range of possibilities in learning environment design which are made possible by advances in technology using a framework called Pedagogy 2.0. In this framework, they capture the potential for connectivity through social software tools which allow "students to create and share ideas, connect and participate in broader learning communities that are not confined to the spaces in which formal teaching and learning take place". Within Pedagogy 2.0. (Figure 2.4) the key elements are: Personalisation, Productivity and Participation. Personalisation stems from the need to give learners self-direction and control over the learning process; Productivity relates to the involvement of students in creating and generating ideas, concepts and knowledge (not just consuming instructor supplied information); and Participation relates to the creation of social learning spaces which encourage dialogue and connection across communities (McLoughlin & Lee, 2008). Each of these elements move beyond instructor-centred tuition, prescribed curricula and content.
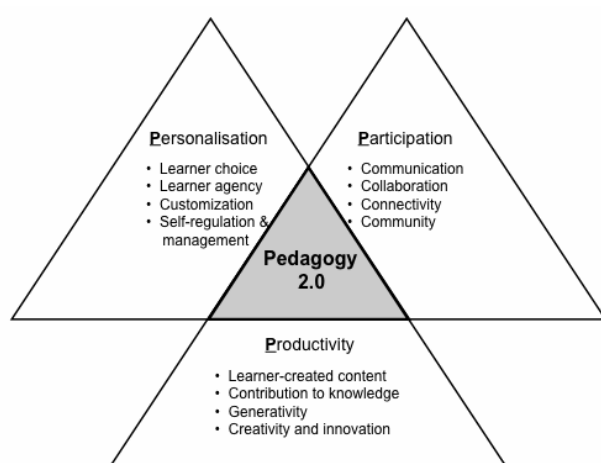
Figure 2.4. Pedagogy 2.0

2.6 Student Diversity in the Online Environment

Online learning has facilitated higher education institutions in the provision of courses to students on a global basis (Nagel, 2009). With expansion into international markets,

it has been logical for business schools to modify the curriculum to incorporate and integrate international business topics. Less attention, however, has been given to the issue of meeting the diverse learning needs of international cohorts of students, taking into account the interaction among cultural factors, teaching methods, language difficulties and learning styles (Diaz & Cartnal, 1999). According to Charlesworth (2009) student diversity in the online environment places emphasis on the importance of developing a thorough understanding of students and their learning preferences. With increasing diversity of students in MBA classes and programs, it is expected that the diversity of approaches to learning will also increase (Rayner & Cools, 2011). This has implications for teaching methods and pedagogy (Kolb & Kolb, 2005).

2.7 Individual Differences

Cassidy (2012, p.793) states that the term "individual differences" refers to: "the array of characteristics, attributes, aptitudes, preferences and propensities present in any group of students which have the potential to influence either the learner experience or the learning outcomes". The effect of individual differences on the efficacy of learning is an enduring question in the literature (McLoughlin, 1999) and they are increasingly cited as contributing to student success (Cassidy & Eachus, 2000).

Individual differences in *student ability* have, for many years, been thought by psychologists and educators to explain academic achievement. It is only in the last few decades that researchers have looked beyond student ability to take into consideration other sources of individual student difference (cognitive styles, learning styles, motivation, gender, ethnicity, etc) and their effects in terms of predicting academic success (Zhang, 2000). The literature reveals that, in terms of graduate management education, the individual factors which influence learning in the online setting are in many respects different to those which influence learning in the traditional classroom setting (Bocchi, Eastman & Swift, 2004). Online learners tend to be more independent learners than their traditionally taught counterparts (Nilsson *et al.*, 2012; Diaz & Cartnal, 1999; Grasha & Yangarber-Hicks, 1999). To succeed online learners need to have self-discipline, initiative, motivation, commitment time management and organisation skills to allow them to work independently (Devi, 2001; Jana, 1999; Kearsley, 2002). It is acknowledged in the literature that there is a gap in the knowledge in relation to learning in the online context and that more research is required to build a theoretical understanding of the factors that influence learning outcomes (Nemanich,

Banks & Vera, 2009). Individual differences relate to many different pre-existing characteristics, including previous education, cognitive ability, age, gender, work experience, relevant academic background, English as first language, learning processes, culture and behavioural differences. Each of these is now considered in turn, drawing upon the literature, to evaluate the influence of these characteristics on academic success in terms of both traditional classroom-based and online graduate management education.

2.7.1 Previous Education

In terms of previous education, the literature reveals that research on individual differences has focused on graduate management admission test (GMAT) and student undergraduate cumulative grade point average (GPA) and their predictive ability with respect to MBA grade point average. These criteria are commonly used by a number of graduate schools of management to guide course admission decisions (Carver & King, 1994). According to Kass and Grandzol (2012) , GMAT is widely regarded as an accurate predictor of academic success for MBA students and studies in support of the validity of GMAT in predicting academic performance in MBA programmes include Kuncel, Crede & Thomas (2007) and Oh, Schmidt, Shaffer & Lee (2008). In the meta analysis undertaken by Oh *et al (2008, p.568)*, using a corrected mean correlation, the validity of GMAT to predict graduate academic performance was r = 0.51 for first year graduate grade point average and r = 0.49 for overall graduate grade point average. That said, the literature on the use of GMAT and GPA to predict academic performance in postgraduate management education is not conclusive. Carver & King (1994, p.95) cite Hecht & Powers (1982), when they point out concerns regarding the use of GMAT score to predict graduate academic performance when the test is taken under nonstandard conditions (for example, taking into account whether English is the student's first language, the institution, and the type of students attracted to a particular programme) – the variation in the multiple correlation of undergraduate GPA and GMAT with MBA grade in the first year were reported to be between 0.12 and 0.67.

Wright & Palmer (1994, p.349) found a weak association between GMAT and GPA scores and graduate grade point performance (multiple R-square was estimated to be 0.186). In a study investigating admissions for non-traditional students (students studying while in employment), Carver & King (1994, p.98) explored a number of precedent variables, including: gender, age, undergraduate major, work experience,

duration of former education, competitiveness of undergraduate institution, undergraduate GPA and GMAT scores and their predictive value on graduate grade point performance Only three variables proved to be significant predictors for non-traditional students and they were: GMAT score, undergraduate GPA and work experience. R^2 was estimated to be 0.22.

Yang and Lu (2001) also found that GMAT and GPA were important predictors of graduate academic performance (grade point average), however, in their study, based on 395 students, they found that, in addition to GMAT and GPA, the student's native language was also somewhat important in explaining variation in MBA graduate grade point average; together GMAT, GPA and native language accounted for 25% of variation in academic performance (R^2=0.259). Yang and Lu's research, however, considered only a limited number of predictors (GMAT, GPA, native language, age and gender).

Clayton and Cate (2004) provided an overview of studies, which have been conducted to predict the success rates of students in MBA or graduate management programmes and concluded that GMAT, GPA and work experience are the most useful variables in terms of predicting success and guiding admissions into graduate business programmes. They noted, however, that when GMAT and GPA are combined with other variables (such as the type of programme e.g. full-time, part-time, or executive MBA), they are less useful in predicting success; the resultant models explaining only 8-21% of variation.

In their own research, Clayton and Cate (2004) examined 189 MBA graduate admissions records over a five year period using discriminant analysis, and found that GMAT and GPA scores played no role in graduation success. Whilst their study was affected by incomplete admissions records (total valid sample = 168), Clayton and Cate found that in predicting graduation success, study status was important (part-time status was a marginally better indicator of eventual graduation than full-time study status) and also resident tuition eligibility and race were important (Caucasian and Hispanic race indicators were better indicators of eventual graduation than those for Asian race). Neither gender nor type of undergraduate college was significant in the analysis. Clayton and Cate argue the case for collection and analysis of dummy variables (such as

gender, full- or part-time study status, race, etc) to complement the traditional use of purely numerical data (GMAT and GPA scores) to predict student success.

Several other researchers have argued that, whilst GMAT and GPA are important, MBA academic performance is also influenced by other variables which lie beyond those traditionally used to predict student success. For example, in relation to executive MBA (EMBA) students, according to Gropper (2007, p.207) "the value of the GMAT as a predictor of performance in the MBA is less certain". Gropper's research (n=180) reveals that for executive MBA students, who tend to be older and have more career accomplishments than the full-time student, the significant variables in predicting overall grade point average in the EMBA were: gender (females performed better than males); an undergraduate degree in engineering (positive influence); and career achievement (division manager level or higher). The number of years of work experience, race, undergraduate GPA and GMAT were not statistically significant in predicting overall grade point average in the EMBA (although GMAT did prove to be a significant predictor variable of year 1 grade point average) with an R^2 of 0.15. It should be noted that his sample was heavily biased towards students of male gender (80% of the sample) and lacked racial diversity (only 10% were non-white students (*ibid,* p.213).

Focusing their research in the online distance learning study context, Alstete and Beutell (2004) examined the experience of 145 MBA students and using regression analysis found that standardised test scores (GMAT and GPA) were not related to course performance (grade), but that there was a significant relationship between academic performance (grade) and participation in the online course discussion boards and also with individual assignment scores. Whilst their study was quite small and the number of variables considered quite narrow, this finding is interesting as it suggests that, in post-graduate management education, there may be differences in the variables which are important in predicting academic success in the online distance learning context compared to the traditional taught environment. While the authors do provide insights on important explanatory variables of academic success, they do not provide details on the overall level of explanation achieved (R^2).

One further insight on the importance of GPA in predicting learning outcomes is provided by Marks, Sibley and Arbaugh (2005) who found that GPA is not significantly associated with perceived student learning/ satisfaction.

Beyond standardised test scores (GMAT and GPA), the research available on the predictors of academic success in postgraduate management education generally, and in relation to courses delivered through online distance learning specifically, is limited and inconsistent. It has been necessary, therefore, to sometimes draw upon research from a wider field to gain insight on the variables which may be potentially important in predicting academic success in the online distance learning context.

2.7.2 Cognitive Ability

There is extensive research in higher education which has established a positive relationship between cognitive ability and academic achievement, and this research is based on the performance of many students, in many different countries and across a wide range of disciplines (Anastasi & Urbina, 1997; Hopkins, 1998). In online education, Nemanich, Banks and Vera (2009) found that student ability (measured by self-reported SAT scores) is positively associated with learning performance (measured using the average score in multiple choice examination questions). Arbaugh (2010a), however, following a review of the literature on the characteristics of students studying online in both undergraduate and postgraduate management education programmes, suggests that while cognitive and demographic characteristics of students play a large role in online course effectiveness at the undergraduate level, behavioural characteristics (course participation) determine effectiveness more at the graduate level.

2.7.3 Age

There is some contradiction in the literature on the influence of age on academic success, with differences in age effects reported between discipline of study and level of programme. Cassidy (2012) cites a number of researchers, including Bourner and Hamed (1987) who suggest that, academically, younger students perform better than older students in undergraduate study of science and engineering-related subjects. Conversely, Sheard (2009) and Naderi *et al (2009b)* noted that, at undergraduate level, older students perform better in GPA. In MBA study, however, Peiperl and Trevelyan (1997) reported a negative correlation between age and MBA performance (average grade), with younger students performing better than older ones. Other studies report no relationship between age and MBA performance (Graham, 1991; Paolillo, 1982; Sulaiman & Mohezar, 2006). One explanation for age-based differences in performance outcome is that younger students have more recent experience of the academic environment and are therefore better placed to deal with the challenges of

graduate study (Peiperl & Trevelyan, 1997). For students studying online, Alstete and Beutell (2004) found no significant relationship between age and MBA academic grade while controlling for other predictor variables, specifically discussion board participation, discussion thread initiation and individual assignment scores.

2.7.4 Gender

The influence of gender on academic performance has also been tested by a number of different researchers. In traditional classroom taught MBA study, several researchers have found no correlation between gender and performance outcome (Ekpenyong, 2000; Hancock, 1999; Peiperl & Trevelyan, 1997). However, there is some evidence in other studies that in distance learning women may outperform men academically (Cheung & Kan, 2002; Price, 2006). Cheung and Kan's research (2002) may not, however, be representative of the experience in the West as the research sample comprised students studying through a distance learning programme in Hong Kong. Taking a more Western perspective there is evidence that, in terms of online graduate management education, females participate more in Internet-based class discussions than in the classroom (Arbaugh, 2000b; 2000c). Alstete and Beutell (2004) found that in MBA study women participated more in discussion boards and initiated more discussion threads than men but, in multiple regression analysis, gender was not significantly related to final course grade. More recent research is not, however, conclusive (Arbaugh, 2005; Lu, Yu & Liu, 2003; Arbaugh & Rau, 2007; Marks, Sibley & Arbaugh, 2005). As far as the executive MBA is concerned, according to Gropper (2007, p.210) there is evidence that gender is a significant factor in academic success (grade point average), and females outperform males, but this study (n=180) was heavily weighted towards male students (80% of the sample); only a small sample of females (36) were included.

2.7.5 Work Experience

For many business schools work experience is a pre-requisite for entry onto an MBA programme. Previous research on the relationship between work experience and academic performance on the MBA is not conclusive. In terms of classroom taught students, several researchers have found work experience to be positively related to academic success (McClure, Wells & Bowerman, 1986; Adams & Hancock, 2000). A study by Sulaiman and Mohezar (2006) which involved an analysis of 489 records of class taught students at the University of Malaysia revealed no relationship between

work experience and academic success (cumulative grade point average). This finding is supported by a number of other researchers (Graham, 1991; Dreher & Ryan, 2000; Dreher & Ryan, 2002; Dreher & Ryan, 2004; Peiperl & Trevelyan, 1997).

In terms of the executive MBA (EMBA) programme, however, work experience, in particular career achievement (students who had achieved a status of division manager or higher), has been shown to have a significant positive effect on performance outcome (grade point average) (Gropper, 2007). In Gropper's study (2007), the number of years of full-time work experience prior to entering the EMBA programme was not significant. None of the studies reviewed considered the influence of work experience on academic achievement in the context of online postgraduate management education programmes.

2.7.6 Relevant Academic Background

Among class taught students Sulaiman and Mohezar (Sulaiman & Mohezar, 2006) found that the relevance of an MBA student's earlier academic experience has a positive effect on the subsequent academic performance (grade point average) of classroom taught students in that subject, i.e. students with a background in business and management perform better in the MBA than students who lack such experience. Not all researchers agree and have reported that class taught MBA students with an undergraduate background in areas other than in business were likely to perform better academically than MBA students with a prior degree in business (Adams & Hancock, 2000; Gump, 2003). By way of explanation, Gump suggested that the students with no prior degree in business may work harder to compensate for their lack of undergraduate preparation.

Christensen, Nance and White (2011) found that class taught students who had not completed a set of undergraduate pre-requisite courses (in marketing, management, accounting, economics, finance and statistics) performed at the same level, or higher, in a traditional classroom taught MBA programme than students who did complete the set of pre-requisite courses. This study considered these relationships in terms of their impact on the final MBA grade point average. Some undergraduate pre-requisite courses proved to more helpful than others: for example, marketing, economics, and business statistics were significant predictors of MBA grade point success, whereas accounting, management and finance were not. The literature reviewed is silent on the

influence of relevant academic background on learning in the context of online postgraduate management education.

2.7.7 English as First Language

Some researchers suggest that amongst traditional classroom taught students, there is no difference in examination outcomes between students for whom English is their first language compared to students who speak English as their second language (Ackers, 1997). Others disagree and have found that international students (for whom English is not their first language) do less well in MBA examination than students for whom English is their first language (De Vita, 2001; Smith, 2009; Peiperl & Trevelyan, 1997). A potential explanation for this difference is that students for whom English is their second language are disadvantaged under the pressure of time in an examination, and also that the quality of their outputs is lessened due to difficulties in expression and a slower pace of writing. Interactions have also been noted between English as first language and type of question in MBA examinations: students for whom English is their second language are less disadvantaged in multiple choice questions (Smith, 2009). Amongst the articles reviewed, no reference is made to the effects of English as first language on learning and performance outcomes in online post-graduate management education.

2.7.8 Student Learning Processes

The idea that students learn in different ways has been a 'prominent pedagogical issue' for over three decades (Hawk & Shah, 2007, p.1).

There are two main models of student learning processes, they are the Learning Styles (Kolb, 1984) model and the Approach to Learning model (Entwistle & Ramsden, 1983). The literature indicates that the Learning Styles model is most popular among researchers in the US and also management educators, whilst the Approach to Learning model has been used mainly by non-management educators in the UK and Australia (Cuthbert, 2005).

Defining learning style is challenging because, in the literature, the terms 'learning style', 'cognitive style' and 'learning strategy' are sometimes used interchangeably and at other times each is considered a distinct definition (Cassidy, 2004).

According to Jonassen and Grabowski, cognitive styles refer to how individuals typically acquire and process information and are derived from cognitive controls and mental abilities (1993). For Jonassen and Grabowski, cognitive controls 'represent patterns of thinking that control the ways that individuals process and reason about information (1993, p.83) and learning styles in effect: 'are applied cognitive styles, removed one more level from pure processing ability' (1993, p.234). The emphasis in cognitive/ learning styles is on 'person bound' differences that influence the way in which individuals learn (Evans & Vermunt, 2013, p.185).

In their review of the literature, Riding and Sadler-Smith (1997) find that there are two important and independent dimensions to describe cognitive style: the Wholistic-Analytic dimension; and the Verbal-Image dimension. These two dimensions are argued to encompass related constructs such as Pask's serialist and holist cognitive strategies (1976b) and Allinson and Hayes intuitive-analytic cognitive styles (1996)

Riding and Cheema (1991) consider that cognitive style is likely to be a significant component of learning style. Cassidy (2004) refers to definitions by Hartley (1998) whereby: cognitive style is considered to be the way in which individuals characteristically approach different cognitive tasks; learning style is the way in which an individual characteristically approaches various learning tasks; and learning strategy relates to the strategy an individual adopts when studying. According to Hartley: '…different strategies can be selected by learners to deal with different tasks. Learning styles might be more automatic than learning strategies which are optional.' (1998, p.149). Cassidy (2004) notes that the distinction drawn between style and strategy is an issue of continuing debate among researchers.

A range of different and sometimes conflicting assumptions about learning lie behind different learning styles models. The traditional way of way of looking at learning styles is one which sees learning style as essentially a fixed individual characteristic and therefore it is important to match teaching style to learning style (Dunn & Dunn, 1999; Dunn & Griggs, 2000). An alternative perspective on learning style is one which sees learning as a social construction (Kolb, 1984; Kolb & Hay, 1999) whereby learning style, whilst part of an individual's identity, is 'flexibly stable', developing as a result of hereditary factors as well as previous experience and the demands of the environment (Pheiffer, Holley & Andrew, 2005).

The learning styles field is complex and there is not a common theoretical framework. As far as Kolb (1984) is concerned, individual learning can be conceptualised as a cyclical process involving four stages of learning starting with concrete experience, through to reflective observation, abstract conceptualisation and active experimentation. Behind this cycle are two dimensions which Kolb considers important for learning to take place: *grasping* which refers to the way in which information is acquired i.e. whether there is a preference for concrete experimentation or abstract conceptualisation, and *transformation* which refers to the ways individuals handle the information i.e. whether there is a preference for active experimentation or reflective observation. According to Kolb (1984) individuals do not use all of the activities equally but instead tend to have a preference for particular activities. Four learning style preferences were identified: activist, reflector, theorist and pragmatist.

In essence, some students are comfortable with theories and abstractions; others feel much more at home with facts and observable phenomena; some prefer active learning and others lean toward introspection; some prefer visual presentation of information and others prefer verbal explanations (Felder & Brent, 2005). Visual learners prefer written material, diagrams or charts. Auditory learners favour spoken communication, such as the use of stories and examples. Kinaesthetic learners need to engage in an activity or a hands-on approach to enhance learning (Kovach, 2009).

Critics of learning styles highlight the definitional issues discussed above. The critics who favour a qualitative research approach, in particular, question whether it is possible to objectively test learning style (Coffield *et al.*, 2004b; 2003) and whether catering to students' learning preferences leads to better learning (Riener & Willingham, 2010). There is also much debate in the literature in relation to the validity and reliability of learning styles models (Coffield *et al.*, 2004a; Cassidy, 2004; Pashler *et al.*, 2008)

The Approach to Learning model stems from the work of Marton and Säljö (1976) who studied how students perceived a particular reading task and then what they did in terms of learning. They discovered that students used different strategies: some took a surface approach to the task, remembering disjointed facts without fully comprehending the meaning of the text, while others used a 'deep' approach and sought to understand the main ideas expressed in the text (Marton & Säljö, 1976). Entwistle and Ramsden (1983) subsequently developed the model to incorporate a further dimension, a strategic

approach to learning, whereby the intention is to maximise grades. Like learning style, approach to learning was found to be significantly related to personality and not to be generally related to ability (Entwistle, 2001). The learning context was found to be influential in students approach to learning (Entwistle & Tait, 1990; Laurillard, 1997).

A student's approach to learning is not considered to be a stable characteristic, but is instead determined by the student's perception of the learning task and context (Laurillard, 1997; Price, 2004). It is thought possible to change student intentions and achievement by manipulating the task and learning context (Prosser & Trigwell, 1999; Entwistle, 2001; Reynolds, 1997). A point of concern with regard to the Approach to Learning model is that while a student may have a habitual approach, actual study practices are situation specific. Zhang found subject-based variation in the usefulness of approach to learning in predicting academic achievement (2000). Tickle also points out that, where an approach to learning is identified, no insight is given on how competent the student is in this approach, for example, a student with a high orientation to deep learning, but who is not competent in its use, may actually not perform as well as a student who is very competent in the surface approach (2001).

There is also mixed evidence in the literature in terms of the relationship between the student approach to learning and academic success. Whilst there is some evidence that both deep and strategic approaches are associated with academic success (Cassidy & Eachus, 2000; Duff, 2004; Diseth, 2002; Diseth *et al.*, 2006), the relationship is not clear-cut. Cassidy (2012) found no association between the surface approach to learning and academic achievement. Diseth (2002) found that the relationship between the surface approach to learning and academic success is curvilinear, and Richardson found that, whereas the strategic and surface approaches were correlated with academic achievement, the deep approach was not (Richardson & Woodley, 2003). Duff et al (2004) found a positive correlation between both deep and strategic approaches to learning and academic achievement, but a negative correlation between a surface approach and academic achievement. In this study, however, correlation coefficients were so small that they failed to reach significance and regression analysis revealed that approach to learning was a poor predictor of academic achievement. Diseth et al (2006) also found that approaches to learning were not significant in predicting academic achievement.

The Learning Styles School and the Approaches to Learning School provide, therefore, different perspectives on the student learning process. The student approach to learning focuses on the different strategies taken by individual students to learning a particular task; they do not describe the characteristics of the student (Biggs & Tang, 2011). Learning styles relate to the individual student and are 'characteristic preferences for alternative ways of taking in and processing information' (Litzinger *et al.*, 2007, p.309).

In this study the focus is on learning style i.e. student preferences for alternative ways of taking in and processing information. As such, learning style is considered an independent student characteristic. The validity of learning styles as an information processing construct is based on the premise that individuals are aware of how they prefer to process information and that they can accurately report their own perceptions.

Significant differences in learning style preferences have been found between students taught online and students taught face-to-face in a classroom (Aragon, Johnson & Shaik, 2002). Online students were found to have a higher preference for abstract conceptualisation (learning by thinking) and to be more reflective (learning by watching) compared to students taught face-to-face in a classroom. Significant differences were also found in terms of the active-experimentation scale (learning by doing), face-to-face taught students having a greater use of this learning mode. Aragon *et al* noted that these cognitive processes are highlighted by the 'anytime, anyplace and, most important, any pace nature of the online environment' (2002, p.242). In this study, however, the sample size of both groups of students (those taught online and those taught face-to-face) was very small (n = 19 in each group) so the findings can only be considered indicative.

The literature suggests that students studying online are predominantly visual learners (Russell, 1999) and prefer a more abstract way of thinking than students who choose to study in a traditional classroom context (Grasha & Yangarber-Hicks, 1999; Terrell, 2002).

In business studies at undergraduate level, Njoroge, Senteza and Suh (2006), citing the work, *inter alia,* of Filbeck and Smith (1996), Biberman and Buchanan (2002), Loo (2002) and Holley and Jenkins (1993) suggest that, for classroom taught students, differences in learning styles may affect choice of student major, exam performance in

particular subjects, and exam performance by question type. In a study which surveyed 764 undergraduate class-taught business students, using structural equation modelling, Strang (2009a) found there to be a significant relationship between learning style and course grade. Using Felder & Solomon's Index of Learning Styles (ILS) model, he found that all of their learning style dimensions (and also all of Hofstede's global culture model indices), were significant in predicting course grade. In terms of learning style, the standardised regression coefficients reveal that the visual-verbal learning style and the active-reflective learning style dimensions had most impact on course grade: students with more visual learning styles performed better academically (the unstandardized coefficient was 0.18 ($P \leq 0.01$); $\beta = 0.16$) and students with more active learning styles also performed better academically (the unstandardized coefficient -0.11 ($P \leq 0.05$) $\beta = -0.16$). The full generalized least squares regression model recorded an R^2 of 0.87. In terms of culture the Uncertainty Avoidance Index (UAI) and Individualism Collectivism Index (ICI) were the dominant factors. Strang's model found that students from risk taking cultures performed better academically (the unstandardized regression coefficient was -0.31 ($P \leq 0.001$), $\beta = -0.62$), as did students from collectivist cultures (the unstandardised regression coefficient was -0.41 ($P \leq 0.05$) $\beta = -0.61$). Strang does not specify exactly which subject in the undergraduate degree programme formed the focus of the research and, although the study was based on multicultural and domestic students enrolled at an Australian university, the sample was heavily skewed towards Asian students.

A point of discussion in relation to learning styles is the 'matching hypothesis' which means instructional style and student learning style should be similar (Coffield *et al.*, 2004a). Zapalski and Brozik (2006, p.326) note that institutions that know about differences in learning style are better able to modify their teaching strategies and techniques in online education in order to ensure their "methods, materials and resources fit the ways in which their students learn and to create a learning environment that will maximise the learning potential of each student". Mismatches between teaching style and the learning style of the student may lead to negative outcomes for students, including lower grades, changes in aspirations, and feelings of inadequacy (Davis & Bostrom, 1993; Fleming, 2006). These in turn may result in lower graduation rates, lower student retention and lengthen study time to graduation (Felder & Silverman, 1988; Felder, 1993). In their research, however, Smith and Townsend (2002) found that for every research study supporting the matching hypothesis, there is another

which rejects it. Indeed, according to Zhang et al (2013) and Evans and Waring (2012) some students welcome style mismatch, but others do not.

There is limited research on the effect of learning style on learning outcome in online graduate management education (Arbaugh, 2010a). In his review of studies in this field, Arbaugh (2010a, p.131) concludes that learning style is not a predictor of course outcomes. However, of the three studies cited by Arbaugh, one considers learning outcomes only in terms of student satisfaction and perceived learning (Marks, Sibley & Arbaugh, 2005); the second draws on two studies which examine students evaluations of learning (Drago *et al.*, 2005); and the third (Lu, Yu & Liu, 2003, p.504) finds no relationship between learning styles and learning performance based on an achievement test and student satisfaction measures. However, the sample of MBA students is very small (n=76) and the focus of the research is a course in Management Information Systems which may not be representative. At undergraduate level, it has been found that learning style is more important in e-learning than in traditional instruction (classroom) based learning. Using the Kolb Learning Style Inventory (LSI) (Kolb, 1985) in a small study (n=94) conducted among undergraduate students studying a course (not specified) by e-learning, Manochehr (2006) found a positive relationship between students with Kolb's Assimilator learning style (which combines abstract conceptualisation and reflective observation i.e. learn best through thinking and watching) and students with Kolb's Converger learning style (which combines abstract conceptualisation and active experimentation i.e. learn best through thinking and doing) and exam performance. Manochehr found no such relationship amongst students taught the same course in the traditional class taught environment.

One of the aims of this research project is to contribute to the knowledge on the relationship between learning styles, the student learning experience, and academic achievement (exam performance) in online graduate management education.

Learning Style Models
No single commonly accepted model to measure learning style exists. Several scales and classifications are in use but the lack of a conceptual framework is a key point of criticism in this area. In fact, there are more than 70 models with conflicting assumptions and competing ideas about learning and the models are quite intricate and comprise different layers or levels of information processing.

A continuum of learning style theories exists. At one end of the continuum are what are referred to as the 'fixed trait' theories whereby students are seen to be essentially fixed in their learning style and practitioners need to create individual learning prescriptions for students according to their preferred style of learning (Means *et al.*, 2009). At the other end of the continuum are the 'fluid trait' theories which conceptualise students as changing their learning style over time and which may depend on learning tasks and contexts. Here practitioners do not focus on matching pedagogy to learning style, but instead focus on increasing teacher and student understanding of their learning processes with a view to developing more independent, balanced learners. The 'fixed trait' approach has come under severe criticism in recent times with little evidence to show that individualised instruction leads to significant gains in learning (Means *et al.*, 2009)

In the event that instruction is biased to one category or another on a learning style dimension, Felder and Brent (2005, p.62) caution that mismatched students may be too 'uncomfortable to learn effectively', and those students whose learning styles actually do match the teaching style will not be helped to develop 'critical skills' in their less preferred learning style categories. According to Felder and Brent (2005, p.62), a balanced approach, which sometime matches and sometimes goes against students preferences is considered optimal in order for students to 'stretch and grow' in directions they might otherwise seek to avoid if given the choice. Strang (2009a) considers internationally suitable and proven learning style theories to include: the Learning Style Inventory (Kolb, 2005) and the Index of Learning Styles model (Felder & Soloman, 2001; Felder & Silverman, 1988).

The learning styles model developed by David Kolb (Kolb, 1984) is based on experiential learning, and views learning as a process, defined by a four-stage learning cycle. Kolb's work draws on the work of a number of important 20th century scholars - such as John Dewey, Kurt Lewin, Jean Piaget, William James, Carl Young, Paulo Freire and Carl Rogers - who considered experience central to their theories of human learning and development.

In Kolb's model, learning is thought to involve four activities – feeling, reflecting, thinking, and doing – and these were viewed as leading to two basic components of learning: how people form their ideas (whether through concrete experience or abstract

conceptualisation), and how they process these ideas further (through active experimentation or reflective observation).The model measures individuals' information-perception orientations on how they form their ideas and their information-processing orientations on how they process their ideas, resulting in four types of learning styles: Diverging, Assimilating, Converging and Accommodating.

Diverging learners prefer to make more use of concrete experience and reflective observation; Assimilating types prefer to learn through reflective observation and abstract conceptualization; Converging types rely on abstract conceptualization and active experimentation; and Accommodating types use active experimentation and concrete experience (Joy & Kolb, 2008). Kolb's Learning Styles Inventory provides a framework for examining an individual's learning preferences. The instrument is based on a self-scoring 12-item questionnaire.

Whilst a popular model for categorising learning styles, the Kolb model has been criticised on a number of different aspects. It is suggested in the literature that there are problems with the instrument, specifically it has been criticised because it brings together unrelated elements of cognitive process, cognitive style and cognitive level and that the experiential model on which the instrument is built is "unrelated to style but rather is a "map" of the learning process" (Sadler-Smith, 2001). Honey and Mumford (1982) expressed dissatisfaction with Kolb's learning cycle model in relation to poor face validity and questionable predictive accuracy. Other specific problems include its focus on experiential learning, which is not the only way people learn (Jarvis, 1987), and also the emphasis placed on the basic personality of the individual, rather than potential cultural variations (Manikutty, Anuradha & Hansen, 2007).

Honey & Mumford accepted Kolb's learning cycle model, but questioned the effectiveness of the Inventory itself (poor face validity and questionable predictive accuracy) (De Vita, 2001), and developed an alternative instrument, the Learning Style Questionnaire (LSQ) which focused on observable behaviour and proposed four types of learner: activists (better equipped to learn from experience), reflectors (better equipped for reflective observation), theorists (who learn best from exploring associations) and pragmatists (who learn best from doing or trying things that yield practical advantage). According to Honey & Mumford (Honey & Mumford, 1982), predisposition to a particular learning style is an individual rather than a collective trait

and the closer the match among preferred learning styles and the teaching methods applied, the more likely one is to learn

The Honey & Mumford LSQ focuses on how managers learn and has been widely used in management training and development. Work conducted by Sadler-Smith (Sadler-Smith, 2001), however, questioned the four-factor structure of the LSQ and raised concerns about its applicability to students in general, and business students in particular (De Vita, 2001).

The Felder & Silverman Index of Learning Style model (ILS) is a learning style model which, whilst designed for traditional learning, is often used in technology-enhanced learning (Graf *et al.*, 2007). This model identifies four distinct categories of learner: active-reflective, sensing-intuitive, visual-verbal, and sequential-global (Felder & Brent, 2005). The Index of Learning Styles (ILS) is a 44-item forced-choice instrument (see Appendix F Felder & Solomon Index of Learning Styles Questionnaire) developed in 1991 by Richard Felder and Barbara Soloman to assess preferences on four of the learning style dimensions in the Felder and Silverman model which are each tested using 11 questions (the inductive-deductive dimension is not assessed). Some of the underlying theories behind scale development are drawn from the Myers-Briggs Type Indicators and Kolb's model. A student's learning style is defined by the answers to the 44 questions (Felder & Brent, 2005) which relate to the ways they receive and process information:

1. Perceive: Sensing learners tend to be concrete, practical, methodical, and oriented toward facts and hands-on procedures. Sensing learners like to relate learned material to the real world. Intuitive learners, by contrast, are more comfortable with abstractions (theories, mathematical models) and are more likely to be rapid and innovative problem solvers .

2. Input : Visual learners prefer to learn from what they have seen (pictures, diagrams, flow charts, demonstrations), whereas verbal learners prefer textual representations, regardless of whether they are written or spoken.

3. Process: Actively process (through engagement in physical activity or discussion) or reflectively (through introspection). Active learners learn best by working actively with the learning material, by applying the material, and by trying things out. Active learners also tend to be more interested in communication with others and prefer to work in groups to discuss learned

material. By contrast reflective learners prefer to think about the learning material and work alone, or in a small group (Graf *et al.*, 2007).

4. Understanding: Does progress toward understanding proceed sequentially (in a linear thinking process) or globally (learn holistically in large 'big picture' jumps)? Sequential learners learn in small incremental steps, and tend to think in a linear manner. They are able to function with only partial understanding of material they have been taught. Global learners use a more holistic approach and think in a systems-oriented manner. They may have trouble applying new material until they fully understand it and see how it relates to material they already know about and understand. Once they grasp the big picture, however, their holistic perspective enables them to see innovative solutions to problems that sequential learners might take much longer to reach, if they get there at all.

Compared to most other learning style models, the ILS describes the learning process in greater detail, and distinguishes learner preferences using scores across four learning style dimensions relating to the way they process information Another main difference is that the ILS examines tendencies, acknowledging that learners with a high preference for certain behaviours can also sometimes act differently. The ILS describes the learning style of a learner in more detail than most of the other learning style models which tend to classify learners into a few groups (Graf *et al.*, 2007).

ILS is often used in research which considers learning styles in the context of advanced technologies. Kuljis and Liu (2005), based on a comparison of different learning style models, concluded that ILS is the most appropriate model in the context of e-learning applications and in Web-based learning systems. Furthermore the ILS is considered simpler to understand for multicultural students for whom English is not their first language (Christensen, Nance & White, 2011; Strang, 2009a). It is important to note that the ILS provides an insight on a student's tendencies or habits which may impact on academic performance**;** learning style itself is not an indicator of what a student is capable of achieving. Indeed Felder and Spurlin (2005, p.111) state the ILS "is used to help instructors achieve balanced course instruction and to help students understand their learning strengths and areas for improvement". In terms of Coffield's continuum of learning styles, ILS is categorised within the group of learning styles models which see learning style as a 'flexibly stable learning preference' (2004b; p.21).

By way of criticism, it is noted that the categories considered in the ILS are not comprehensive, although it is unrealistic to expect that any instrument can fully capture the totality of individual differences in how students receive and process information (Felder & Henriques, 1995). Also, the dimensions have been shown not to be fully independent (there is a correlation between the sensing-intuitive and sequential-global scales (Felder & Spurlin, 2005). Nevertheless, these items do not limit the usefulness of the model in revealing the distribution of learning styles in a student group to facilitate the development of more balanced methods of instruction.

2.7.9 Culture

In defining culture there is more or less agreement that culture can be conceptualised as: "shared motives, values, beliefs, identities and interpretations of meanings of significant events that result from common experiences of members of collectives that are transmitted across generations" (House *et al.*, 2004, p.15). Culture influences the way we perceive, organise and process information (Samovar *et al.*, 1981) and is perceived to be "inseparable from distance learning and teaching" (Uzuner, 2009, p.15). Many educators in the twenty first century are finding that cultural differences among students have a significant impact on the learning process (Joy & Kolb, 2009). Joy & Kolb cite a number of researchers, including: Barmeyer, Hayes & Alinson (1988) who believe culture acts as a strong socialisation agent; Earley & Ang (2003) who state that culture influences information processing and cognition; and Reynold (1997) who stated that differences in cultural socialisation are thought to influence learning preferences and produce different learning styles.

In his study of 764 undergraduate class-taught business students, and using structural equation modelling, Strang (2009a, p.288) found there to be a significant relationship between culture and course grade, and the better performing students were those who, according to Hofstede's indices, had 'collectivist and risk-taking cultural dispositions'. Of course the results of this research should be considered with considerable caution given the use of the Hofstede Index to operationalize culture (which raises issues in relation to the ecological fallacy (see below - *Approaches to operationalizing culture*) which means that a single culture measure would apply to all students from a specific country which is invalid. Furthermore the survey was based on a sample of students

which was heavily skewed to students of Asian nationality embarked on undergraduate business studies (see p.46 for further details of the study).

In the context of her work looking at the relationship between learning styles preferences and culture in classroom based higher education, Charlesworth (2008) examined the work of researchers who have focussed on the importance of social and contextual influences on learning. She cites Lave, 1997; Lave and Wenger, 1991; and Rogoff, 1990 and notes their references to situated learning or situated cognition. Lattuca (2002, p.712) highlighted the views of theorists from various fields who have begun to think that "learning cannot be separated from the context in which it occurs" and who cast learning as a process that is "both cognitive and social".

According to Sulkowski (2009, p.514), international students admitted into taught programmes in UK higher education institutions have grown up in 'significantly different educational and value systems' and the particular challenges they face in traditional class-room based teaching include: language problems; a mismatch between teaching and preferred learning styles; unsuitable assessment methods; differing views about the interaction between lecturers and students and among peers; and cultural distance.

Approaches to operationalizing culture

Lenartowicz and Roth (1999) provide a comprehensive perspective of approaches taken in the literature to operationalizing culture using the following typology: Ethnological description; Use of proxies – Regional Affiliation; and Direct Values Inference (DVI) and Indirect Values Inference (IVI).

Ethnological description relates to "qualitative approaches, typically sociological, psychological and/or anthropological used as bases for identifying and/or comparing cultures" (Lenartowicz & Roth, 1999). It provides a descriptive approach to appraise cultures and an example given is of Hall's classification of high- and low- context cultures which distinguishes cultures on the way messages are communicated, either explicitly or in the context (Hall, 1976). Ethnological description of culture is considered to have its limitations as it allows the classifications of cultures along only one dimension.

Regional affiliation relates to the defining of culture based on characteristics that reflect or resemble culture, for example nationality or place of birth. This approach is common in business applications (Steenkamp, Hofstede & Wedel, 1999; Lenartowicz & Roth, 1999). Both Hofstede (1980) and Steenkamp (2001) are supportive of the approach. According to Steenkamp (2001), there is empirical support that culture can be validly conceptualised at the national level if there is some meaningful degree of within-country commonality and between-country differences in culture. Hofstede (1991) sees that nations are the origin of a great deal of mental programming and that this is due to, *inter alia*, a relatively similar history, language, political, legal and educational environment.

Direct values inference (DVI) measures the values of subjects in a sample to infer cultural characteristics based on aggregation of these values (Lenartowicz & Roth, 1999). This is the approach used by Hofstede (1980; 1991; 2001). Based on statistical analysis of a multi-country sample on work-related values, Hofstede proposed that cultures are comparable on five dimensions: individualism-collectivism; uncertainty avoidance; power distance; masculinity-femininity; and long-term orientation.

Indirect values inference/ benchmarks (IVI) ascribe characteristics of cultural grouping without directly measuring members of the group and the most noteworthy example is the use of Hofstede scores of national cultures (Hofstede, 1980). The main concern with this approach is the measurement error arising from imposition of a national cultural measure assessed by the benchmark survey to each individual of the sample being surveyed (Lenartowicz & Roth, 1999).

A key issue in cross-cultural research is that there are often two levels of theorising (individual and country) which have to be taken into consideration when analysing data and drawing conclusions (Grenness, 2012). For example Hofstede's research (1980) measures cultural values on a country level and so researchers who make causal inferences from such group data to individual behaviours make the ecological fallacy, meaning that they wrongly assume that relationships observed for groups hold at the individual level. Clearly this is not valid, in terms of culture, a student in Orkney is likely to be very different from a student in London or Swansea.

Relationship between culture and learning style
According to Edmundson (2007), learning styles are affected by culture, and this should therefore be taken into account in the process of instructional design. Shade (1989)

believes distinctive learning style emerges among people sharing a common historical and geographical setting because they must collectively adapt to a unique set of environmental demands. Characteristic learning-style of a nation/ culture is also thought to be institutionalised and reinforced through its child rearing practices and education systems (Rodrigues, 2004).

De Vita (2001, p.167) notes that "A simple process of logical analysis applied to the semantics of the terms 'culture' and 'learning style' leaves little room for doubt on the existence of cultural influences in the development of individual learning preferences". Citing various scholars (Samovar et al, 1981; Terpstra and David, 1985; and Triandlis, 1964), De Vita (2001, p.167) explains that this is because culture influences the way we perceive, organise and process information, the way in which we communicate, interact with others and solve problems, and the way we form 'mental categories' and retrieve them in order to create patterns which allow us to generate new knowledge by means of previously acquired knowledge. De Vita (2001, p.167) concludes that this must, by definition, affect "the preferences students have for thinking, relating to others, and particular types of classroom environments and experiences" and points to the fact that this is how Grasha and Yangarber-Hicks (1999) defined learning styles with reference to student learning.

Researchers have paid little attention to the investigation of cultural influences on the development of individual learning style preferences, and how this information can be used to develop teaching approaches which provide a more inclusive approach to instruction (Kopf, 2007). De Vita (2001, p.172) states that: "even rarer in the literature is the exploration of the implications that cultural influences on learning style preferences have for the instructional approaches to be adopted by teachers and management educators who are confronted with culturally heterogeneous groups of learners". Furthermore, according to Strang (2010) there are few interdisciplinary studies which consider the impact of culture and learning style on academic outcome in higher education.

The fact that there is no common theory or framework in terms of classifying models of learning style, and categorising the intangible qualities of culture makes it difficult to explore the relationship between the two. Studies which have attempted to do so in the context of business education include De Vita (2001) who used the Index of Learning

Styles (ILS) (Felder, 1999). In De Vita's small study (n=63), which was based on an undergraduate international business management class in a UK university (class taught environment), culture was categorised only in terms of whether the student was a UK national or an international student. Even so, De Vita's research findings revealed that "greater variation of learning style preferences exists within the international student sample" (De Vita, 2001, p.168). According to De Vita (2001), this suggests that variations in learning preferences are likely to co-exist in culturally heterogeneous cohorts of students. De Vita's research is based on a very small sample of students and so it cannot be determined with confidence whether wider variation in learning style is present in culturally heterogeneous groups of students. The same is true of a second finding from De Vita's study and that is that both learning style and culture affected learning outcome.

This finding is, however, supported by Strang (2009a) who, using the Hofstede model of global culture and Felder & Solomon's ILS, and produced a statistically significant model containing eight factors which together accounted for 87% of variation in average grade. As noted earlier, better performing students were those with collectivist and risk-taking cultural dispositions, and as far as learning style is concerned better grades were noted among those students who had visual input and active processing learning approaches *(Section 2.7.8.)*. Recall also that Strang's study was based on students enrolled on a traditional undergraduate business degree programme in an Australian university (not studying online). Furthermore, whilst 21 countries were represented in the sample (n=764), the sample was skewed with over half of the sample (51%) from just three countries i.e. the Philippines, India and Singapore (Strang, 2009a, p.283). Another important concern in relation to Strang's research is its reliance on Hofstede's measures of cultural values which, of course, introduce difficulties associated with the ecological fallacy i.e. imposing a national culture measurement upon each member of the sample. That said, according to Strang's model 87% of the variation in academic grade is accounted for by eight factors, four of which represent cultural backgrounds, and four factors measure learning style (ILS). According to Strang all eight of the factors are statistically significant in predicting learning outcome (average grade). However, the model is dominated by two cultural factors (Hofstede' Uncertainty Avoidance Index (UAI) and Individualism-Collectivism Index (ICI)) and two learning style dimensions (the ILS visual-verbal learning style dimension and active-reflective learning style dimension).

Commenting on De Vita's work, Church (2001) notes that since culture is thought to influence perceptual, organizational, processing, and communication styles and because these processes are the core elements in learning style theory it follows that culture and learning style share a relationship that cannot be overlooked by researchers. Jaju, Kwak and Zinkhan (2002) investigated learning style in a study conducted among traditional class taught undergraduate business students (n=623) in three cultures – USA, India and South Korea –and found that the three cultures differed significantly on each of Hofstede's (2001) dimensions and that there was a relationship between culture and learning style (as measured by Kolb's experiential learning model). Specifically Jaju, Kwak and Zinkhan (2002) found that students from the US prefer reflective observation and concrete experience, students from India prefer active experimentation and abstract conceptualisation, and student in Korea prefer reflective observation and abstract conceptualisation. Another research study, conducted amongst class taught students, has found differences in learning style related to culture on the active-reflective scale: students from South East Asia preferred a more reflective approach compared to European students (Charlesworth, 2008). Rajshekhar and Joseph (2007) found that, relation to classroom taught students, the likelihood of learning increased according to the closeness of match between the students' learning style and the teaching methods applied. They conclude that: "Simply stated, school administrators should not expect that students in different countries will benefit equally from standardised education tools." (Rajshekhar & Joseph, 2007, p.377).

In a review examining 27 studies of past research on questions of culture in distance learning, Uzuner (2009, p.15) concludes that notable amongst these studies is "an emphasis on the idea that culture is inseparable from distance learning and teaching", and that the cultural issues faced in the distance learning environment reflect those faced in the traditional classroom. Uzuner (2009, p.15) concludes that there is a need to recognise the diversity within online communities of learners and that there is "broad agreement that online instructors should be sensitive to cultural issues, become aware of variations in students' learning strategies and avoid the 'one size fits all' approach when viewing the process of learning".

It should be noted, however, that many of the studies reviewed by Uzuner (2009) lacked a strong theoretical underpinning and detail on research methodology, verification processes and explanations of how triangulation was achieved. It is wise, therefore, to

consider these findings as only indicative of the potential diversity in the distance learning experience among various cultural groups.

2.7.10 Behavioural Differences

It is thought that behavioural characteristics of students play an important role in online course effectiveness (as measured by perceived student learning and satisfaction with the course delivery medium) in post-graduate programmes (Arbaugh & Rau, 2007). In terms of behaviour, participant interaction has been found to be important in online MBA courses (Arbaugh, 2005; Arbaugh & Rau, 2007; Benbunan-Fich & Arbaugh, 2006). The level of student-student interaction and instructor-student interaction are considered to be of consequence in MBA courses (Arbaugh & Rau, 2007; Marks, Sibley & Arbaugh, 2005), and to have a positive effect on learning outcomes (Marks, Sibley & Arbaugh, 2005; Arbaugh & Rau, 2007; Peltier, Schibrowsky & Drago, 2007). Modern constructivist and connectivist theorists place emphasis on student to student interaction in investigating and developing multiple perspectives (Anderson, 2008).

Instructor involvement is referred to as 'presence' in the literature (Garrison & Vaughan, 2008) and in the Community of Inquiry framework (Garrison, Anderson & Archer, 2001) (see Fig.2.1.) there are three components: social presence (created through a welcoming and supportive environment); cognitive presence (whereby meaning is constructed through sustained communication); and teaching presence (structuring and facilitating discourse and critical thinking), which each endeavour to increase the sense of community and connection which exists between instructors and students (Ladyshewsky & Soontiens, 2013).

Arbaugh (2000a) suggests that lack of face-to-face interaction makes it difficult for students to develop social ties and exchange information. However, not all researchers agree that student-student interaction is important. Kellog & Smith (2009), for example, find that working adult students present a different picture; for them student-student interactivities are not well valued due to time inefficiency, interaction dysfunction, and intrusion on flexibility. According to Marks, Sibley and Arbaugh (2005) instructor-student interaction is twice as important as student-student interaction in terms of learning outcomes, measured by perceived learning and student. It should be noted that in all of these studies learning outcomes are considered in terms of student perceptions

of learning and perceived satisfaction with the course, not actual examination grade, which is the key parameter.

Interestingly, in a study comparing students taught in a traditional classroom setting with students studying the same undergraduate course (Principles of Management) online (N=200, about half chose each context option), Nemanich, Banks and Vera (2009) found that student ability (measured using SAT scores) is a significant predictor of performance (measured by exam performance) but only for students studying online. By way of explanation they note that: "the limited feedback and lack of interaction with instructors and fellow students results in learning performance that is more closely linked to individual abilities than in the classroom, where students with lower ability can ask clarifying questions to the instructor and self-correct misunderstandings of their readings by listening to group discussions". Nemanich, Banks and Vera (2009, p.131) sum up that online students "are more dependent upon their own abilities".

In the online environment students have the flexibility and convenience of studying at their own pace. However, by comparison classroom based learning provides the opportunity for much more two-way communication between teacher and student (Kock, Verville & Garza, 2007; Marks, Sibley & Arbaugh, 2005). Kock, Verville and Garza (2007) found that the face-to-face aspect of classroom based learning provides students with nonverbal cues that decrease the level of ambiguity and cognitive effort required by students resulting in a more enjoyable student experience and enhanced understanding. Student enjoyment is an integral component of classroom motivation (Cybinski & Selvanathan, 2005) and according to Nemanich, Banks and Vera (2009, p.130) "increased interest and effort resulting from greater enjoyment of a course promotes stronger learning performance".

Also of importance in considering individual difference in learning is the concept of self-efficacy (Greener, 2010). According to Bandura's theory of self-efficacy (1977), the extent to which an individual student believes they will be able to achieve a certain designated level of performance has an influence over the outcome. Self-efficacy beliefs can determine how people feel and think about the task, how they motivate themselves, and how they behave. According to Coffin (1999), such beliefs may lead to student motivation problems in online learning.

2.8 Analytical Frameworks

Whilst there is no single model to explain how e-learning functions (Oliver & Conole, 2003), considerable student learning research has been directed towards identifying the relationships between variables and developing integrated learning models (Vermunt & Vermetten, 2004; Biggs, 1993c; Entwistle & McCune, 2004; Price & Richardson, 2004; Price, 2011). There remains, however, among both researchers and practitioners, a 'lack of holistic definition and understanding of what impinges upon investigating student learning.'(Price, 2014, p.57).

A holistic perspective means that an appreciation is required not just of the student, but also the wider context of learning. As pointed out by Entwistle and Waterston (1988, p.264):

> 'there is a danger of focusing too narrowly on the study processes of students as if that studying took place in a vacuum. In fact the learning environment has profound effects on studying'.

According to Schon (1987, p.3), education is 'a soft, slimy, swamp of real-life problems' leading Biggs (1993b) to suggest 'one's framework needs to be able to map the state of the swamp, and not just the anatomy of the alligators'.

Kirkwood and Price (2005, p.260) argue that: '…learning can be enhanced when innovations take into account not only the characteristics of the technology, but also the pedagogic design, the context within which learning takes place, student characteristics and their prior experience, and familiarity with the technologies involved'. Vermunt (2005) has also adopted a holistic stance, taking into consideration both the role of context and personal aspects, in investigations on student learning. According to Price, a holistic investigation should incorporate '…the complexities involved in the whole educational enterprise' (Price, 2014, p.58). She acknowledges, however, that there is a lack of certainty in relation to precisely which factors should be taken into account in developing a holistic model to improve student learning.

In building a holistic framework a useful starting point is Biggs (1993c). Biggs 3P model of learning and teaching adopts a systems based approach. Learning outcomes are viewed as being determined by a range of factors, including student-related factors, teaching-related factors, and the approach to learning that students use while engaging in any particular task to achieve an outcome. In his adaptation of Dunkin and Biddle's

(1974) presage-process-product model, Biggs illustrates how all the factors influence each other, forming an interactive system (Figure 2.5):

Presage   **Process**   **Product**
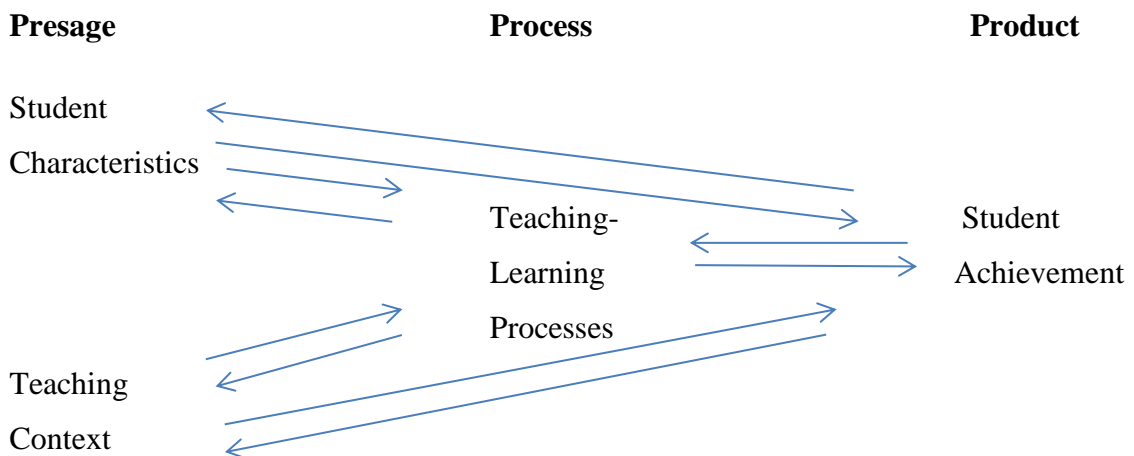
Figure 2.5. Presage, process and product in the classroom (Biggs, 1993c, p.448).

This version, referred to by Biggs (1993c) as the Classroom-based model, differs from the original Dunkin and Biddle model in two ways: first the focus is on student learning, not teaching; and second, all factors mutually affect each other. The Presage variables essentially incorporate factors in place before learning occurs. Conversely, Process refers to the activities associated with learning; and Product is the outcome of the learning which is "usually quantified" (Biggs, 1993c, p.449). The model shows that there are three potential sources of influence which might affect student achievement and they are: factors relating to the cohort of students and what they bring with them (Presage "Student Characteristics"); factors relating to what the teacher does (Presage "Teaching Context"); and the interaction between the two (the "Teaching and Learning Process").

Biggs (2012, p.43) advocates that this system has to be seen as a whole and that 'components have to be considered as they affect each other, not acting separately or additively'. Hamilton & Tee (2010, p.76), in their efforts to build a structural equation model to understand blended learning among tertiary education students, tested the two-way interactions between presage, process and product constructs. Their findings validate the 3P model as a dynamic interactive cognitive and behavioural learning system. Other researchers have examined Biggs 3P as a one-way "presage-to-process-product" (Young, Klemz & Murphy, 2003; Zhang, 2000) and it has also been extended to 4Ps "presage-perceptions-process-product" which will be discussed later (Price & Richardson, 2004; Price, 2011; Price, 2014). The factors which make up the interactive

system in Biggs 3P model are: the Presage 'Student Characteristic' variables which concern learner characteristics that may affect the learning process (including, demographics, prior knowledge, learning styles, competence in language of instruction, etc); and the Presage 'Teaching Context' factors which relate to the classroom environment, the curriculum, and teaching methods.

The 'Teaching-Learning' Process refers to the student approach to learning (see Section 2.7.8.) and takes into account student motivation and learning. It draws a distinction between deep learning (which is when students engage in tasks appropriately and meaningfully) and surface learning (which is characterised by rote memorisation of data and is based on the student motive of using the minimum effort to obtain or meet course requirements). In surface learning, low level cognitive activities are used (Biggs, 1993b; Biggs, 2012). Deep learning is a key goal of higher education (Nemanich, Banks & Vera, 2009).

In Biggs 3P model the student approach to learning is operationalised using the Study process Questionnaire (SPQ). In 2001 the SPQ was revised (R-SPQ-2F) to exclude the achieving approach to learning (which relates to the student's strategic orientation). This is because it was discovered that the achieving approach, rather than describing the way students engage in learning tasks (a generic description of 'what the student does'), instead related more to how students organise their learning i.e. when, where and for how long tasks will be engaged in (Biggs, Kember & Leung, 2001).

Learning models in the student approach to learning tradition place emphasis on different aspects of the learning process, determined using various self-report research instruments and inventories. It is acknowledged, however, that 'there is not yet a full understanding of how student learning develops within and across learning environments' (Gijbels *et al.*, 2013, p.20) and that no individual model provides complete insight into how student learning develops. Questions have been raised on the use of models in based on the student approach to learning tradition, for example, relating to the use of deep and surface approaches as dichotomous variables (Gijbels *et al.*, 2013, p.21).

According to Entwistle:

'The defining features [of deep and surface approaches] also fail to do justice to differences between disciplines. The specific processes involved in seeking deep understanding, as well as the balance between them, must vary across subject areas. Ideally the idea of a deep approach needs to be reformulated to show how it emerges in a particular course of study…'' (1997, p.216).

Broadly speaking student approach to learning models place emphasis on the general (as opposed to course-specific) learning approach, however, Pintrich in his work on self-learning regulation states that a strong assumption in his research is that all the scales are operationalised at the course level (2004). One of the key reasons behind this is that students may use different learning strategies for different courses.

In Biggs 3P model, the student approach to learning is considered in terms of student predispositions to adopt particular processes (as opposed to student strategies when faced with a particular task) and is operationalised using the Study Process Questionnaire (SPQ) – (most recent version being R-SPQ-2F) (Biggs, Kember & Leung, 2001). The SPQ, and the revised two-factor version R-SPQ-2F, have been extensively used by educational psychologists to measure the student approach to learning. Never-the-less, concerns exist in relation to its psychometric characteristics on both theoretical and practical grounds which led Richardson to conclude: '…the SPQ cannot be recommended as a useful research instrument.' (2000, p.85)

Specific concerns on the use of SPQ relate to: internal consistency of its constituent scales; the validity of the construct; and content validity in higher education today, specifically in relation to use amongst socially and culturally diverse student populations (Richardson, 2004; Justicia *et al.*, 2008). There are also concerns about the validity of the construct which stem from its reliance on self-reports of the learning process (espoused theory v's theory in use) (Argyris, 1976)

Biggs himself has concerns in relation to the categorisation of students using the student approach to learning. In his view, the student approach to learning should not be considered a stable characteristic of the individual, but is instead a function of both individual characteristics and the teaching context. The SPQ is designed to measure predispositions towards a particular approach to learning (as opposed to learning strategies used in a specific learning situation). It is not appropriate, therefore, to categorise students as 'deep' or 'shallow' learners on the basis of SPQ responses; in fact Biggs specifically advises against the use of shallow/ deep as independent variables

(Biggs, Kember & Leung, 2001). This point is reinforced by the mixed results of researchers investigating the relationship between student approach to learning and academic achievement (Duff, 2004; Cassidy, 2012; Richardson & Woodley, 2003; Diseth, 2002).

Student achievement (or learning outcome) is the Product and reflects "what we want the student to do" (Biggs, 1993c). Product indicates the level of understanding and performance that students are expected to achieve as a result of engaging in the teaching and learning experience (Biggs & Tang, 2011). The intended learning outcomes are key to Biggs 3P model and the challenges students experience in working towards these outcomes through the teaching-learning process provide direction on how the learning environment, or teaching-learning activities, may be adapted to better meet student needs. In terms of learning outcomes, assessment is needed which gauges where students are in terms of their level of understanding or competence in the concept or skills in question. Course grade is a commonly used variable to measure learning outcome in an educational setting (Young, Klemz & Murphy, 2003).

Price and Richardson expanded Biggs 3P model to include four groups of factors: presage, perceptions, process and product (2004). This 4P model was originally presented as a framework within which to consider factors to improve student learning; it was later argued that the 4P model might also be used to predict student leaning (Price, 2014).

The 4P model is presented as a holistic model to better understand student learning, and whilst many factors are included in the model, it is noted that there is also scope for the inclusion of other factors which may help to explain variation in student learning, for example affective and emotional factors (Price, 2014). A key part of the 4P model relates to perceptions which include both student and teacher conceptions of learning/ teaching as well as student and teacher perceptions of context. Conceptions and perceptions cannot be observed and so insights on these require a qualitative phenomenographic approach. Concerns have been expressed that mixing constructs from different research traditions is problematic in terms of the development and interpretation of research findings (Biggs, 1993a). Lonka and Lindblom-Ylänne (1996, p.30) are, however, supportive of the use of different inventories and research approaches. Price (2014) does not prescribe how the measurements should take place.

Several researchers have adapted Biggs 3P classroom-based model and used it in the context of online education (Nemanich, Banks & Vera, 2009; Haverila & Barkhi, 2009; Cybinski & Selvanathan, 2005). Cybinski and Selvanathan (2005) used the 3P Model to compare students studying statistics in a traditional classroom environment with business undergraduate students studying statistics online taking into account student attitudes towards subject matter, prior experience studying maths, and learning environment (classroom or online) as 'presage' characteristics; student enjoyment of the statistics course and test anxiety as 'process' characteristics'; and exam scores as 'product'. Haverila and Barkhi (2009) adapted the model to study the effectiveness of e-learning among graduate students taking into account their preconceptions, experience, ability and interest ('presage' student characteristics), their perceptions of the learning environment ('process'), and perceived effectiveness ('product'). Nemanich, Banks and Vera (2009) also adapted the 3P model and used it to compare students studying in a traditional classroom environment with students studying online. They identified the 'presage' characteristics as: student ability (SAT score), course content relevance (perceptual measurement scale), the learning environment (classroom versus online) and confidence in the instructor's expertise (perceptual measurement scale). Their 'process' measures related to aspects of the students experience, specifically, student enjoyment (perceptual measurement scale) and student understanding of relationships in course content (perceptual measurement scale). Learning performance, or 'product' was measured through examination performance (objective test score).

The 3P Model, therefore, has been used successfully in the online distance learning context with some adaptation from the original to capture various aspects of the online learning experience, as well as some variations in 'presage' and 'process' variables which may influence learning effectiveness in this domain.

2.9 Overview

In this chapter I have discussed the growth in online learning, and the potential of technology to add value to the learner experience. I have noted that concerns have been expressed that technology is not always used in ways which enhance the learner experience; that interventions are technology-led rather than based on student educational needs. The diversity of students who choose to study online has been

identified as a key challenge and, to better understand student needs, a review has been undertaken of the nature of individual student differences and what is known about their effects on learning and academic success. Several analytical frameworks to help build a theoretical understanding of the various factors (including individual student characteristics, the teaching context, and the online distance learning study context) that may potentially influence online learning and academic achievement have been reviewed.

Chapter 3 Literature Synthesis

Fuelled by advances in educational technology and the development of the internet online education has become an important field of development for universities. Several advantages for students lie behind the growth in online education, including the flexibility and convenience of studying at their own pace, in their own space and in their own time (Marks, Sibley & Arbaugh, 2005; Kock, Verville & Garza, 2007). These benefits are especially compelling in postgraduate education where many students are in full-time employment and have to balance the time demands of work, travel and family (Ladyshewsky & Soontiens, 2013). It is now widely accepted that in both undergraduate and graduate business education students studying online can be equally or more successful than students taught face-to-face in the traditional classroom (Kotey & Anderson, 2006; Arbaugh *et al.*, 2009; Means *et al.*, 2009; Allen & Seaman, 2010).

Despite the significant growth in the use of technology in higher education there are real concerns relating to whether technology is used in an optimal way to improve the student learning experience (Kirkwood & Price, 2005; Price & Kirkwood, 2008; Laurillard, 2002a; Laurillard, 2009). There is a lack of evidence used to support enhancement activities and many interventions are technology-led (Kirkwood & Price, 2005; Kirkwood, 2009; Price & Kirkwood, 2011).

The lack of a theoretical framework for online learning (Oliver & Conole, 2003) combined with the diversity of students choosing to study online (Diaz & Cartnal, 1999; Charlesworth, 2009; Rayner & Cools, 2011) make it challenging to take an evidence-based approach to the enhancement of student learning online. Several writers have attempted to model learning using a holistic framework in an attempt to capture the interaction between various antecedent variables, learning processes and learning outcomes. Many of these models are derived from Biggs 3P framework.

In the Biggs 3P framework *learning process* is at the heart of the model; it is the point of interaction between teacher and student and where students derive their particular approach to learning. The student approach to learning is operationalised using the Study Process Questionnaire (SPQ). The student approach to learning is, however, a generic tool which relates to a student's habitual approach to studying, rather than actual study practices which are situation specific (Tickle, 2001). Context is also an issue, the

student approach to learning is derived when students interact with teachers, but, of course, students studying online do not have direct face-to-face interaction with teachers. The SPQ instrument was designed for classroom-based teaching, and even the re-development of this instrument in 2001 (Revised-SPQ-2F) uses questions set in the classroom context. The principal motivation behind its re-development was a 'commitment to teachers researching the learning environment in their own classrooms' (Biggs, Kember & Leung, 2001, p.145).

Laurillard (2008) states that the best use of learning technology should begin with an understanding of the educational problems students face. In that spirit, and taking into account the concerns highlighted above relating to the student approach to learning construct, I intend to adapt the Biggs 3P model to build a theoretical model of online learning which, instead, positions student educational needs at the heart of the model. These student educational needs referred to as the 'student learning experience' are considered at course-level and are operationalised using a learning inventory which is developmental in nature and derived from Bloom's taxonomy (see Section 4.5.4.).

Adapted Model

In my adaptation of the 3P model (from this point referred to as 3P e-learning (3Pe), I aim to provide an analytical framework within which to build a theoretical understanding of the factors that influence the student learning experience and academic achievement online.

Presage   **Process**   .   **Product**

Student Characteristics

Teaching Context

Student Learning Experience i.e. perception of learning challenges

Academic Achievement

Online Distance Learning Study Context
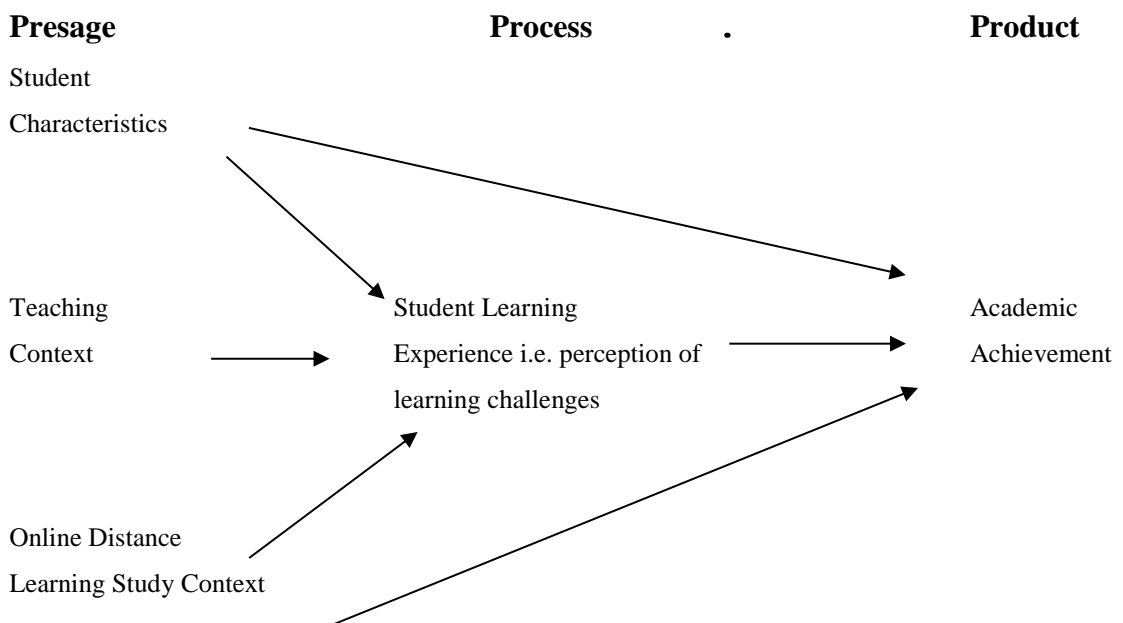
Figure 3.1. Adapted 3P Model – 3P e-learning (3P-e)

The theoretical framework I propose is set at course level and considers individual student characteristics, the online study context, and the teaching context, as they integrate to influence the student learning experience (student perceptions of the learning challenges they face) and also academic achievement.

Economics is selected as the focal course for the research for three reasons: (i) it is a core course on the MBA programme; (ii) Economics combines both abstract and definitional constructs thus presenting different and distinctive learning challenges to students; and (iii) this research project is a sub-project within a wider research study investigating student use of new technologies.

In relation to *Presage* factors, as far as antecedent *student characteristics* are concerned, as already discussed, individual differences between students have the potential to influence learning and learning outcomes. The literature reveals that, in terms of graduate management education, the individual factors which influence learning in the online setting are in many respects different to those which influence learning in the traditional classroom setting (Bocchi, Eastman & Swift, 2004). There are, however, gaps in the knowledge in terms of the factors that influence learning outcome in the online context.

For MBA programmes delivered in the traditional classroom setting, there is convincing evidence in the literature that previous education expressed through GMAT and GPA scores are significant predictors of academic success (Kuncel, Credé & Thomas, 2007; Oh *et al.*, 2008; Kass, Grandzol & Bommer, 2012). In terms of the online MBA, however, the literature is not so clear, and there are suggestions that GMAT and GPA may be poorer predictors of academic success and that other factors, such as behavioural aspects of studying online, are more important (Alstete & Beutell, 2004).

Cognitive ability has been found to be positively associated with learning performance in many different countries and in many different disciplines (Anastasi & Urbina, 1997; Hopkins, 1998). In online education student ability (measured by self-reported SAT scores) is positively associated with learning performance (Nemanich, Banks & Vera, 2009). However, it has been found that, while cognitive ability plays a large role in online course effectiveness at the undergraduate level, behavioural characteristics determine effectiveness more at the graduate level (Arbaugh, 2010a).

In terms of age, Peiperl and Trevelyan (1997) report a negative correlation between age and MBA performance in the classroom taught environment; conversely other researchers report no age based differences (Paolillo, 1982). For students studying online, Alstete *et al* found no significant relationship between age and MBA academic grade while controlling for other predictor variables, specifically discussion board participation, discussion thread initiation and individual assignment scores (Alstete & Beutell, 2004).

In traditional classroom based MBA study, a number of researchers report no correlation between gender and performance (Ekpenyong, 2000; Hancock, 1999; Peiperl & Trevelyan, 1997). In online graduate management education, initially researchers reported that the online environment was friendly to women and it has been found that in MBA study women participate more in discussion boards and initiated more discussion threads than men (Alstete & Beutell, 2004) but gender was not significant in influencing grade. More recent research, however, has been inconclusive on whether gender influences learning outcomes in graduate management education delivered online (Arbaugh, 2005; Arbaugh & Rau, 2007; Marks, Sibley & Arbaugh, 2005).

Whilst for many business schools work experience is a pre-requisite for entry onto a post graduate management education programme, the literature reveals that the evidence is contradictory in terms of whether a relationship exists between work experience and academic performance of students taught in a traditional classroom setting. None of the studies reviewed have considered the influence of work experience in the context of online MBA programmes. However, it is interesting to note that in Executive MBA programmes (where students tend to study while in employment) career achievement to divisional manager status or higher, prior to study, has been shown to have a positive effect on performance outcome (Gropper, 2007).

The literature on the relationship between relevant academic background and academic performance on the MBA is also inconclusive. On the one hand, it has been found that, among class taught students, earlier academic experience is influential (Sulaiman & Mohezar, 2006), but other researchers have found there to be no relationship (Adams & Hancock, 2000; Gump, 2003). Some undergraduate business-related courses have been found to be more helpful than others: for example, previous study of marketing,

economics and business statistics have been found to be significant predictors of MBA grade point average (Gump, 2003). This study will contribute to the knowledge on the influence of relevant academic background on academic performance in the context of online postgraduate management education.

The literature is divided in terms of whether speaking English as first language is advantageous in terms of performance outcomes in MBA programmes taught in English in a traditional classroom setting. Some researchers have found no difference (Ackers, 1997), whereas other researchers have found that students for whom English is not their first language do less well in MBA examination (De Vita, 2001; Smith, 2009; Peiperl & Trevelyan, 1997). Interactions between English as first language and performance outcome have been found in relation to the type of question asked in MBA examinations (open-ended or multiple choice) and students for whom English is not the first language have been found to be less disadvantaged in multiple choice questions (Smith, 2009). Amongst the articles reviewed, no reference is made to the effects of English as first language on learning and performance outcomes in online post-graduate management education. This gap in the literature will be addressed in this study.

Learning style, which refers to "characteristic preferences for alternative ways of taking in and processing information" (Litzinger *et al.*, 2007, p.309), has an impact on performance and learning outcomes. According to Bocchi, students studying online approach their learning differently than their classroom taught counterparts (Bocchi, Eastman & Swift, 2004). Significant differences have been found between the learning styles of students taught online and students taught in a traditional classroom setting (Aragon, Johnson & Shaik, 2002). The literature provides contradictory evidence on the influence of learning style on academic success in the traditional classroom setting and in the online context. In online graduate management education, the literature is quite limited and learning styles are not related to performance outcomes. It should be noted, however, that in most of the reviewed studies performance outcomes were assessed through student perceptions of course outcomes rather than objective assessment which is a major weakness. This study will use the Felder & Silverman ILS model to add to the knowledge on the influence of learning styles on the online learning experience and academic achievement.

Cultural differences amongst students have been found to have an effect on their learning processes. Culture has also been found to influence student grade in the traditional classroom situation, but research is limited and tends to have been conducted at undergraduate level. There is a lack of literature examining the effects of culture in the context of online postgraduate management education. Studies into the effects of culture on learning outcomes face difficulties in operationalizing culture. In this study to avoid the ecological fallacy I operationalise culture through the use of proxies using regional clusters (see Section 4.5.5.).

In terms of the factors which influence learning outcomes in both traditional classroom based and online postgraduate management education, the literature is, therefore incomplete, and sometimes contradictory. There is sufficient evidence in the literature, however, to suggest that as far as student characteristics are concerned, individual student differences are important in terms of student learning online, and furthermore, that the student characteristics which lie behind academic success in the online context may be different to the student characteristics which are important in predicting academic success in the traditional classroom setting. It is not so surprising that the factors which influence learning in the online setting are different. The online environment offers a contrasting learning experience (students studying online have to be more independent learners (Diaz & Cartnal, 1999; Nilsson *et al.*, 2012) and the type of student attracted to online post-graduate management education is faced with many demands on their time (Ladyshewsky & Taplin, 2013).

A wide set of *student characteristics* (see Section 4.5.4. Table 4.4.) are therefore included in 3P-e model (Figure 3.1.) to establish, when considered together (and alongside other antecedent variables relating to the online distance learning study context and satisfaction with course resources), which influence both the student learning experience and academic achievement. It should be noted that learning style is included within the set of independent student characteristics.

The *online distance learning context variables* (see Section 4.5.4. Table 4.5.) considered in the 3P-e Model (Fig. 3.1.) are those associated with: working on your own; maintaining motivation; managing time; building a sense of belonging to Edinburgh Business School; interacting with faculty; and networking with other students. It is thought that behavioural characteristics of students play an important

role in online course effectiveness in postgraduate programmes (Arbaugh & Rau, 2007) and particular challenges for students, include lack of teacher presence and the inability to interact directly with other students (Arbaugh & Rau, 2007; Marks, Sibley & Arbaugh, 2005).

It is suggested that lack of face-to-face interaction in the online setting makes it difficult for students to develop social ties and exchange information (Arbaugh, 2000a). However, not all researchers agree that student-student interaction is important. Kellog & Smith, for example, have found that working adult students present a different picture; for them student-student interactivities are not highly valued due to time inefficiency, interaction dysfunction, and intrusion on flexibility (Kellogg & Smith, 2009). It has also been found that students studying online "are more "dependent upon their own abilities" than classroom taught students (Nemanich, Banks & Vera, 2009; p.131). Student motivation may also be relevant in the online setting. Classroom based learning provides the opportunity for more two-way communication between teacher and student and non-verbal cues which decrease the level of ambiguity and cognitive effort required by students which have been found to result in a more enjoyable student experience and enhanced understanding (Kock, Verville & Garza, 2007). Student enjoyment appears to be an integral component of classroom motivation. Further, Bandura's theory of self-efficacy (1977) suggests that the extent to which an individual students believes he or she is capable of achieving a particular component of learning may in turn affect the actual learning outcome. According to Coffin (1999), such beliefs may lead to student motivation problems in online learning.

In the adapted model, the *teaching context* refers to student satisfaction with EBS course resources. These moderate the effects of individual ability on learning performance. Limited information is available in the literature in relation to course content and academic achievement in online management education (Arbaugh, 2010a). However, both content- and interaction-related features of online courses have been found to be associated with student perceptions of the quality of the online learning experience for online MBA students (Peltier, Schibrowsky & Drago, 2007). In the adapted model, the *teaching context* is based on an inventory of student satisfaction scores with EBS Economics course resources (see Section 4.5.4. Table 4.6.) across a range of measures from basic knowledge building through to helping students with complex problem solving.

In terms of *Process,* according to the Biggs 3P (Biggs, 1993c) model, the teaching-learning process is the point of interaction between student and teaching presage factors (see Figure 3.1). It is the point where student learning takes place and where students derive their particular approach to the task in question, which depends on both the demands of the teaching context and the student's own predilection for a surface, deep, or achieving approach to learning.

In this study, instead of using the student approach to learning (and SPQ), learning is operationalised in terms of student perceptions of course specific learning challenges (see Section 4.5.4. Table 4.7.). As noted earlier, Laurillard (2008) is supportive of the idea that the best use of learning technology can be made by starting with an understanding of educational problems. This reinforces the view of Ramsden (1992) who considers it to be necessary to discover how students learn and understand the subject matter they are being taught in order to design and provide a productive learning environment. Therefore, in the adapted model, a student learning inventory is used to identify, at course-level, the educational problems perceived by students in the study of a particular course (in this study the focal course is Economics). The inventory used is based on Bloom's taxonomy and considers a range of perceived learning challenges ranging from basic knowledge building through to higher order learning processes. The individual learner is the basic unit of analysis.

Bloom's original Taxonomy of Educational Objectives (1956) is a multi-tiered model which classifies thinking according to six cognitive levels of increasing complexity. It was developed as a framework to classify expectations or intentions in relation to student learning as a result of instruction. It is the most widely used framework to define 'good learning' and focuses on judgements of learning level which were derived by analysing the opinion of 2,000 educators on the qualities of good learning. Six levels were identified, and ordered (in terms of increasing quality from the simplest level or degree of difficulty through to the most complex level of difficulty), as follows: knowledge; comprehension; application; analysis; synthesis; and evaluation. Bloom's work is also the starting point of the theory on critical thinking, each level being related to a different level of cognitive ability (Duron, 2006).

The original taxonomy was revised in 2001 with some changes to terminology (major categories changed from noun to verb forms and some retitling of levels) (Anderson *et al.*, 2001). As well as being used to measure how well students master specific

educational objectives, it has been emphasised that the revised taxonomy can also be used to classify instructional and learning activities (Krathwohl, 2002). The new terms are defined as (Anderson *et al.*, 2001, p.67-68):

Level	Cognitive Ability
1. Remembering	retrieving, recognising and recalling relevant knowledge from long-term memory
2. Understanding	constructing meaning from oral, written and graphic messages through interpreting, exemplifying, classifying, summarising, inferring, comparing and explaining
3. Applying	carrying out or using a procedure through executing or implementing
4. Analysing	breaking material into constituent parts, determining how parts relate to one another and to an overall structure or purpose through differentiating, organising, attributing
5. Evaluating	making judgement based on criteria and standards through checking and critiquing
6. Creating	putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

In the 3P-e model (Fig 3.1.), *Product* represents student academic achievement and is based purely on examination performance. The use of academic grades as a performance measure follows established practice in studies of academic success (Gropper, 2007; Yang & Lu, 2001; Oh *et al.*, 2008). However, it is acknowledged that examination grade is not a complete measure of performance as it does not measure wider managerial competencies such as leadership and decision-making (Gropper, 2007).

Theoretical Proposition

The theoretical model tested in this study (as shown in Fig 3.1.) proposes that certain student characteristics, online study context and teaching context variables are more important than others in influencing (at course-level) student perceptions of the learning challenges they experience (intermediate outcomes) and that these in turn influence academic achievement. It is anticipated that by better understanding the educational

problems students face, direction can be provided for a learner-needs focus for the development of online educational resources, and thus provide for an improved learning experience and greater academic success.

Chapter 4 Research Aim, Objectives, Hypotheses & Methodology

4.1. Research Aim

To determine which factors are most important in influencing the student learning experience and student academic achievement in online postgraduate management education.

4.2. Research Objectives

1. To determine which student characteristics, teaching context and online distance learning study context factors influence the student experience in the study of Economics on the Edinburgh Business School online distance learning MBA programme (see Section 5.1.).

2. To determine which student characteristics, online distance learning study context factors and learning challenges experienced in the study of Economics influence student academic achievement in Economics on the Edinburgh Business School online distance learning MBA programme (Section 5.2.).

3. To determine which student characteristics and online distance learning study context factors influence student academic achievement in other core courses on the Edinburgh Business School online distance learning MBA programme (see Section 6).

4.3 Research Hypotheses

Learning challenges

There is no relationship between student characteristics, teaching context and online distance learning study context and the student learning experience in the study of Economics on the Edinburgh Business School online distance learning MBA programme.

Academic achievement

There is no relationship between student characteristics, online distance learning study context and challenges experienced in the study of Economics and academic

achievement in the *study of Economics* on the Edinburgh Business School online distance learning MBA programme.

There is no relationship between student characteristics and online distance learning study context and academic achievement in *other core courses* on the Edinburgh Business School online distance learning MBA programme.

4.4 Operational Hypotheses

Recall that the basis for the theoretical framework is an adaptation of Biggs 3P Model (Figure 3.1.) referred to as the 3P-e model which is positioned at the course level.

The 3P-e model consists of two outcome elements: the first relates to an intermediate outcome represented by variables influencing the student learning experience (see Section 4.4.1.); and the second element relates to academic achievement as the dependent variable (see Section 4.4.2.). For the purpose of this study the 3P-e model is considered in the context of the study of Economics on the Edinburgh Business School MBA programme. The operational hypotheses for both the intermediate outcome (student learning experience) and final outcome (academic achievement) are fully specified in Appendix A Student Experience in the Study of Economics – Operational Hypotheses and Appendix B Academic Achievement in Economics – Operational Hypotheses.

To provide a point of comparison additional analysis was undertaken in relation to other core courses on the Edinburgh Business School MBA programme. The theoretical framework was somewhat limited, being restricted to only student characteristics and online distance learning study context variables as potential predictors of academic achievement (see Section 4.4.3.).

4.4.1 Student Learning Experience in The Study Of Economics (Intermediate Outcome)

In the 3P-e theoretical framework, the factors which are hypothesised to influence the student learning experience (the intermediate outcome) are referred to as *presage* factors and relate to student characteristics, the teaching context and the online distance learning context.

Each group of variables will now be considered in turn using extracts (see Figures 4.1.– 4.3.) from the theoretical framework to present in detail the hypothesised relationships. The full 3P-e theoretical framework as it pertains to the student learning experience (intermediate outcome) is presented in Figure 4.4.

With reference to *student characteristics,* the literature reveals that there are many individual factors which may influence learning in the online setting. A wide set of variables is therefore considered under the student characteristics heading and the choice of variables is influenced by the literature review and *a priori* reasoning.

A detailed account of the student characteristics considered within the model together with the hypothesised direction of the relationship between each characteristic and the various aspects of the student learning experience intermediate outcome variables (Y_1-Y_8) is shown in Figure 4.1.3P-e Extract 1 Student Characteristics Predicted Direction of Operational Hypotheses. As noted above, fully specified hypotheses in relation to the student experience in the study of Economics are provided in Appendix A.
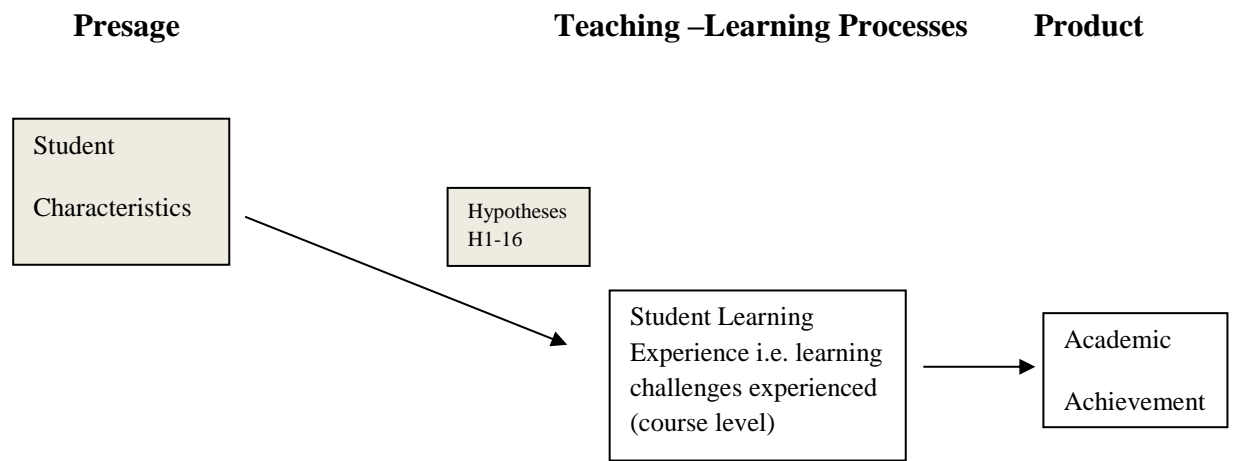
Presage   **Teaching –Learning Processes**   **Product**

Student

Characteristics

Hypotheses
H1-16

Student Learning
Experience i.e. learning
challenges experienced
(course level)

Academic

Achievement

Predicted direction

Student characteristics   *of Hypotheses*

Student Learning Experience
i.e. learning challenges
experienced (course level):

H1 Ability   +ve[1] $\longrightarrow$

H2 Age   -ve[2] $\longrightarrow$

H3 Active-reflective learning style +ve $\longrightarrow$ Building up knowledge (Y_1)

H4 Sensing-intuitive learning style +ve $\longrightarrow$ Understanding theory and concepts (Y_2)

H5 Visual-verbal learning style   -ve $\longrightarrow$

H6 Sequential-global learning style -ve $\longrightarrow$ Understanding numerical calculations (Y_3)

H7 North America region   -ve $\longrightarrow$

H8 Trinidad & Tobago region   -ve $\longrightarrow$ Applying theory to business problems (Y_4)

H9 African region   -ve $\longrightarrow$ Understanding relevance of theory to the real world (Y_5)

H10 Rest of world region   -ve $\longrightarrow$

H11 First language English   +ve $\longrightarrow$ Linking different theories together (Y_6)

H12 Employed   +ve $\longrightarrow$ Applying skills to specific business problems (Y_7)

H13 Gender – male   -ve $\longrightarrow$

H14 Passed exam first time   +ve $\longrightarrow$ Solving complex business problems (Y_8)

H15 Prior attainment degree   +ve $\longrightarrow$

H16 Previous study Economics   +ve $\longrightarrow$

Academic

Achievement

[1]+ve = positive direction or relationship predicted
[2]-ve = negative direction of relationship predicted

Figure 4.1. 3P-e Extract 1 Student Characteristics Predicted Direction of Operational
Hypotheses

The *online distance learning study context* variables relate to generic behavioural aspects of studying online. The variables included are shown in Figure 4.2. 3P-e Extract 2 Online Distance Learning Study Context Predicted Direction of Operational Hypotheses with the hypothesised direction of the relationship between each and the variables representing the student learning experience ($Y_1 - Y_8$).

Presage   **Teaching –Learning Processes**   **Product**

Online distance learning study context	Predicted direction of hypotheses		Student Learning Experience i.e. learning challenges experienced (course level):
Perceived level of difficulty:			Building up knowledge (Y_1)
H17 Working on own	+ve[1]	→	Understanding theory and concepts (Y_2)
H18 Maintaining motivation	+ve	→	Understanding numerical calculations (Y_3)
H19 Managing time	+ve	→	Applying theory to business problems (Y_4)
H20 Building sense of belonging to EBS	+ve	→	Understanding relevance of theory to the real world (Y_5)
H21 Interacting with EBS faculty	+ve	→	Linking different theories together (Y_6)
H22 Networking with students	+ve	→	Applying skills to specific business problems (Y_7)
[1]+ve = positive direction or relationship predicted			Solving complex business problems (Y_8)

Figure 4.2. 3P-e Extract 2 Online Distance Learning Context Predicted Direction of Operational Hypotheses

71

The *teaching context* refers to student satisfaction with Edinburgh Business School course resources as they relate to each aspect of the student learning experience (Y_1-Y_8). The hypothesised direction of the relationship between the variables representing satisfaction with course resources and the student learning experience is positive, as shown in Figure 4.3. 3P-e Extract 3 Teaching Context Predicted Direction of Operational Hypotheses.

Presage   **Teaching –Learning Processes**   **Product**

Satisfaction with	Direction	Student Learning Experience i.e. learning challenges experienced (course level):
EBS course materials:	*of hypotheses*	
H23 Building up knowledge	+ve[1]	Building up knowledge (Y_1)
H24 Understanding theory and concepts	+ve	Understanding theory and concepts (Y_2)
H25 Understanding numerical calcs	+ve	Understanding numerical calculations (Y_3)
H26 Applying theory to business problems	+ve	Applying theory to business problems (Y_4)
H27 Understanding relevance of theory to real world	+ve	Understanding relevance of theory to the real world (Y_5)
H28 Linking different theories	+ve	Linking different theories together (Y_6)
H29 Apply skills business probs	+ve	Applying skills to specific business problems (Y_7)
H30 Solving complex business problems	+ve	Solving complex business problems (Y_8)

[1]+ve = positive direction or relationship predicted

Figure 4.3. 3P-e Extract 3 Teaching Context Predicted Direction of Operational Hypotheses

The 3P-e theoretical framework as it pertains to the student learning experience (intermediate outcome) is as shown in Figure 4.4. 3P-e Intermediate Outcome Theoretical Framework (Student Learning Experience) Predicted Direction of Operational Hypotheses.

Presage   **Teaching –Learning Processes**   **Product**

Student Characteristics

Hypotheses H1-16

Student Learning Experience i.e. learning challenges experienced (course level):

Building up knowledge (Y_1)

Understanding theory and concepts (Y_2)

Understanding numerical calculations (Y_3)

Applying theory to business problems (Y_4)

Understanding relevance of theory to the real world (Y_5)

Linking different theories together (Y_6)

Applying skills to specific business problems (Y_7)

Solving complex business probs (Y_8)

Teaching Context

Hypotheses H23-30

Online Distance Learning Study Context

Hypotheses H17-22

Academic Achievement

Figure 4.4. 3P-e Intermediate Outcome Theoretical Framework (Student Learning Experience) Predicted Direction of Operational Hypotheses

4.4.2 Academic achievement – Economics

In the 3P-e theoretical framework the factors which are hypothesised to influence academic achievement at course level include the presage *student characteristics* and *online distance learning context,* as well as the intermediate variables which relate to the student learning experience i.e. in this study the *learning challenges experienced in the study of Economics.*

Academic achievement in Economics is measured in terms of four dimensions of student academic performance: overall exam result; multiple choice questions only; case study question only; and essay questions only.

Drawing on the literature, operational hypotheses were developed in relation to each measure of academic achievement and the independent variables concerning student characteristics, online distance learning study context and the teaching-learning processes (perception of the learning challenges faced in the study of Economics):

The *student characteristics* and *online distance learning study context* variables considered within the model are exactly the same as those hypothesised as being influential on the intermediate outcome (student learning experience in the study of Economics – see Section 4.4.1.) so they will not be detailed again. The direction of each hypothesis also remains constant. As noted above, a full list of hypotheses in relation to performance in the Economics exam is provided in Appendix B Academic Achievement in Economics – Operational Hypotheses.

The factors which are hypothesised to influence academic achievement in Economics are shown in Figure 4.5. 3P-e Full Theoretical Framework Academic Achievement.

Presage   **Teaching –Learning Processes**   **Product**

Student

Characteristics

Hypotheses
H31-46

+ve/ -ve relationship predicted[2]

Student Learning Experience i.e. learning
challenges experienced (course level):

Building up knowledge (Y_1)

Understanding theory and concepts (Y_2)

Understanding numerical calculations (Y_3)

Applying theory to business problems (Y_4)

Understanding relevance of theory to the real
world (Y_5)

Linking different theories together (Y_6)

Applying skills to specific business problems
(Y_7)

Solving complex business problems (Y_8)

Hypotheses
H47-52

+ve[1]

relationship predicted

Academic

Achievement

+ve[1]

Hypotheses
H53-60

Online Distance
Learning Study
Context

[1]+ve = positive direction or relationship predicted

[2]for details of direction of relationship predicted see Appendix B Academic Achievement in Economics –
Operational Hypotheses

Figure 4.5. 3P-e Full Theoretical Framework Academic Achievement

4.4.3 Academic achievement – Other Core Subjects

As noted earlier, in order to provide a point of comparison, additional analysis was undertaken in relation to other core courses on the Edinburgh Business School MBA programme. The theoretical framework was somewhat limited, being restricted to only *student characteristics* and *online distance learning study context* variables as potential predictors of academic achievement.

A full list of hypotheses in relation to higher exam performance of students in other core courses is provided in Appendix C Academic Achievement Other Core Courses – Operational Hypotheses. The theoretical framework is as presented in Figure 4.6. Theoretical Framework Other Core Courses.

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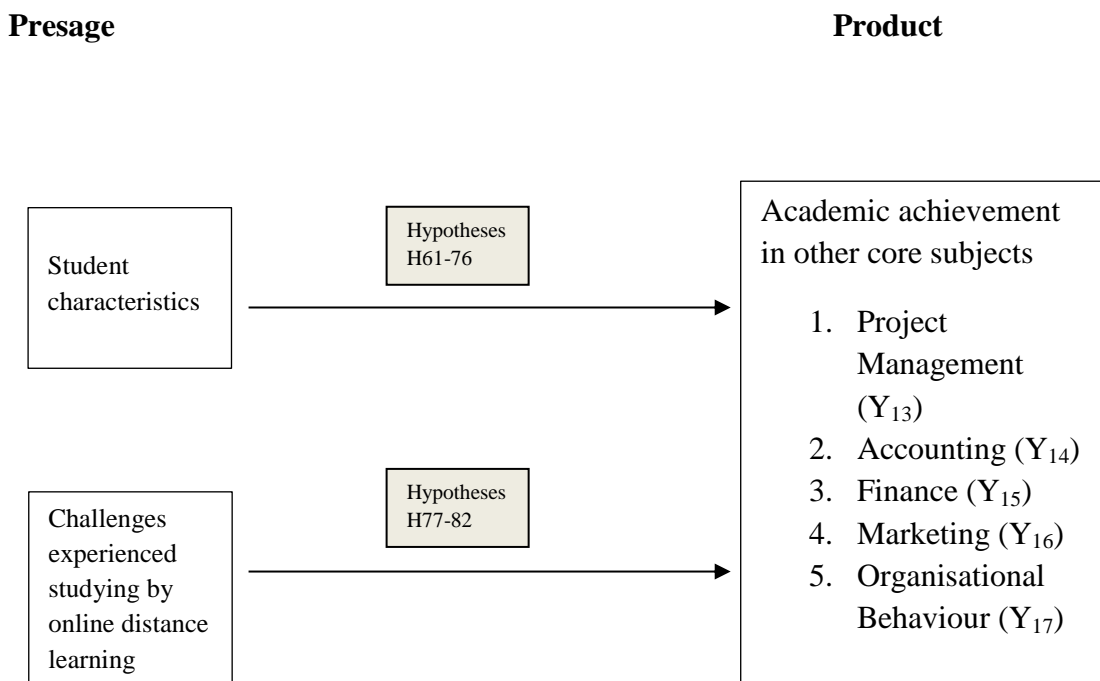
Figure 4.6. Theoretical Framework Other Core Courses

4.5 Research Methodology

4.5.1 Research Philosophy & Focus

This thesis adopts the positivist paradigm. The primary aim is to determine which factors are most important in influencing the student learning experience and academic achievement in the study of Economics on the Edinburgh Business School online distance learning programme. The study seeks to test hypotheses developed from existing theory and on the basis of empirical evidence.

Economics is selected as the focal course for the research because it combines both abstract and definitional constructs thus presenting different learning challenges to students. It is also a core course on the MBA programme. In Biglan's framework for studying the cognitive process in different academic fields, Economics is positioned in the middle of the 'hard-soft' spectrum (existence of paradigms), and also in the middle of the 'pure-applied' dimension (requirements for practical application) (1973). A further reason for the choice of Economics as the focal course is that the study draws on the findings of a wider research study, conducted by the author, which investigates student attitudes towards, and use of, new technologies (see Section 4.5.6.). The skills-based objectives of the Economics courses are that students should develop:

- a systematic approach to problem solving
- an analytical approach on decisions on resource allocation
- the ability to apply the economic analytical framework to consumer and firm resource allocation problems.

In common with all courses on the MBA programme, a comprehensive set of learning resources is provided to students via the course website. The resources on the course website comprise:

1. The *Economics course text*. This is available in printed and online formats and the topics covered include:

- Economic concepts, issues and tools.

- An overview of economics, demand and supply.

- The market, economic efficiency, organisation of industries.

- Public goods, externalities, income distribution.

- International sector, macroeconomics.

- Income distribution, potential output, circular flow of income.

- A simple model of income determination.

- An expanded model of income determination.

- Fiscal policy, money, the central bank and monetary policy.

- The quantity theory and the Keynesian theory of money.

- Integration of the real and monetary sectors of the economy.

- Inflation and unemployment

- The world economy.

The *course text* is written specifically to support distance learners. Economic concepts and theories are introduced and then applied to real world problems. Then, based on these theories, various economic policies are evaluated. At the end of each module the course text features a rich set of multiple choice questions and case study questions, together with fully worked solutions. These provide students with an opportunity to self- test how well they have mastered fundamental concepts and principles. In the on-line version of the course text, the worked solutions link back automatically to the relevant sections of the course.

2. The *Self-Assessment* resources:

Each of the twenty modules in the Economics course is supported by two sets of multiple choice questions, each with an accompanying set of fully explained solutions. The questions in these test banks supplement the end of module questions in the course text and are typically below final examination standard. When students submit their responses to the multiple choice questions their answers are marked automatically and they are provided with a full explanation of the answer to each question. The self-assessment resources facilitate learning by providing students with feedback on their cognitive capabilities as they progress through the course; students may adjust their learning approach accordingly.

3. *The Profiler™*:

This is a software learning tool which is specifically designed to give students comprehensive feed-back on their strengths and weaknesses in the course toward the end of their studies.

The Profiler™ does not depend on the result of a single test to provide this feed-back, rather it builds a picture of student strengths and weaknesses based on a large number of observations on different exercises undertaken by the student (comprising multiple choice questions, case study and essay questions) which are mapped to component conceptual parts of the courses and graded by level of difficulty. In assessing their performance in tackling case study and essay type questions, after writing their answer in full, students are required to click the

'Suggested Answer' link which leads to the professor's fully worked solution to the case study or essay question. Students are then required to rate their answer in comparison with the Professor's worked solution on a scale of 1 to 4. The ratings have the following meanings:

1. I did not really understand the question and did not see its relevance to the case. I could not think of any ideas, concepts or models which would enable me to tackle it.
2. I understood the question and its relevance, I identified some relevant ideas but could not see how to apply them effectively to the issue.
3. I identified some relevant ideas and attempted to apply them to the question with a limited degree of success.
4. My answer is as good as the Professor's and may be superior. I am comfortable with this type of problem and I can recognise the underlying principles in a variety of situations.

The rating given is stored and contributes to the feedback which the student receives through the Profiler™.

To make the best use of the Profiler, students have to spend a significant amount of time tackling the different types of questions which span all the component conceptual parts of the Economics course (Figure 4.7. Component Conceptual Parts of the Economics Course).
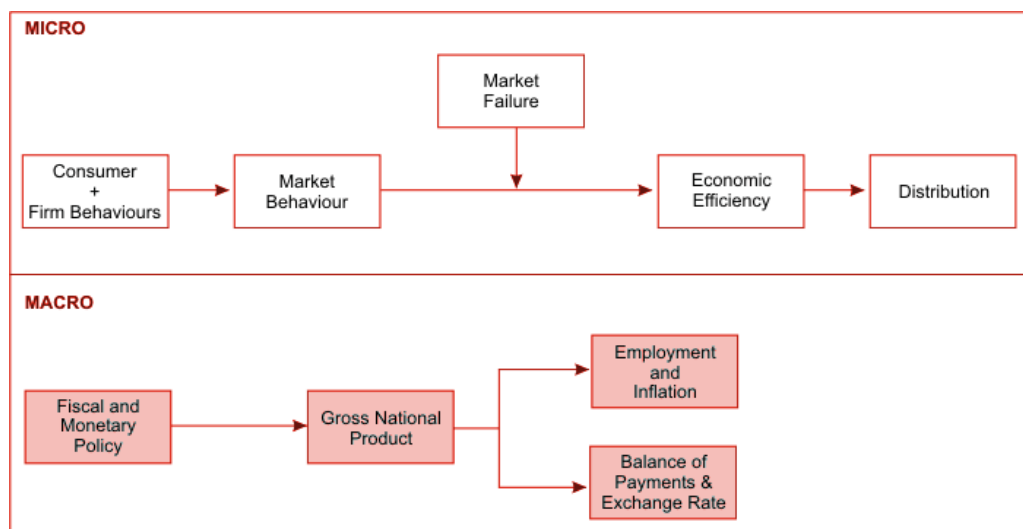
Figure 4.7. Component Conceptual Parts of the Economics Course

Students may also choose to direct their own learning processes by tackling
Profiler case study and essay questions at the end of each module. To facilitate
this, students may refer to the Suggested Order Matrix (Figure 4.8. Suggested
Order Matrix) which provides a graphic presentation of case study and essay
question by module and by level of difficulty
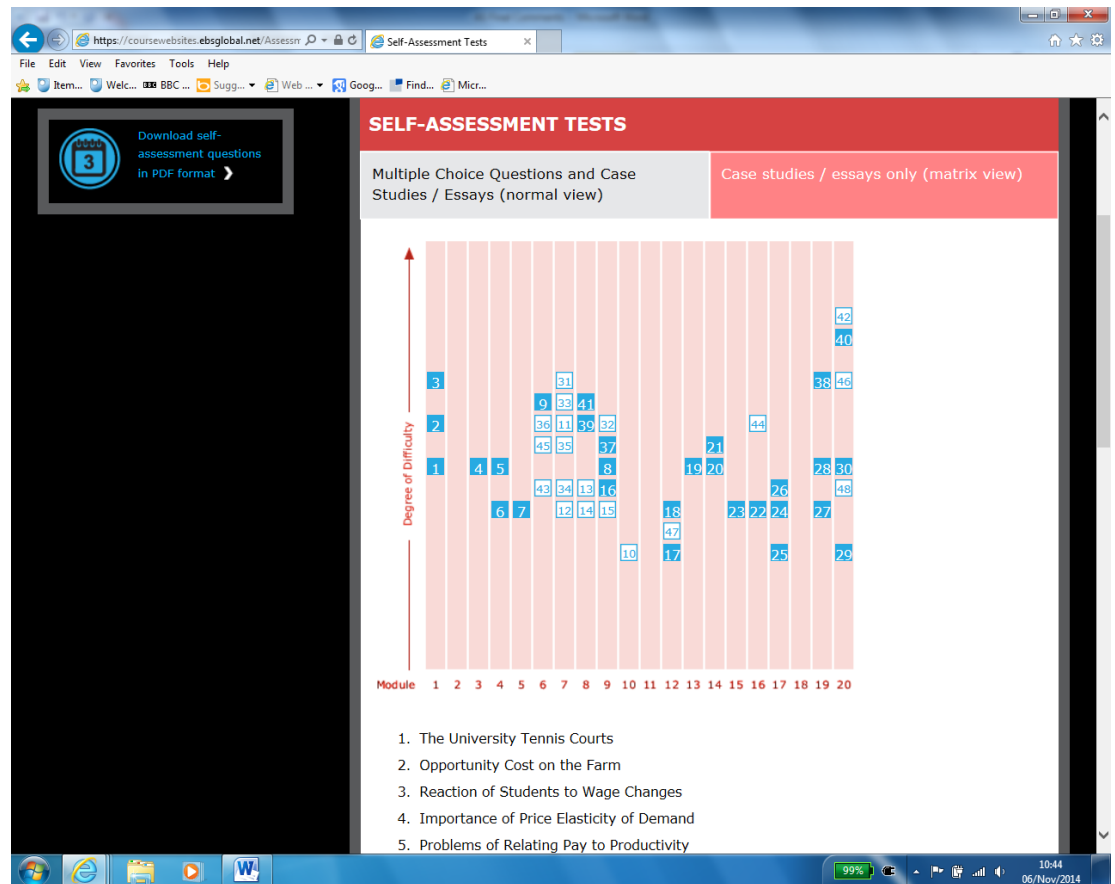
Figure 4.8. Suggested Order Matrix

The results are analysed taking into account the theoretical underpinning and the
level of difficulty of the questions which are up to final examination standard;
the findings are presented graphically (see Figure 4.9.Profiler Results) so that
the students can see clearly how well they understand the key concepts in the
course.
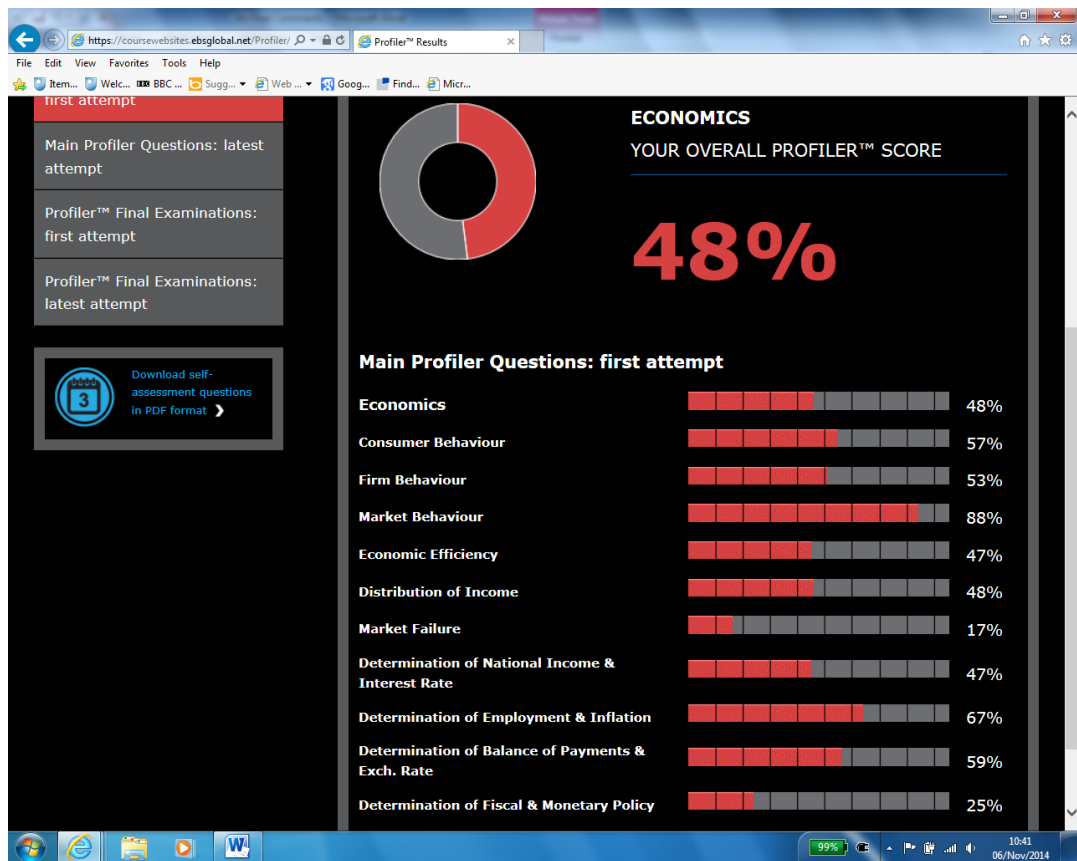
Figure 4.9. Profiler Results

4. *Past Examination Papers*:

Students are given access to the last 10 examination papers accompanied by model solutions to each question (prepared by Edinburgh Business School faculty) and a selected good student answer (an actual answer written by a student in the examination).

5. *Faculty Board :*

The Faculty Board provides students with an opportunity to interact with Edinburgh Business School faculty and with other students to post questions and discuss academic matters. In the Economics course there are six discussion forums: Key Concepts; Microeconomics (Modules 1-10); Macroeconomics (Modules 11-20); General Queries; Self-Assessment Exercises and Practice Final Exams; and Simulation.

6. *Frequently Asked Questions*:

A set of frequently asked questions across all twenty modules in the Economics course is provided together with detailed answers.

7. *Economics Simulation* 'Running the British Economy':

Using this online simulation, students have an opportunity to take control of the UK economy using this online simulation. They are required to:

- analyse the basic structure of the British economy and evaluate their starting position

- understand the various policy tools under their control and be able to estimate the efficiency of each in different economic situations

- be prepared to deal with world events over which there is no control but which can affect the economy

- understand why the right policy decisions one year are not appropriate in another year, even in an apparently similar economic climate

- trade-off short-term losses for long-term gains

The Economics course requires an estimated 200 hours of self-study and is assessed by one 3 hour examination and the pass mark is 50%. There is no choice in the selection of the questions to be answered and the paper is structured as follows:

Element	Marks	%
30 Multiple choice questions	60	37.5
1 Microeconomics case study	20	12.5
1 Microeconomics essay	40	25.0
1 Macroeconomics essay	40	25.0
Total	160	100

4.5.2 Dimensions

There are two analytical dimensions:

- the first line of enquiry is to consider the learning challenges faced by students studying Economics and the relationships between these challenges and various independent variables (including student characteristics, online distance learning study context variables, and satisfaction with Edinburgh Business School online course resources).

- the second line of enquiry is to consider academic achievement and its possible relationship with student characteristics, the online distance learning study context and the learning challenges experienced in the study of Economics. This line of enquiry is also extended to academic achievement in other core courses, albeit with more limited data.

4.5.3 Ethics

The research was approved by Edinburgh Business School Ethics Committee in accordance with Heriot-Watt University Postgraduate Research Student Code of Practice.

Students were informed of the purpose of the research and that the findings would be used to inform course resource development decisions at Edinburgh Business School. Furthermore students were advised that the results of the research would be used to inform the author's doctoral research.

Participation in the research was voluntary and students were reassured that their responses to the research questionnaires would be treated in confidence and that responses were non-attributable. There has been no breach of participants' rights to confidentiality and anonymity and data will continue to be treated in the aggregate in any publications which result from this research.

The rights of students not to participate in the research have been recognised and no pressure has been placed on student to do so. There has been no detriment arising from the process or the findings of the research, either to participants or non-participants.

The author is responsible for all the data analysis and every effort has been made to check the accuracy of the analysis. No alteration has been made to the primary data and the results have not been falsified. Findings have been reported both fully and accurately irrespective of whether they conform to expected outcomes. All sources of secondary data have been acknowledged. At all times the researcher has acted openly, truthfully and pursued accuracy through data collection, analysis and reporting.

4.5.4 Dependent and Independent Variables

Dependent Variables

Student experience in the study of Economics

In terms of the student experience in the study of Economics, several learning challenges are considered, ranging from building up knowledge of Economics through to higher order learning challenges in applying Economics theory (Table 4.1.). These challenges were derived from Bloom's Taxonomy of Educational Objectives (see p.65) which has previously been used to implement mastery of learning in Economics (Bacdayan, 1997). Academic faculty in Edinburgh Business School who support online distance learning students in the study of Economics were also consulted. Exploratory research was also conducted among a convenience sample of students attending a revision seminar at Edinburgh Business School (see Section 4.5.10.).

Table 4.1. Dependent variables – student perceptions of learning challenges experienced in the study of Economics

(Y_1)	Building up knowledge of Economics
(Y_2)	Understanding theory and concepts
(Y_3)	Understanding numerical calculations
(Y_4)	Applying theory to business problems
(Y_5)	Understanding relevance of theory to the real world
(Y_6)	Linking different theories together
(Y_7)	Applying skills to specific business problems
(Y_8)	Solving complex business problems

Academic Achievement – Economics

Academic achievement in Economics is considered in terms of four dimensions of student academic performance: (i) overall exam result; (ii) multiple choice questions only; (iii) case study question only; and (iv) the two essay questions only (Table 4.2.).

Table 4.2. Dependent variables – academic achievement – Economics

(Y_9)	Overall Economics exam %
(Y_{10})	Economics exam MCQ only %
(Y_{11})	Economics exam case study only %
(Y_{12})	Economics exam essay questions only %

Academic achievement - other core subjects

The other core subjects included in the study are: Project Management; Accounting; Finance; Marketing; and Organisational Behaviour. Strategic Planning was omitted from the research as this core course is a capstone course which students should only study at the end of the MBA programme. For the other core subjects the research focuses upon the overall exam mark only (Table 4.3.).

Table 4.3. Dependent variables – other core subjects

(Y_{13})	Project Management exam %
(Y_{14})	Accounting exam %
(Y_{15})	Finance exam %
(Y_{16})	Marketing exam %
(Y_{17})	Organisational Behaviour exam %

Independent Variables
Student characteristics

The full list of independent variables relating to student characteristics is shown in
Table 4.4. A detailed specification of all the independent variables is provided in
Appendix D Independent Variables.

Table 4.4. Independent variables – student characteristics

(X_1)	Student ability (proxy variable measured by mean score across core exam subjects, excluding subject of interest)
(X_2)	age
Learning style	
(X_3)	active-reflective learning style dimension
(X_4)	sensing-intuitive learning style dimension
(X_5)	visual-verbal learning style dimension
(X_6)	sequential-global learning style dimension
Region	
N_1	North American
N_2	Trinidad & Tobago
N_3	Africa
N_4	Rest of World
Reference group:	European
First language	
E_1	English
Reference group:	Other
Employment Status	
W_1	employed either full-time or part-time
Reference group:	unemployed
Gender	
G_1	male
Reference group:	female
Attempts at Economics exam	
P_1	passed at first attempt
Reference group:	failed at first attempt
Highest Prior Qualification	
Q_1	degree level
Reference group:	sub-degree level
Previous Study of Economics	
S_1	previously studied Economics
Reference group:	not previously studied Economics

Online distance learning study context

The online distance learning study context is considered in terms of student perceptions of the challenges they experience in online distance learning study. In this regards, six aspects of the online distance learning study context are identified as independent variables (Table 4.5.). The items are drawn from behavioural aspects of online study identified in the literature review (Section 2.7.10.) as well as in discussion with academic colleagues in Edinburgh Business School who support students studying online.

Table 4.5. Independent variables – online distance learning study context

(X_7)	perceived level of difficulty experienced working on your own
(X_8)	perceived level of difficulty experienced maintaining your motivation
(X_9)	perceived level of difficulty experienced managing your time
(X_{10})	perceived of difficulty experienced building sense of belonging to EBS
(X_{11})	perceived level of difficulty experienced interacting with EBS faculty
(X_{12})	perceived level of difficulty experienced networking with other students

Teaching Context

The independent variables also include the teaching context which is considered in terms of student satisfaction with EBS online course materials in relation to different aspects of learning, ranging from building up knowledge through to higher order learning challenges (Table 4.6.).

Table 4.6. Independent variables –teaching context

(X_{21})	satisfaction EBS course materials in building up knowledge of Economics
(X_{22})	satisfaction EBS course materials in understanding theory and concepts of Economics
(X_{23})	satisfaction EBS course materials in understanding of numerical calculations
(X_{24})	satisfaction EBS course materials in applying theory to business problems

(X$_{25}$)	satisfaction EBS course materials in understanding relevance of theory to the real world
(X$_{26}$)	satisfaction EBS course materials in linking different theories together
(X$_{27}$)	satisfaction EBS course materials in applying skills to specific business problems
(X$_{28}$)	satisfaction EBS course materials in solving complex business problems

Student experience in the study of Economics[1]

The challenges students experience in the study of Economics were also included as independent variables in the investigation of factors which influence student achievement (performance outcome) in the Economics exam (Table 4.7.).

Table 4.7. Independent variables – challenges experienced studying Economics

(X$_{13}$)	perceived level of difficulty experienced building up knowledge
(X$_{14}$)	perceived level of difficulty experienced understanding theory and concepts
(X$_{15}$)	perceived level of difficulty experienced understanding numerical calculations
(X$_{16}$)	perceived level of difficulty experienced applying theory to business problems
(X$_{17}$)	perceived level of difficulty experienced understanding the relevance of theory
(X$_{18}$)	perceived level of difficulty experienced linking different theories
(X$_{19}$)	perceived level of difficulty experienced applying skills to specific business problems
(X$_{20}$)	perceived level of difficulty experienced solving complex business problems

[1]challenges experienced studying Economics are dependent variables in assessment of the student experience in the study of Economics, and independent variables in the identification of factors which influence performance outcomes in Economics.

4.5.5 Operationalising Culture

Whilst Hofstede's framework is the most widely used national cultural framework in psychology, sociology, marketing or management studies (Soares, Farhangmehr & Shoham, 2007), it cannot be overlooked that Hofstede's research (1980) measures cultural values on a country level. To avoid the ecological fallacy i.e. the assumption that relationships observed for groups hold at individual level, in this research study the possible effects of culture are considered using purely regional affiliation. This approach is common in business applications (Steenkamp, Hofstede & Wedel, 1999;

Lenartowicz & Roth, 1999) and bot Hofstede (1980) and Steenkamp (2001) are supportive of this approach (see Section 2.7.9. Culture). The following regional clusters are used: North America; Europe; Trinidad & Tobago; Africa; and the rest of the world.

4.5.6 Stages of Research

The research project started off as a sub-project within a wider research study investigating various learning challenges students face in the study of Economics, satisfaction with EBS course materials, and their attitude towards and use of new technologies.

In the wider research study (Stage I) all students studying Economics by distance learning between December 2009 and December 2011 (population 4,514 students), were invited to complete an online research questionnaire (Appendix E Experience Studying Economics Questionnaire). Those who responded to this survey (846 students) were invited to participate in a second stage of research (Stage II) in which students were asked to complete a learning styles questionnaire (Appendix F Felder & Solomon Index of Learning Styles Questionnaire). A total of 255 students submitted the learning styles questionnaire (30% response rate).

In relation to this group of 255 students, for whom data had been gathered on both learning challenges faced in the study of Economics and learning styles, additional data was collected from internal EBS records and also by contacting students (where gaps in data were identified) to record the following:

- academic achievement (exam score in Economics, including overall mark, multiple choice questions only mark, case study question only mark, and essay questions only mark).
- previous experience studying Economics
- prior attainment of degree level qualification/ or not
- employment status
- average percentage grade across core MBA courses (excluding Economics)
- overall exam score for other core courses (Accounting, Project Management, Finance, Marketing, Organisational Behaviour)
- whether Economics exam passed at first attempt or not
- whether English is spoken as a first language.

All questionnaires were coded and linked to Student Identification codes (SID number) to allow additional information to be added to the dataset from Edinburgh Business School student records.

Details - Stage I Experience of studying Economics survey

The online self-completion questionnaire was designed by the author to determine student perceptions of the learning challenges they face studying Economics and studying by online distance learning, as well as their satisfaction with EBS Economics course materials. The questionnaire was part of a wider survey on use of new technologies, also designed by the author (Appendix E Experience Studying Economics Questionnaire), and was hosted on SurveyMonkey.

The experience of studying Economics, and satisfaction with Edinburgh Business School course materials, were both examined using a construct which comprised 8 items stretching across different levels of cognitive process, from building up basic knowledge, to developing understanding, applying theory and complex problem solving. The experience of studying through distance learning was examined using a construct comprising 6 items, each quite different, including the experience of working alone, motivation, and time management. Each of the questions was based on a five-point Likert-type scales. In addition the questionnaire collected demographic information, including age, gender, and region, and data was also added from the internal Edinburgh Business School database, including data on whether a degree level qualification was held prior to embarking on MBA study and also their Economics examination mark.

Details - Stage II Learning styles survey

In Stage II the survey instrument used was the Felder & Solomon Index of Learning Styles (ILS) questionnaire (Appendix F Felder & Solomon Index of Learning Styles Questionnaire). Students were invited to complete the questionnaire online. The ILS is a psychometric research instrument and was created based on the Felder-Silverman model. The Felder & Silverman learning style model (ILS) (Felder & Silverman 1988) is a learning style model which is often used in technology-enhanced learning (Graf *et al.*, 2007; Carver, Howard & Lane, 1999), as well as in traditional learning environments.

The Felder & Silverman ILS model was used in this study because, compared to most other learning style models, it describes the learning process in greater detail (Graf *et al.*, 2007) – it distinguishes between learning styles preferences on four dimensions. It is also used because it is simpler to understand for multicultural students for whom English is not their first language (Christensen, Nance & White, 2011; Strang, 2009a). Furthermore, the ILS is widely used in the context of learning styles research in relation to advanced learning technologies. Its relevance in this context was confirmed by Kuljis and Liu in a comparison of a number of learning style models in relation to the application of e-learning and Web-based learning systems (Kuljis & Liu, 2005).

This ILS instrument is a 44-item questionnaire which is designed using a four dimension model that classifies students according to where they fit on a number of scales pertaining to the ways they receive and process information (Felder & Silverman, 1988). The four dimensions are: sensing-intuitive; active-reflective; visual-verbal; and sequential-global. Each learning style on the ILS is associated with 11 forced choice questions, with options "a" or "b" in agreement with one or other category of the dimension (for example active or reflective). 11 "a" choices on the active-reflective scale would represent a strong preference for active learning. The method actually used to score subtracts the "b" responses from the "a" responses to obtain a score that is an odd number between +11 and -11 on each scale. For example, a student who answer "yes" to eight and "no" to three questions out of the eleven representing the active-reflective dimension would score 5 and be regarded as having a preference for an active learning style (Nilsson *et al.*, 2012)

4.5.7 Sampling

The sampling frame is students studying Economics purely by distance learning on the Edinburgh Business School MBA programme between December 2009 and December 2011, who had applied to sit the Economics exam (although some deferred the exam), and who had studied Economics in English (N= 4,514), each student used the same course materials.

In total 846 completed and usable self-completion questionnaires was received to the Stage I study (19% response). As noted in Section 4.5.6. Stages of Research, respondents to the Stage I survey (the wider study designed to investigate the learning challenges student face in the study of Economics, satisfaction with EBS course

90

materials and their attitude towards and use of new technologies) provided a backdrop for this research thesis. However, additional research was undertaken whereby all 846 respondents to the Stage 1 research were invited to participate in a second stage of research (Stage II) which involved completion of a learning styles questionnaire (Appendix F, Felder & Solomon Index of Learning Styles Questionnaire). A total of 255 completed and usable Learning Styles Survey questionnaires were received, a response rate of 30%.

The characteristics of the sample are:
- All are enrolled as students on the Edinburgh Business School online MBA programme
- All study purely by distance learning (no class tuition)
- All studied Economics between December 2009 and December 2011
- All had applied to sit the Economics exam (although some deferred the exam)
- All study from the same course text
- All have access to the same course website
- All sit the Economics exam in English

To check that the sample of 255 students is representative of the total population comparisons were made between the sample and the population in relation to average age, gender and average final overall Economics exam mark.

	Population (N=4,514)	Sample (n=255)
Age – mean	36.72 years	36.49 years
Gender – proportion male	60%	67%
Economics exam mark - mean	55.88%	59.78%

The sample consists of 171 (67.1%) male and 84 (32.9%) female students. The age of respondents ranged from 19 years to 57 years, with an average age of 36 years and a standard deviation of 7.8 years. Half of the sample, 112 (50%) had previously studied Economics, and of these just over four fifths (81.3%) had studied Economics at University/ College level. In terms of employment status, 86.4% of respondents were in employment while they studied and 94% of this group were in full-time employment. English was the first language for 113 (51.1%) of students. In terms of region, 87

respondents (34.1%) were from Africa, 64 (25.1%) were from Europe, 37 (14.5%) were from North America, 28 (11.0%) were from Trinidad & Tobago, and 39 (15.3%) were from the rest of the world.

4.5.8 Statistical Analysis

Multiple linear regression analysis is a commonly used statistical technique in educational research (Elmore & Woehlke, 1996; Nathans, Oswald & Nimon, 2012). The technique provides the opportunity to consider the effect of one or more predictor (independent) variables in accounting for variance in a single dependent variable, while controlling for the effect of other factors, and is applicable to the testing of hypotheses whether derived from formal theory, previous research or simple scientific hunch (Cohen, 1988).

According to Braun and Oswald (2011), linear regression is an important tool for creating and testing predictive models. Linear regression also provides proven methods for dealing with : data transformations (for example log transformations); non-linear relationships; multicollinearity; outliers; and heteroscedasticity (Hair *et al.*, 1998).

The hypotheses developed are directional in nature, and the significance of individual variables in contributing to each model is assessed using critical values of the two-sided t-test thus ensuring the scientific rigour of the analysis. The research results were analysed using SPSS.

According to Braun and Oswald (2011), linear regression is an important tool for creating and testing predictive models. Linear regression also provides proven methods for dealing with : data transformations (for example log transformations); non-linear relationships; multicollinearity; outliers; and heteroscedasticity (Hair *et al.*, 1998).

The hypotheses developed are directional in nature, and the significance of individual variables in contributing to each model is assessed using critical values of the two-sided t-test thus adding an extra degree of scientific rigour to the analysis. The research results were analysed using SPSS.

With specific regard to the teaching-learning processes, insights are determined through an eight level hierarchy ranging from lower to higher level challenges in relation to the

study of Economics. A number of regressions were run, each regression examined the student experience in relation to a different learning challenge faced in the study of Economics (as dependent variables): building up knowledge of Economics (Y_1); understanding theory and concepts (Y_2); understanding numerical calculations (Y_3); applying theory to business problems (Y_4) ; understanding the relevance of theory to the real world (Y_5); linking different theories together (Y_6); applying skills to specific business problems (Y_7); and solving complex business problems (Y_8).

The independent (explanatory) variables relate to: *student characteristics*; *the teaching context* (student satisfaction with EBS course materials); and the *online distance learning study context* (student perceptions of challenges faced) (See Section 4.5.4.))

With regard to academic achievement in Economics, models were calibrated for the following dependent variables: the overall result in the Economics exam (Y_9); result in multiple choice questions in the Economics exam only (Y_{10}); result in the case study question in the Economics exam only (Y_{11}); and result in essay questions in the Economics exam only (Y_{12}). For each element of the exam a percentage mark was calculated to facilitate interpretation of the individual models. The independent (explanatory) variables relate to: *student characteristics*; the *teaching context* (student satisfaction with EBS course materials); the *online distance learning study context* (student perceptions of challenges faced); and *teaching-learning processes* (learning challenges experienced in the study of Economics) (See Section 4.5.4.).

As far as academic achievement in the other core courses is concerned, regressions examined exam performance in terms of the overall result in: Project Management (Y_{13}); Accounting (Y_{14}); Finance (Y_{15}); Marketing (Y_{16}); and Organisational Behaviour (Y_{17}).

The independent (explanatory) variables relate to: student characteristics; the teaching context (student satisfaction with EBS course materials); and the *online distance learning study context* (student perceptions of the difficulties experienced).

4.5.9 Rating Scales

The rating scales used to assess the students experience in the study of Economics, satisfaction with Edinburgh Business School course materials; and the student experience of distance learning study are Likert items scales in which each respondents is asked to evaluate how easy or difficult they found the experience of studying

Economics, how satisfied they were with Edinburgh Business School course materials, and how challenging they found various aspects of the distance learning experience. Each of the scales used was symmetric, with equal numbers of positive and negative positions, and comprised five ordered response levels.

Despite being ordinal in nature, the individual items on the scales were treated as interval data. There is considerable debate in the literature as to whether they should be treated as ordinal data (Norman, 2010) and the main issues are:

1. Likert scales are arbitrary. The value assigned to Likert items has no objective numerical basis.
2. Whether the "distance" between each Likert item is equivalent.

While a Likert scale is ordinal, the use of symmetrical scaling (equal amounts of positive and negative positions) and the assumption of equidistance between items (distance between 1 and 2 equidistant to distance between 3 and 4) allows an interval level measurement to be approximated and reasonably inferred. Moreover, when models were calibrated using both ordinal linear regression (OLR) and ordinary least squares (OLS) regression analysis in relation to all Q.1 items, all of the variables that were significant when all other independent variables are added to the preliminary model using OLS (see Section 5) were identical to those which were significant in the models developed when all other independent variables are added to the preliminary model using OLR with three exceptions:

	Level of Significance		
	OLR[1]	OLS[1]	OLS Parsimonious
Level of difficulty perceived understanding the theory and concepts of Economics			
Ability (X_1)	0.046[2]	0.063	NS

(see Table 5.7. for OLS parsimonious regression model and Appendix G OLR Saturated Models Selected Q1 Item Analysis)

Level of difficulty perceived understanding numerical calculations			
Managing your time (X_9)	0.049[2]	0.068	NS

(see Table 5.10. for OLS parsimonious regression model and

Appendix G OLR Saturated Models Selected Q1 Item Analysis)

Level of difficulty perceived linking

different theories together

Sequential-global learning style (X_6)   0.049[2]   0.06   NS

(see Table 5.19. for OLS parsimonious regression model and

Appendix G OLR Saturated Models Selected Q1 Item Analysis)

[1] = when all other independent variables added to the preliminary model

[2] = significant at the 0.05 level

NS= not significant

In relation to each of the above selected items, none of the variables identified as exceptions proved to be significant in the OLS parsimonious models

4.5.10 Reliability, Validity and Generalizability

Learning challenges questionnaire

Several steps have been taken to ensure the research survey is both internally and externally valid, and this extends to the choice of underlying research instruments and careful research design, taking advantage of exploratory research and wide consultation amongst academic colleagues in Edinburgh Business School to refine the design. In the exploratory research a convenience sample was drawn of 60 students studying Strategic Planning and attending on campus classes in July 2011. A draft learning challenges questionnaire was distributed (Appendix H Draft Learning Challenges Questionnaire) and included many open ended questions so that students could raise any issues not included in the questionnaire. The responses were used to refine the final learning challenges questionnaire used in this study.

Reliability

Reliability refers to the reliability of the research instrument and considers the consistency of the responses obtained in the survey. Cronbach's alpha is an internal consistency estimate of the reliability of test scores. It measures internal consistency by providing an average of all possible split pair correlations and is appropriate for use when the quantity being measured reflects a preference or an attitude. A reliability

coefficient of 0.70 or higher is considered acceptable in most social science research situations (Kline, 2000).

To assess reliability Cronbach's coefficient alpha statistics were calculated across the following important questions in the research.

Question 1: Student Experience of Studying Economics
The alpha coefficient for the eight items is 0.887 suggesting that the items have relatively high internal consistency.

Question 2: Student Satisfaction with Economics Course Resources.
The alpha coefficient for the eight items is 0.930 suggesting that the items have relatively very high internal consistency and therefore it is appropriate to use construct statistics in the development of the regression models.

Question 4: Student Experience of Distance Learning
The alpha coefficient for the six items is 0.744 suggesting that the items do not have high internal consistency so it was concluded that each items should be considered independently in the development of the regression models.

Validity
In terms of content validity, the design of the questionnaire relating to the experience of studying Economics and satisfaction with course materials are based on an eight items instrument built around Bloom's taxonomy which gives adequate coverage of a range of understandings in relation to the study of Economics, from basic knowledge through to complex problem solving. With regards to the students experience of online distance learning, this was considered across a range of items including challenges experienced working on your own, maintaining motivation, managing time, building a sense of belonging to Edinburgh Business School, interaction with faculty and networking with other students.

Generalisability (external validity)
The scope of the research is limited to Edinburgh Business School students studying Economics on the online distance learning programme and are therefore not generalizable to students who receive tuition support. The findings are not generalizable

to other course on the Programme or to other business schools, however, it is hoped that the insights given on the subject specific academic challenges faced and the challenges experienced in online study are of wider interest and promote interest in academic research to further the knowledge in this field.

Learning styles questionnaire (ILS)

The ILS is widely used as an instrument to identify learning styles. There are competing claims about the reliability of ILS (Van Zwanenberg, Wilkinson & Anderson, 2000; Reynolds, 1997). However, empirical evidence exists that the ILS model is valid (De Vita, 2001; Zwyno, 2003; Litzinger *et al.*, 2007). Zwyno (Zwyno, 2003, p.2) also cites a survey of 242 students at Tulane University, New Orleans conducted by Livesay *et al* (Livesay *et al.*, 2002) who found the ILS to be valid with reliabilities from 0.54 to 0.72. Litzinger *et al* conducted a comprehensive psychometric study to validate the ILS (n=448) and they found that it had reliabilities from 0.55 to 0.76 (Litzinger *et al.*, 2007, p.314). Their conclusion was that the ILS: "generate data with satisfactory internal consistency reliability and that the evidence for its validity is strong" (Litzinger *et al.*, 2007, p.316)

4.5.11 Modelling Strategy

According to Braun and Oswald (2011, p.339), '…when a theory is in the early development phase, there is a place for empirical results to inform the theory…' and so they see a need for some 'critical interplay between theory and data'. This means that theory can be used as a guide in identifying the predictor variables, but empirical results may also serve to inform theory. Braun states: '…without theory one can easily be overwhelmed by infinite possibilities; therefore theory is necessary to guide the search for the most appropriate and important constructs to be measured and modelled.'

In building the regression models, therefore, an attempt has been made to achieve a balance in the interplay between theory and data. To this end, in the analysis, the preliminary model specified variables which were hypothesised to be of greatest importance in explaining the dependent variable based upon *a priori* theory, previous empirical findings by other researchers, and also experience of working with distance learning students. The model building process then proceeded by moving from the preliminary model by listing all other independent variables. Finally the analysis

calibrated the most parsimonious model containing only significant variables. This represents the experimental approach to modelling.

A similar approach was used to build models of the relative influence of student characteristics, online distance learning context and learning challenges experienced in the study of Economics on performance in the Economics exam. Models were also built to examine the relative influence of student characteristics and the online distance learning context on performance in the other core subjects (no data was available in relation to learning challenges experienced in other core subjects)**.**

Chapter 5 Econometric Analysis - Economics

5.1 Student Experience In The Study Of Economics

5.1.1 Summary Results

The student learning experience was deconstructed using an eight level developmental hierarchy derived from Bloom's taxonomy, ranging from the lower level learning challenges of building knowledge and understanding of Economics through to higher level challenges relating to application of theory and problem solving. The learning challenges in the study of Economics which students found most difficult were: solving complex business problems; applying skills to business problems; linking different theories together; and applying theory to business problems (see Appendix I).

Regression analysis was used to determine which factors influence each of the eight aspects of the student learning experience and a wide set of antecedent variables were considered in building the models, including variables relating to *student characteristics, teaching context* and *online distance learning study context*.

An overview of the findings is presented in Table 5.1. Summary of Parsimonious Models – Regression Analysis) and are illustrated in Figures 5.1. – 5.4. Full details of the analysis, including the calibration of preliminary and parsimonious models in relation to each of the eight aspects of the student learning experience are provided in Sections 5.1.3. – 5.1.10. All of the models built to examine the student learning experience are statistically significant at the 1% level, and the variance explained ranges from 24% (level of difficulty perceived building up knowledge of Economics) to 41% (level of difficulty perceived understanding numerical calculations). Of the wide range of antecedent variables included in the regressions, only a few proved to be significant when interaction effects were taken into account (Table 5.1.).

As can be seen in Table 5.1., *teaching context*, which relates to satisfaction with course materials, is the most significant explanatory variable in all eight models investigating the student learning experience (Hypotheses 23-30 are accepted).

Certain *student characteristics* are also important. Specifically, *previous study of Economics* is significant in explaining the level of difficulty students experience in building up knowledge of Economics; understanding the theory and concepts of Economics, applying skills to specific business problems; and solving complex business

problems (Hypothesis 16 is accepted in relation to Y_1, Y_2, Y_7 and Y_8). In terms of *learning style*, the sensing-intuitive learning style dimension is significant in relation understanding theory and concepts of Economics; applying theory to business problems; applying skills to specific business problems; and solving complex business problems (sensing learners perceive higher levels of difficulty) (Hypothesis 4 is accepted in relation to Y_2, Y_4, Y_7 and Y_8). Further, the sequential-global learning style dimension is a significant explanatory variable in relation to understanding the theory and concepts of Economics (global learners experience higher levels of difficulty) (Hypothesis 6 is accepted in relation to Y_2), and the visual-verbal learning style dimension is a significant predictor of the level of difficulty students experience in: understanding the relevance of theory; linking different theories together; and applying skills to specific business problems (verbal learners experience higher levels of difficulty) (Hypothesis 5 is accepted in relation to Y_5, Y_6, and Y_7). Finally, *gender* is significant in understanding numerical calculations and understanding relevance of theory (female learners experience higher levels of difficulty).This was not expected so Hypothesis 13 is rejected in relation to Y_3 and Y_5.

As far as the *online distance learning context* is concerned, students who find it difficult to *interact with EBS faculty* perceive higher levels of difficulty in: understanding the theory and concepts of Economics; understanding relevance of theory; and applying skills to specific business problems (Hypothesis 21 is accepted in relation to Y_2, Y_5, and Y_7). Difficulty *working on your own* is significant in explaining variation in the level of difficulty students perceive in building up knowledge of Economics and linking different theories together (Hypothesis 17 is accepted in relation to Y_1 and Y_6). Finally, there is a significant relationship between difficulty *maintaining motivation* and the level of difficulty perceived in understanding numerical calculations (Hypothesis 18 is accepted in relation to Y_3), and also between the level of difficulty experienced *managing time* and difficulty perceived understanding the relevance of theory (Hypothesis 19 is accepted in relation to Y_5) .

The following variables are *not significant* in the student experience in the study of Economics: student ability; age; active-reflective learning style; region; English spoken as first language; employment status; whether passed exam first time; degree level qualification; previous study of Economics; perceived difficulty managing time; perceived difficulty building a sense of belonging to EBS; and perceived difficulty networking with other students.

Table 5.1. Summary of Parsimonious Models - Regression Analysis (standardised regression coefficients)

	Model 1 Building up Knowledge (Y_1)	Model 2 Understand theory and concepts (Y_2)	Model 3 Understand numerical calculations (Y_3)	Model 4 Applying theory to business problems (Y_4)	Model 5 Understand relevance of theory (Y_5)	Model 6 Linking different theories (Y_6)	Model 7 Applying skills to specific business problems (Y_7)	Model 8 Solving complex business problems (Y_8)
Significant Variables			*Standardised*	*Regression*	*Coefficients*			
Student characteristics								
Previous study of Economics	0.137*	0.137*					0.139*	0.101*
Sensing-intuitive learning style		0.207**		0.185***			0.151**	0.192**
Visual-verbal learning style					-0.117*	-0.144**	-0.169**	
Sequential-global learning style		-0.166**						
Gender			0.109*		0.120*			
Teaching context								
Satisfaction EBS course resources	0.414***	0.411***	0.605***	0.495***	0.463***	0.517***	0.501***	0.551***
Online distance learning study context								
Interacting with faculty		0.150*			0.131*		0.186**	
Working on your own	0.156**					0.158**		
Maintaining motivation			0.113*					
Managing time					0.162**			
F	23.286***	14.747***	57.966***	48.023***	25.060***	44.337***	27.136***	35.221***
$\bar{R}^2$	0.235	0.255	0.408	0.277	0.347	0.348	0.399	0.329

*significant at P<0.05 **significant at P<0.01
***significant at P<0.0001

Figure 5.1. Intermediate Outcomes Key Challenge 1 and 2

Key Challenge 1 – Building up Knowledge of Economics

Presage   Teaching –Learning Processes

Direction of relationship

Student Characteristics

Previous study of Economics   +ve

Teaching Context

Satisfaction EBS course resources building up knowledge of Economics   +ve

Level of difficulty building up knowledge of Economics (Y₁)

Online Distance Learning Study Context

Level of difficulty working on own   +ve
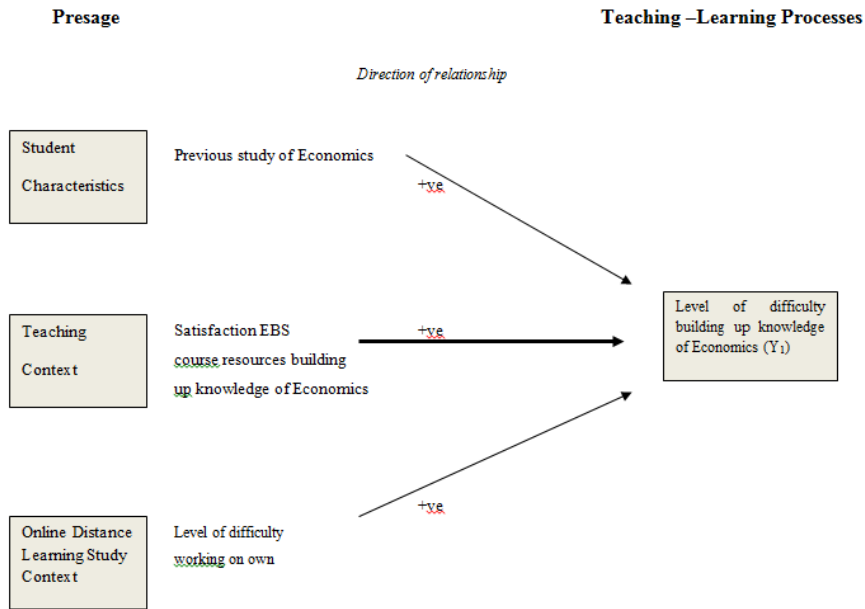
Key Challenge 2 – Understanding Theory and Concepts of Economics

Presage   Teaching –Learning Processes

Direction of relationship

Student Characteristics

Previous study of Economics   +ve
Sensing-intuitive learning style   +ve
Sequential-global learning style   -ve

Teaching Context

Satisfaction EBS course resources understanding theory and concepts   +ve

Level of difficulty understanding theory and concepts (Y₂)

Online Distance Learning Study Context

Level of difficulty Interacting with faculty   +ve

+ve = predicted direction of relationship is positive

-ve = predicted direction of relationship is negative

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Figure 5.2. Intermediate Outcomes Key Challenge 3 and 4

Key Challenge 3 – Understanding Numerical Calculations

Presage   **Teaching –Learning Processes**

Direction of relationship

Student Characteristics

Gender - Male

-ve

Level of difficulty understanding numerical calculations (Y₃)

Teaching Context

Satisfaction EBS course resources understanding numerical calculations

+ve

Online Distance Learning Study Context

Level of difficulty: Maintaining motivation

+ve

Key Challenge 4 - Applying Theory to Business Problems

Presage   **Teaching –Learning Processes**

Direction of relationship

Student Characteristics

Sensing-intuitive learning style

+ve

Level of difficulty applying theory to business problems (Y₄)

Teaching Context

Satisfaction EBS course resources applying theory to business problems

+ve

Online Distance Learning Study Context

NS

+ve = predicted direction of relationship is positive

-ve = predicted direction of relationship is negative

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Figure 5.3. Intermediate Outcomes Key Challenge 5 and 6
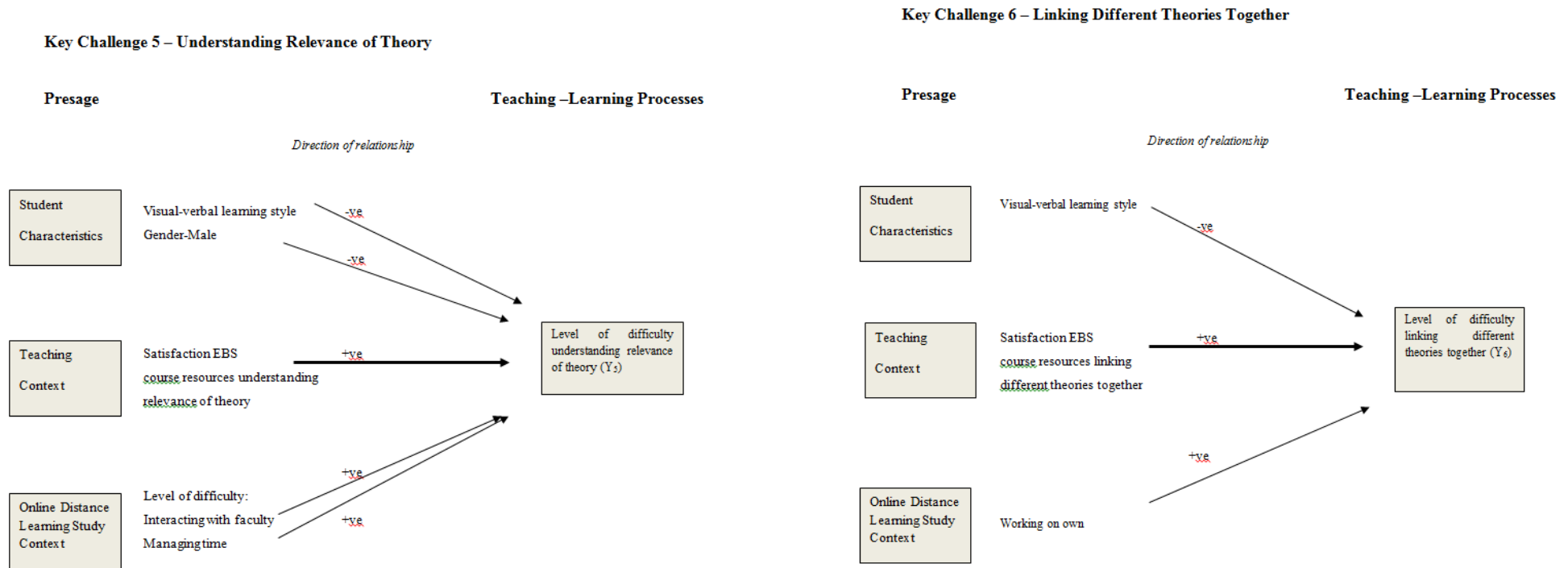
+ve = predicted direction of relationship is positive

-ve = predicted direction of relationship is negative

Figure 5.4. Intermediate Outcomes Key Challenge 7 and 8

Key Challenge 7 – Applying Skills to Business Problems

Presage   Teaching –Learning Processes

Direction of relationship

Student Characteristics

Previous study of Economics
Visual-verbal learning style   +ve
Sensing-intuitive learning style   -ve
                                    +ve

Teaching Context

Satisfaction EBS course resources applying skills to business problems   +ve

Level of difficulty applying skills to business problems (Y₇)

Online Distance Learning Study Context

Interacting with faculty   +ve

Key Challenge 8 – Solving Complex Business Problems
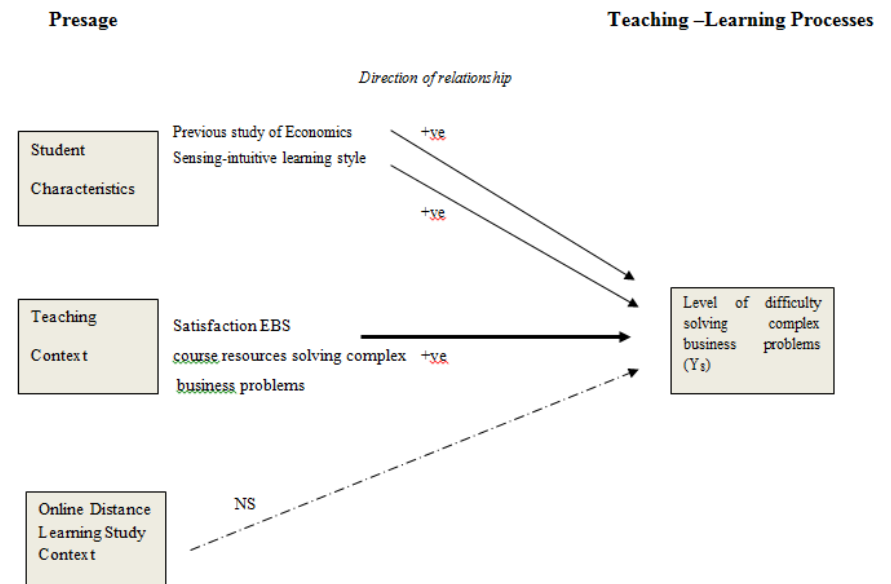
Presage   Teaching –Learning Processes

Direction of relationship

Student Characteristics

Previous study of Economics   +ve
Sensing-intuitive learning style
                                    +ve

Teaching Context

Satisfaction EBS course resources solving complex business problems   +ve

Level of difficulty solving complex business problems (Y₈)

Online Distance Learning Study Context

NS

+ve = predicted direction of relationship is positive

-ve = predicted direction of relationship is negative

5.1.2 Descriptive statistics

Table 5.2. provides a summary descriptive analysis together with the scoring range of the continuous and ordinal variables.

Table 5.2. Summary descriptive analysis and the scoring range of continuous and ordinal variables

Measure	N	Median	Range
Dependent Variables:			
Learning challenges experienced in the study of Economics:			
(Y_1) Building up knowledge of Economics	255	3.00	1-5
(Y_2) Understanding theory and concepts	254	3.00	1-5
(Y_3) Understanding numerical calculations	252	4.00	1-5
(Y_4) Applying theory to business problems	251	3.00	1-5
(Y_5) Understanding relevance of theory to real world	252	4.00	1-5
(Y_6) Linking different theories together	252	3.00	1-5
(Y_7) Applying skills to specific business problems	251	3.00	1-5
(Y_8) Solving complex business problems	247	2.00	1-5

Independent Variables:	N	Mean	Standard Deviation	Range
Student characteristics				
(X_1) Ability*	236	61.07	10.01	0-100
(X_2) Age	255	36.49	7.76	unbounded
Learning style				
(X_3) Active-Reflective learning style	254	6.91	2.30	1-12
(X_4) Sensing-intuitive learning style	254	5.86	2.73	1-12
(X_5) Visual-verbal learning style	254	4.70	2.75	1-12
(X_6) Sequential-global learning style	254	6.33	2.32	1-12

	N	Median		Range
Online distance learning study context:				
(X_7) Working on your own	253	3.00		1-5
(X_8) Maintaining your motivation	254	3.00		1-5
(X_9) Managing your time	254	3.00		1-5
(X_{10}) Building sense of belonging to EBS	248	3.00		1-5
(X_{11}) Interacting with EBS faculty	235	3.00		1-5

(X$_{12}$)Networking with other students	234	2.00	1-5

Teaching context - satisfaction EBS course materials

(X$_{21}$) Building up knowledge of Economics	252	4.00	1-5
(X$_{22}$) Understanding theory and concepts	252	4.00	1-5
(X$_{23}$) Understanding numerical calculations	252	4.00	1.5
(X$_{24}$) Applying theory to business problems	250	3.00	1-5
(X$_{25}$) Understanding relevance of theory to real world	250	4.00	1-5
(X$_{26}$) Linking different theories together	249	3.00	1-5
(X$_{27}$) Applying skills to specific business problems	249	3.00	1-5
(X$_{28}$) Solving complex business problems	243	3.00	1-5

*mean score across core exams excluding Economics

Fully detailed descriptive statistics for both dependent and independent variables are provided in Appendix I Descriptive Statistics Dependent and Independent Variables.

5.1.3 Student Experience Building up Knowledge of Economics

    i)   *Preliminary model of the perceived level of difficulty building up knowledge of Economics (Y$_1$)*

In the preliminary model, the variables which are hypothesised to be the most important in explaining students perceptions of the level of difficulty experienced building up knowledge of Economics (Y$_1$) are: satisfaction with EBS course materials in building up knowledge of Economics (X$_{21}$); ability (X$_1$); previous attainment of a degree level qualification (Q$_1$); previous study of Economics (S$_1$); gender (G$_1$); age (X$_2$); English spoken as first language (E$_1$); and learning style (X$_3$-X$_6$). These variables were selected based on *a priori* reasoning and experience of working with online distance learning students. The variables were entered into the model simultaneously.

Only two variables proved to be significant in the preliminary model: X$_{21}$ satisfaction with EBS course materials building up your knowledge of Economics and S$_1$ previously studied Economics, the direction of the relationship for both of these variables was positive, as predicted (Table 5.3.).The resultant model is significant and accounts for 22% of the variance in Y$_1$ ($\bar{R}^2 = 0.221$) (Table 5.3.)

Table 5.3. Preliminary regression model with perceived level of difficulty building up knowledge of Economics (Y_1) as the dependent variable.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std Error	Beta		
(Constant)	1.980	.564		3.514	0.001
(X_{21})Satisfaction with EBS course materials building up your knowledge of Economics	0.499	0.066	0.501	7.563	0.000
(X_1)Ability	-0.005	0.006	-0.056	-0.839	0.403
(Q_1)Degree Highest Qualfn	-0.170	0.130	-0.087	-1.305	0.194
(S_1)Previously Studied Economics	0.255	0.113	0.146	2.253	0.025
(G_1)Gender	-0.113	0.128	-0.061	-0.882	0.379
(X_2)Age	-0.003	0.007	-0.025	-0.386	0.700
(E_1)English First Language	0.043	0.113	0.025	0.384	0.702
(X_3)Active-Reflective	0.024	0.025	0.064	0.961	0.338
(X_4)Sensing-Intuitive	0.018	0.022	0.057	0.812	0.418
(X_5)Visual-Verbal	-0.017	0.021	-0.055	-0.778	0.438
(X_6)Sequential-Global	-0.035	0.026	-0.093	-1.325	0.187

$F(11,189)=6.154***$

$\bar{R}^2 = 0.221$

*significant at P<0.05. **significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model there is only a slight improvement in variance explained ($\bar{R}^2 = 0.237$). In addition to satisfaction with Edinburgh Business School course materials in building up knowledge of Economics (X_{21}) and previous study of Economics (S_1), one further variable, the level of challenge experienced by the student working on their own (X_7) proved to be significant and, as expected, each of these variables is positively related to Y_1.

Although not significant, the direction of the relationship is positive, as expected, between Y_1 and the following variables: English as a first language (E_1); employed status (W_1); and passed the Economics exam first time (P_1). Ability (X_1); prior

attainment of a degree level qualification (Q_1); gender (G_1) were also not significant in predicting Y_1 but for each the relationship with Y_1 is negative. Whereas this was expected in relation to G_1, it was not expected in relation to X_1 and Q_1. It should be noted that the negative weight given to ability (X_1) in the regression is opposite in sign from its bivariate correlation with the criterion, but X_1 is not significant.

Unexpectedly the direction of the relationship is positive between age (X_2) and Y_1, but X_2 is not significant. In terms of learning style, the relationships between both the active-reflective learning style dimension (X_3) and the sensing-intuitive learning style dimension (X_4) and the Y_1 variable, although positive, as expected, are not significant. Similarly, the relationships between both the visual-verbal learning style dimension (X_5) and the sequential-global learning style dimension (X_6) and Y_1 are negative, as expected, but not significant. Region is also not significant in predicting Y_1. As far as the online distance learning study context is concerned, apart from the level of challenge experienced working on your own (X_7), none of the variables (X_8-X_{12}) were significant in predicting Y_1.

ii) The parsimonious model

The parsimonious model excludes all the insignificant variables and the model is significant with $\bar{R}^2 = 0.235$. Three variables are significant in predicting Y_1: satisfaction with Edinburgh Business School course materials in building up knowledge of Economics (X_{21}); whether the student had previously studied Economics (S_1); and the level of challenge experienced working on your own (X_7) (Table 5.4.).

The most important predictor of the perceived level of difficulty experienced by students in building up knowledge of Economics is satisfaction with EBS course material in helping students to build up knowledge of Economics (X_{21}); the unstandardized regression coefficient is 0.394 ($P \leq 0.001$). This implies that for each additional point on the five point ordinal scale measuring student satisfaction with EBS course materials, the perceived level of difficulty experienced by the student in building up knowledge of Economics eases by 0.394 on the five point perceived level of difficulty experienced scale.

The level of challenge experienced in working on your own (X_7) is the second most important predictor variable. The unstandardized regression coefficient on X_7 is 0.104 ($P \leq 0.05$), which implies that for each additional point gained in the five point scale measuring the level of challenge working on your own, the level of difficulty experienced by the student in building up knowledge of Economics reduces by 0.104 on the five point perceived level of difficulty experienced scale.

The unstandardized regression coefficient on S_1 is 0.237 ($P \leq 0.05$) which implies that students with previous experience studying Economics benefit from this and the perceived level of difficulty experienced building up knowledge of Economics is reduced by 0.237 points on the five point perceived level of difficulty experienced scale

Table 5.4. The parsimonious regression model with perceived level of difficulty building up knowledge of Economics (Y_1) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.531	0.238		6.443	0.000
(X_{21})Satisfaction with EBS course materials building up your knowledge of Economics	0.394	0.058	0.414	6.774	0.000
(S_1)Previously Studied Economics	0.237	0.103	0.137	2.310	0.022
(X_7)Working on your own	0.104	0.041	0.156	2.549	0.011

F(3,215)=23.286***
$\bar{R}^2 = 0.235$
*significant at P<0.05. **significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

The regression equation with perceived level of difficulty building up your knowledge of Economics as the dependent variable (Y_1). The figures in parenthesis are t values and n = 218.

$$Y_1 = \quad 1.531 \quad + 0.394X_{21} \quad + 0.237S_1 \quad + 0.104X_7$$
$$(6.77)^{***} \quad (2.31)^* \quad (2.55)^*$$

Y_1 = perceived level of difficulty experienced building up knowledge of Economics

X_{21} = satisfaction with EBS course materials building up knowledge of Economics

S_1 = previous study of Economics

X_7 = perceived level of difficulty experienced working on your own

*significant at P<0.05. **significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.5.) .

Table 5.5. Correlations and Collinearity Statistics - perceived level of difficulty building up knowledge of Economics

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_{21})Satisfaction with EBS course materials building up your knowledge of Economics	0.449	0.419	0.401	0.940	1.064
(S_1)DUMMY Previous Study Economics	0.135	0.156	0.137	0.998	1.002
(X_7)Working on your own	0.262	0.171	0.151	0.939	1.065

Interpretation of the results

The research results reveal that, relative to other learning challenges in the study of Economics, the perceived level of difficulty building knowledge of Economics is not

perceived to be a major point of difficulty (Appendix I), 10% of respondents scoring 2 or less on the Likert scale measuring the level of difficulty perceived by students in building knowledge of Economics (1=very difficult, 5 = very easy). The best fit model accounts for 23% of the variance in Y_1, and the study has shown that this is influenced by several variables considered in the study which relate to: student characteristics; the online distance learning context; and the course situation (satisfaction with EBS Economics course materials).

The analysis shows satisfaction with EBS course materials in building knowledge of Economics, is positively and highly related to the perceived level of difficulty experienced by students building up knowledge of Economics (H23 is supported). This emphasises the importance of on-going commitment to the provision of high quality course materials to support student learning in building knowledge of Economics. The study also shows that the online distance learning context exerts an important influence on the perceived level of difficulty experienced by students in building up knowledge of Economics. Specifically, a significant distance learning context predictor is the perceived level of difficulty experienced working on your own (H17 is supported).

Technology provides many new opportunities to develop the course infrastructure to address this difficulty and facilitate the development of closer relationships between students and also between students and EBS teaching faculty. Attention should be given to developing further initiatives to support and encourage greater interaction between students and EBS faculty including, for example: the creation of online study groups; synchronous and asynchronous teaching sessions with an online tutor; etc.

Previous experience of the study of Economics is a significant predictor of the perceived level of difficulty experienced by students in building knowledge of Economics; the perceived level of difficulty experienced by students in building knowledge of Economics decreases significantly if the student has previous experience studying the subject (H16 is supported). In terms of addressing this problem it might be possible to introduce a primer Economics course to ease those students who are completely new to Economics into the course.

5.1.4 Student Experience Understanding Theory and Concepts of Economics

i) *Preliminary model of the perceived level of difficulty understanding the theory and concepts of Economics (Y_2)*

In the preliminary model, the variables which are hypothesised to be the most important in explaining students perceptions of the level of difficulty experienced understanding the theory and concepts of Economics (Y_2) are: satisfaction with EBS course materials in understanding the theory and concepts of Economics (X_{22}); ability (X_1); previous attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2); English spoken as first language (E_1); and learning style (X_3-X_6) (Table 5.6.) . In the absence of literature specific to this issue, these variables were selected based on *a priori* reasoning and experience of working with online distance learning students. The variables were entered into the model simultaneously.

In the preliminary model, four variables proved to be significant in predicting Y_2 : satisfaction with EBS course materials in understanding the theory and concepts of Economics (X_{22}); previous study of Economics (S_1); the sensing-intuitive learning style dimension (X_4); and the sequential-global learning style dimension (X_6). The direction of the relationship between each of X_{22}, S_1 and X_6 and Y_2 is positive, as predicted, meaning that students who: are satisfied with EBS course materials; had previously studied Economics; and have a more intuitive learning style, find it easier to understand the theory and concepts of Economics. The direction of the relationship between the sequential-global learning style dimension (X_6) and Y_2 is negative, meaning that students with a more sequential learning style find it easier to understand the theory and concepts of Economics.

The resultant model accounts for 28% of the variance in the level of challenge experienced by students in understanding the theory and concepts of Economics (Y_2) ($\bar{R}^2 = 0.279$).

Table 5.6. Preliminary regression model with perceived level of difficulty understanding theory and concepts of Economics (Y_2) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.732	0.604		2.869	0.005
(X_{22})Satisfaction with EBS course materials re. understanding theory and concepts	0.580	0.072	0.519	8.084	0.000
(X_1)Ability	-0.007	0.006	-0.071	-1.100	0.273
(Q_1)Degree Highest Qualfn	-0.146	0.137	-0.069	-1.066	0.288
(S_1)Previously Studied Economics	0.306	0.118	0.161	2.590	0.010
(G_1) Gender	0.007	0.133	0.004	0.055	0.956
(X_2)Age	0.000	0.008	-0.001	-0.018	0.986
(E_1)English First Language	-0.143	0.118	-0.076	-1.214	0.226
(X_3)Active-Reflective	0.001	0.027	0.002	0.026	0.979
(X_4)Sensing-Intuitive	0.056	0.023	0.163	2.414	0.017
(X_5)Visual-Verbal	-0.020	0.023	-0.060	-0.885	0.377
(X_6)Sequential-Global	-0.064	0.027	-0.160	-2.359	0.019

F(11,188)=8.008***

$\bar{R}^2 = 0.279$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is a slight improvement in variance explained ($\bar{R}^2 = 0.282$). Three variables are significant in explaining variation in Y_2: satisfaction with EBS course materials (X_{22}); previous study of Economics (S_1) (both with positive directions as predicted) and the level of difficulty experienced by the student interacting with EBS faculty (X_{11}), is also

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significant and the direction of the relationship is positive, as predicted. The sensing-intuitive learning style dimension (X_4) and sequential-global learning style dimension (X_6) are not significant.

Although not significant in predicting Y_2, the direction of the relationships between the following items and the perceived level of difficulty experienced understanding the theory and concepts of Economics is positive, as expected: employed status (W_1); and passing the Economics exam first time (P_1). A positive relationship was also noted between age (X_2) and Y_2; this was not expected but the relationship is not significant. Other non-significant variables in predicting Y_2, but with an unexpected negative relationship with the dependent variable are: ability (X_1); prior attainment of a degree (Q_1), and English as a first language (E_1). As expected gender (G_1), is negatively related to Y_2, but again the relationship is not significant.

Region was not significant in predicting Y_2. As expected, students categorised as being from North America(N_1), Trinidad & Tobago (N_2) and the rest of world (N_4) found understanding the theory and concepts of Economics more challenging than European students (reference group). Unexpectedly students from Africa (N_3) found this less challenging than students from Europe. None of these relationships, however, are significant.

Learning style was also not significant in predicting Y_2. The direction of the relationships between each of the learning style dimensions and Y_2 were as predicted, with the exception of the active-reflective learning style dimension (X_3) which was negatively related to Y_2.

Apart from the level of challenge experienced interacting with EBS faculty, none of the distance learning context variables is significant in predicting Y_2. Although not significant, as expected, there is a positive relationship between most of these variables and Y_2; students who find it easier to work on their own, maintain motivation, build a sense of belonging to EBS, and interact with EBS faculty find it easier to understand the theory and concepts of Economics. Unexpectedly, the relationship between the levels of challenge experienced both in managing time and also in networking with other students and Y_2 is negative. However, neither of these relationships are significant.

ii) The parsimonious model

The parsimonious model is significant and explains 26% of the variance in the perceived level of difficulty students experience understanding the theory and concepts of Economics ($\bar{R}^2 = 0.255$) (Table 5.7.). Five variables are significant in predicting Y_2: satisfaction with Edinburgh Business School course materials in understanding theory and concepts of Economics (X_{22}); whether the student had previously studied Economics (S_1); the level of difficulty experienced interacting with EBS faculty (X_{11}); the sensing-intuitive learning style dimension[1] (X_4); and the sequential-global learning style dimension[2] (X_6). The most important influence on Y_2 is X_{22} satisfaction with Edinburgh Business School course materials in understanding the theory and concepts of Economics (Table 5.7.).

The unstandardized regression coefficient for X_{22} is 0.453 ($P \leq 0.001$). This implies that for each additional point increase on the five point scale measuring student satisfaction with EBS course materials, the level of difficulty experienced by the student in understanding theory and concepts of Economics eases by 0.453 on the five point perceived level of difficulty experienced scale.

The unstandardized regression coefficient on (S_1) is 0.260 ($P \leq 0.05$) implies that students with previous experience studying Economics benefit from this and the level of difficulty experienced understanding the theory and concepts of Economics is reduced by 0.260 points on the five point perceived level of difficulty experienced scale

The unstandardized regression coefficient on X_{11} is 0.118 ($P \leq 0.05$) and implies that for each additional point gained in the five point scale measuring the level of challenge interacting with EBS faculty, the level of difficulty experienced by the student in understanding theory and concepts of Economics declines by 0.118 on the five point perceived level of difficulty experienced scale.

In terms of X_4 the unstandardized regression coefficient is 0.072 ($P \leq 0.01$). This means that for every one point move on the learning style index towards an intuitive learning style, the level of difficulty students experience in understanding the theory and concepts of Economics eases by a 0.072 on the five point perceived level of difficulty experienced scale.

For X_6 the unstandardized regression coefficient is - 0.067 ($P \leq 0.05$). This means that for every one point move on the learning style index towards a sequential learning style, the level of difficulty students experience in understanding the theory and concepts of Economics eases by a 0.067 on the five point perceived level of difficulty experienced scale.

[1]= retained due to significance in the preliminary model

[2]= retained due to significance in the preliminary model

Table 5.7. The parsimonious regression model with perceived level of difficulty understanding theory and concepts of Economics (Y_2) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.151	0.327		3.519	0.001
(X_{22})Satisfaction understanding theory and concepts	0.453	0.070	0.411	6.497	0.000
(S_1)Previously Studied Economics	0.260	0.118	0.137	2.198	0.029
(X_{11})Interacting with EBS faculty	0.118	0.050	0.150	2.351	0.020
(X_4)Sensing-Intuitive	0.072	0.023	0.207	3.099	0.002
(X_6)Sequential-Global	-0.067	0.027	-0.166	-2.472	0.014

$F(5,196)=14.747$***

$\bar{R}^2= 0.255$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with perceived level of difficulty experienced understanding theory and concepts of Economics as the dependent variable (Y_2). The figures in parenthesis are t values and n = 201.

$$Y_2 = 1.151 + \quad + 0.453X_{22} \quad + 0.260S_1 \quad + 0.118X_{11} \quad +0.072X_4 \quad - 0.67X_6$$
$$\quad\quad\quad (6.50)*** \quad (2.20)* \quad (2.35)* \quad (3.10)** \quad (2.47)*$$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Y_2 = perceived level of difficulty experienced understanding theory and concepts of Economics

X_{21} = satisfaction with EBS course materials understanding theory and concepts of Economics

S_1 = previously studied Economics

X_{11} = challenge experienced interacting with EBS faculty

X_4 = sensing-intuitive learning style dimension

X_6 = sequential-global learning style dimension

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.8.) .

Table 5.8. Correlations and collinearity statistics – perceived level of difficulty understanding theory and concepts of economics

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_{22})Satisfaction understanding theory and concepts	0.446	0.421	0.396	0.927	1.079
(S_1)Previously Studied Economics	0.109	0.155	0.134	0.957	1.045
(X_{11})Interacting with EBS faculty	0.228	0.166	0.143	0.907	1.102
(X_4)Sensing-Intuitive	0.140	0.216	0.189	0.827	1.209
(X_6)Sequential-Global	-0.071	-0.174	-0.151	0.821	1.218

Interpretation of the results

The research results reveal that, relative to other learning challenges in the study of Economics, understanding the theory and concepts of Economics is perceived to be a point of difficulty by just under one fifth of students (Appendix I); 18% of respondents scoring 2 or less on the Likert scale measuring the perceived level of difficulty experienced (1=very difficult, 5 = very easy). Intensive research was undertaken during the development of EBS course materials for distance learning students and this provides some reassurance that essential building blocks are in place to allow the majority of EBS Economics students to move towards the skills-based objectives of the course.

The teaching context, measured by satisfaction with EBS course materials in understanding the theory and concepts of Economics (X_{22}), is the most important variable in relation to the perceived level of difficulty experienced by students understanding the theory and concepts of Economics (H24 is supported). The design of course materials is core to the student experience.

The study also shows that a particular aspect of the distance learning context, the perceived level of difficulty experienced by students interacting with EBS faculty (X_{11}), is an important influence on the perceived level of difficulty perceived by students in understanding the theory and concepts of Economics (H21 is supported). This emphasises the need to explore opportunities to improve student-faculty interaction to better facilitate the development of student understanding of the theory and concepts of Economics, either synchronous and asynchronously.

Predictably, as with building knowledge of Economics, previous experience in the study of Economics is an important and significant predictor of the perceived level of difficulty experienced by students in understanding the theory and concepts of Economics (H16 is supported). The theory and the concepts of Economics are more likely to trouble students who have no previous experience of the subject which suggests that it may be helpful to provide additional learning resources to help students with no previous Economics training to tackle theoretical and conceptual bottlenecks.

In terms of learning styles, the sensing-intuitive learning style (X_4) is significant in predicting the perceived level of difficulty experienced by students in understanding the theory and concepts of Economics (H4 is supported). Sensing learners find

understanding the theory and concepts of Economics more difficult than intuitive learners. Also, the sequential-global learning style dimension (X_6) is significant (negative direction in the relationship) in predicting the perceived level of difficulty experienced by students in understanding the theory and concepts of Economics (H6 is supported). Sequential learners find understanding the theory and concepts of Economics more difficult than global learners.

It is important, therefore, that EBS provide as much real world context as possible to their course materials; providing a compelling lead into more abstract theories and concepts whose real world application may be less than obvious to the sensing learners who represent the majority of EBS students. Course introductions which emphasise the "why you need to know" will also be beneficial to sensing learners should facilitate student engagement with the learning materials.

5.1.5 Student Experience Understanding Numerical Calculations

i)   *Preliminary model of the perceived level of difficulty understanding numerical calculations in Economics (Y_3)*

In the preliminary model, the variables which were hypothesised to be the most important in explaining students perceptions of the level of difficulty experienced understanding numerical calculations Economics (Y_3) are: satisfaction with EBS course materials in understanding numerical calculations in Economics (X_{23}); ability (X_1); previous attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2); English spoken as first language (E_1); and learning style (X_3-X_6) (Table 5.9.). In the absence of literature specific to this issue, these variables were selected based on *a priori* reasoning and experience of working with online distance learning students. The variables were entered into the model simultaneously.

Only two variables (X_{23} and G_1) are significant in predicting Y_3: As expected, students who are satisfied with EBS course materials find the challenge of understanding numerical calculations easier (positive relationship). Unexpectedly, male students find this challenge easier than females; this positive relationship was not predicted. The resultant model is significant and accounts for 41% of the variance in the level of challenge experienced in understanding numerical calculations in Economics ($\bar{R}^2 = 0.410$).

Table 5.9. Preliminary regression model with perceived level of difficulty understanding numerical calculations in Economics (Y_3) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.091	0.593		0.153	0.878
(X_{23})Satisfaction with EBS course materials - understanding numerical calculations	0.709	0.066	0.626	10.705	0.000
(X_1)Ability	0.007	0.006	0.068	1.151	0.251
(Q_1)Degree Highest Qualfn	0.010	0.139	0.004	0.075	0.940
(S_1)Previously Studied Economics	0.008	0.117	0.004	0.066	0.948
(G_1)Gender	0.263	0.132	0.119	1.989	0.048
(X_2)Age	0.006	0.008	0.042	0.732	0.465
(E_1)English First Language	-0.181	0.118	-0.087	-1.531	0.127
(X_4)Active-Reflective	0.013	0.027	0.027	0.477	0.634
(X_5)Sensing-Intuitive	0.008	0.023	0.021	0.350	0.726
(X_6)Visual-Verbal	0.016	0.022	0.044	0.714	0.476
(X_7)Sequential-Global	-0.009	0.027	-0.019	-0.316	0.753

$F(11,187)=13.483^{***}$

$\bar{R}^2 = 0.410$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is a slight improvement in the variance explained ($\bar{R}^2$=0.439). The only significant variable is satisfaction with EBS course materials in helping student understanding of numerical calculations, with a positive sign, as expected.

Although not significant, the direction of the relationships are as expected between Y_3 and: ability (X_1); prior attainment of a degree level qualification (Q_1); passed the

Economics exam first time (P_1). Also not significant in predicting Y_3 are: gender (G_1); age (X_2); previous study of Economics (S_1); English as a first language (E_1); and employment status (W_1). The direction of the relationship between each of these items and Y_3 is unexpectedly negative, with the exceptions of gender (G_1) and age (X_2) where the direction of the relationship is unexpectedly positive.

Learning style is not significant in predicting Y_3. The direction of the relationships between the sensing-intuitive learning style dimension (X_4) and Y_3 is as predicted. Unexpectedly, there is a negative relationship between the active-reflective learning style dimension (X_3) and Y_3, and a positive relationship between both the visual-verbal learning style dimension and the sequential-global learning style dimension and Y_3. None of these relationships are significant

Region is not significant in predicting Y_3. The distance learning context variables are also not significant in predicting Y_3. As expected, there is a positive, relationship between many of the distance learning context variables and Y_3. Although not significant, students who find it easier to work on their own (X_7), maintain motivation[1] (X_8), build a sense of belonging to EBS (X_{10}), interact with EBS faculty (X_{11}) and network with other students (X_{12}) find it easier to understand numerical calculations in Economics. Unexpectedly, the level of challenge experienced managing time (X_9) was negatively related to Y_3. Although the finding is not significant, it should be noted that this is opposite in sign from its correlation criterion (Appendix J Bivariate Correlations).

[1] = just outside significance

ii)   The parsimonious model

The results of the parsimonious model show that the independent variables account for 41% of variation in the perceived level of difficulty experienced understanding financial calculations in Economics (Y_3) ($\bar{R}^2 = 0.408$) (Table 5.10). Three variables are significant in predicting (Y_3): satisfaction with Edinburgh Business School course materials in helping understanding of numerical calculations in Economics (X_{23}); dummy gender variable (G_1); and the perceived level of difficulty experienced maintaining motivation[1] (X_8). The most important of these is X_{23} (standardised regression coefficient = 0.605).

The unstandardized regression coefficient for (X_{23}) is 0.669 ($P \leq 0.001$). This means that for each one point increase on the five point scale measuring student satisfaction with EBS course materials in helping students understanding of numerical calculations in Economics, the perceived level of difficulty experienced by the student in understanding numerical calculations in Economics eases by 0.669 on the five point level of difficulty experienced scale. The unstandardized regression coefficient on G_1 is 0.243 ($P \leq 0.05$) and implies that male students find it easier to understand numerical calculations in Economics than female students. In terms of the five point perceived level of difficulty rating scale male gender eases the experience by 0.243 points.

The unstandardized regression coefficient on X_8 is 0.096 ($P \leq 0.05$) meaning that for each additional point increase on the five point scale measuring the level of challenge maintaining your motivation, the perceived level of difficulty experienced by the student in understanding numerical calculations in Economics eases by 0.096 on the five point level of difficulty experienced scale.

[1]= retained as just outside of significance when all independent variables added

Table 5.10. The parsimonious regression model with perceived level of difficulty understanding numerical calculations in Economics (Y_3) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.667	0.228		2.923	0.004
(X_{23}) Satisfaction understanding numerical calculations	0.669	0.054	0.605	12.279	0.000
(G_1)Gender	0.243	0.109	0.109	2.230	0.027
(X_8)Maintaining your motivation	0.096	0.042	0.113	2.289	0.023

$F_{(3,245)}=57.966^{***}$

$\bar{R}^2 = 0.408$

*Significant at $P<0.05$. **Significant at $P<0.01$. ***Significant at $P<0.001$.

The best fit regression equation

Regression equation with perceived level of difficulty understanding numerical calculations in Economics as the dependent variable (Y_3). The figures in parenthesis are t values and n = 248

$$Y_3 = \quad 0.667 \quad + 0.669X_{23} \quad + 0.243G_1 \quad + 0.096X_8$$
$$\qquad\qquad (12.28)^{***} \quad (2.23)^* \qquad (2.29)^*$$

Y_3 = perceived level of difficulty experienced understanding numerical calculations in Economics

X_{23} = satisfaction with EBS course materials helping understanding of numerical calculations in Economics

G_1 = gender

X_8 = level of challenge experienced maintaining motivation

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.11).

Table 5.11. Correlations and collinearity statistics – perceived level of difficulty understanding numerical calculations in Economics

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_{23}) Satisfaction with EBS course materials in helping understanding numerical calculations	0.625	0.617	0.600	0.982	1.018
(G_1)Gender	0.144	0.141	0.109	0.997	1.003
(X_8)Maintaining your motivation	0.188	0.145	0.112	0.985	1.015

Interpretation of the results

The perceived level of difficulty experienced by students in understanding numerical calculations in Economics does not seem to be a major cause for concern (Appendix I), 18% of respondents scoring 2 or less on the Likert scale measuring the level of difficulty experienced perceived by students in understanding numerical calculations (1 = very difficult, 5 = very easy).

The best fit model accounts for 41% of the variance in the experience of students understanding numerical calculations in Economics and the study shows that this variance is accounted for by only three factors: the most important is satisfaction with EBS course materials in helping students understand numerical calculations in Economics; followed by gender; and the level of difficulty experienced by students maintaining motivation. Satisfaction with EBS course materials, is positively and highly related to the level of difficulty experienced by students understanding numerical calculations in Economics (H25 is supported) and augmentation of materials to better help students understand numerical calculations in Economics is likely to ease the perceived level of difficulty experienced by students. There is a positive relationship between lower level of difficulty experienced by students maintaining motivation and a lower level of difficulty perceived understanding numerical calculations (H18 is supported).

Augmentation of course materials may also be a way to help students to maintain motivation, particularly if new learning resources bring a more personal dynamic to the faculty-student relationship and help build student confidence and motivation. Motivation may also be aided by the opportunity to engage with peers, both to discuss and tackle numerical challenges in Economics, as well as provide mutual personal support. Synchronous and asynchronous tutorials also provide an opportunity to work through problems with students and, in the case of synchronous interaction, would provide an opportunity for more personal words of encouragement from faculty to student.

In terms of student characteristics, gender also proved to be significant in predicting the perceived level of difficulty experienced by students in understanding numerical calculations in Economics; male students find it easier then female students to understand numerical calculations (H13 is rejected).

5.1.6 Student Experience Applying Theory to Business Problems

i)   *Preliminary model of the perceived level of difficulty in applying theory to business problems (Y_4)*

In the preliminary model, the variables which are hypothesised to be the most important in explaining students perceptions of the level of difficulty experienced applying theory to business problems (Y_4) are: satisfaction with EBS course materials in applying theory to business problems (X_{24}); ability (X_1); previous attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2); English spoken as first language (E_1); and learning style (X_3-X_6). In the absence of literature specific to this issue, these variables were selected based on *a priori* reasoning and experience of working with online distance learning students. The variables were entered into the model simultaneously.

The preliminary model is significant and accounts for 27% of the variance in the perceived level of challenge experienced applying theory to business problems ($\bar{R}^2=$ 0.271) (Table 5.12). In the model only two variables proved to be significant (with positive signs as expected) in predicting Y_4: X_{24} and X_4. Students who were satisfied

with EBS course materials and students with a more intuitive learning style find it easier to apply theory to business problems.

Table 5.12. Preliminary regression with perceived level of difficulty applying theory to business problems (Y_4) dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.476	0.585		2.524	0.012
(X_{24})Satisfaction applying theory to business problems	0.502	0.065	0.492	7.702	0.000
(X_1)Ability	-0.004	0.006	-0.042	-0.659	0.511
(Q_1)Degree Highest Qualfn	-0.115	0.132	-0.057	-0.872	0.384
(S_1)Previously Studied Economics	0.191	0.114	0.105	1.674	0.096
(G_1)Gender	0.021	0.130	0.011	0.160	0.873
(X_2)Age	-0.002	0.007	-0.015	-0.236	0.814
(E_1)English First Language	0.012	0.115	0.007	0.109	0.914
(X_3)Active-Reflective	0.036	0.026	0.089	1.383	0.168
(X_4)Sensing-Intuitive	0.063	0.022	0.191	2.806	0.006
(X_5)Visual-Verbal	-0.026	0.022	-0.084	-1.222	0.223
(X_6)Sequential-Global	-0.025	0.026	-0.065	-0.947	0.345

F(11,187)=7.687***
$\bar{R}^2 = 0.271$
*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is a slight improvement in variance explained ($\bar{R}^2 = 0.295$). Only two variables proved to be significant predictors of Y_4: satisfaction with EBS course materials in applying theory to business problems (X_{24}) and the sensing-intuitive learning style dimension (X_4), both with positive signs as expected. Although not significant, the direction of the relationships are as expected (positive) between the perceived level of difficulty experienced applying theory to business problems and prior attainment of a degree level qualification (Q_1) ; previous experience in the study of Economics (S_1); English as

a first language (E_1); employed status (W_1); and passed the Economics exam first time (P_1). The relationship between Y_4 and age (X_2) is negative, as expected, but not significant. As expected there is a negative relationship between gender (G_1) and Y_4, but again the relationship is not significant. Unexpectedly ability (X_1) is found to have a negative relationship with Y_4, but the relationship is not significant.

Region is not a significant predictor of Y_4. With the exception of the sensing-intuitive learning style dimension (X_4) which is a significant predictor of Y_4, the other learning style dimension (X_3, X_5 and X_6) are not significant. The direction of the relationship between each of these three dimensions and Y_4 are as predicted.

The distance learning context variables are not significant predictors of Y_4. As expected, there is a positive relationship between almost all of these variables and Y_4 but unexpectedly the level of challenge experienced in maintaining motivation is negatively related to Y_4.

ii) The parsimonious model

The parsimonious model is significant and explains 28% of the variance in the perceived level of challenge perceived by students in applying theory to business problems ($\bar{R}^2 = 0.277$) (Table 5.13.). In the model two variables are significant in Y_4: satisfaction with Edinburgh Business School course materials in applying theory to business problems (X_{24}); and the sensing-intuitive learning style dimension (X_4). The most important of these two variables, in terms of their level of influence on Y_4, is satisfaction with Edinburgh Business School course materials in applying theory to business problems (standardised regression coefficient = 0.495). This means that for each additional point increase on the five point scale measuring student satisfaction with EBS course materials in helping with application of theory to business problems, the level of difficulty experienced by the student in applying theory to business problems eases by 0.494 on the five point level of difficulty experienced scale.

In terms of the sensing-intuitive learning style dimension, the unstandardized regression coefficient was 0.061 ($P \leq 0.0001$). This means that for every one point shift on the learning style index towards an intuitive learning style, students perceptions of the level of difficulty students experienced in understanding the theory and concepts of Economics is reduced by a 0.061 on the five points level of difficulty experienced scale.

Table 5.13. The parsimonious regression model with perceived level of difficulty applying theory to business problems (Y_4) dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.268	0.215		5.898	0.000
(X_{24}) Satisfaction with EBS course materials in applying theory to business problems	0.494	0.054	0.495	9.122	0.000
(X_4)Sensing-Intuitive	0.061	0.018	0.185	3.407	0.001

F(2,244)=48.023***

$\bar{R}^2 = 0.277$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with perceived level of difficulty applying theory to business problems as the dependent variable (Y_4). The figures in parenthesis are t values and n = 246

$$Y_4 = \quad 1.268 \quad + 0.494X_{24} \quad + 0.061X_4$$
$$\qquad\qquad (9.12)*** \qquad (3.41)**$$

Y_4 = perceived level of difficulty experienced applying theory to business problems
X_{24} = satisfaction with EBS course materials in applying theory to business problems
X_4 = sensing-intuitive learning style dimension

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage, the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10

(Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.14).

Table 5.14. Correlations and collinearity statistics – applying theory to business problems

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_{24})Satisfaction applying theory to business problems	0.498	0.504	0.495	1.000	1.000
(X_4)Sensing-Intuitive	0.194	0.213	0.185	1.000	1.000

Interpretation of the results

The research results reveal that, relative to other learning challenges in the study of Economics, applying theory to business problems is perceived as a point of difficulty by just under one fifth of students (Appendix I); 19% of students scoring 2 or less on the Likert scale. The ability to apply theory to business problems is core to the achievement of the skills-based objectives of the course. The best fit model accounts for 28% of the variance in the experience of students applying theory to business problems and the study shows that this variance is accounted for by only two factors: satisfaction with EBS course materials in helping students to apply theory to business problems (teaching context); and the sensing-intuitive learning style dimension (student characteristic).

Satisfaction with EBS course materials in helping students to apply theory to business problems is significantly and positively related to the level of difficulty experienced by students in applying theory to business problems in Economics (H26 is supported). Ensuring course materials are aligned with this higher order learning objective is a priority if improvements are to be realised in alleviating some of the difficulties experienced by students in this regard.

The sensing-intuitive learning style dimension is also highly significant in predicting the level of difficulty experienced by students in understanding the theory and concepts of Economics. Students at the sensing end of this learning style dimension experience most difficulty (H4 is supported) and this emphasises the importance of injecting more real

world context in the programme. Initiatives to help sensing learners should revolve around the provisions of more practical examples and explanations why particular theories are important and how they can be applied in the real world.

5.1.7 Student Experience Understanding Relevance of Theory to the Real World

> i) *Preliminary model of the perceived level of difficulty understanding relevance of theory to the real world (Y_5)*

In the preliminary model, the variables which are hypothesised to be the most important in explaining students perceptions of the level of difficulty experienced understanding relevance of theory to the real world (Y_5) are: satisfaction with EBS course materials in understanding the relevance of theory to the real world (X_{25}); ability (X_1); previous attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2); English spoken as first language (E_1); and learning style (X_3-X_6). In the absence of literature specific to this issue, these variables were selected based on *a priori* reasoning and experience of working with online distance learning students. The variables were entered into the model simultaneously.

Only two variables proved to be significant in predicting Y_5: satisfaction with Edinburgh Business School course materials in helping students understand the relevance of theory to the real world (X_{25}); and the gender variable (G_1). The direction of the relationship between X_{25} and Y_5 is positive, as expected. With regard to G_1, the direction of the relationship with Y_5 is positive, however, this was not expected. The resultant model is significant and explains 32% of the variance in the level of challenge experienced in understanding the relevance of theory to the real world ($\bar{R}^2 = 0.316$) (Table 5.15).

Table 5.15. Preliminary regression model regression with perceived level of difficulty understanding relevance of theory to the real world (Y_5) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.119	0.640		1.748	0.082
(X_{25})Satisfaction EBS course materials understanding relevance of theory	0.527	0.065	0.507	8.151	0.000
(X_1)Ability	-0.001	0.006	-0.006	-0.103	0.918
(Q_1)Degree Highest Qualfn	-0.146	0.141	-0.065	-1.031	0.304
(S_1)Previously Studied Economics	0.076	0.122	0.038	0.621	0.535
(G_1)Gender	0.348	0.137	0.164	2.532	0.012
(X_2)Age	0.006	0.008	0.049	0.790	0.430
(E_1)English First Language	-0.168	0.122	-0.084	-1.375	0.171
(X_3)Active-Reflective	0.017	0.027	0.038	0.610	0.543
(X_4)Sensing-Intuitive	0.008	0.024	0.024	0.357	0.722
(X_5)Visual-Verbal	-0.025	0.024	-0.071	-1.056	0.292
(X_6)Sequential-Global	0.020	0.028	0.047	0.717	0.475

$F(11,187)=9.927**$

$\bar{R}^2 = 0.316$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is only a slight improvement in variance explained ($\bar{R}^2=0.369$). Only two variables are significant in explaining variation in Y_5: satisfaction with EBS course materials in understanding relevance of theory to the real world (X_{25}); and the level of challenge experienced by the student managing their time (X_9) and the direction of both of these relationship was positive, as predicted.

Although not significant, the direction of the relationships are positive, as expected, between Y_5 and: previous study of Economics (S1); employed status (W_1); and passed the Economics exam first time (P_1). Also not significant in predicting Y_5 are: ability

(X_1); prior attainment of a degree level qualification (Q_1); and English as first language (E_1). Unexpectedly, the relationship between each of these variables and Y_5 is negative. The relationship between both age (X_2) and gender (G_1) and Y_5 are positive (not expected) but, neither of these relationship is significant.

Learning style is not a significant predictor of Y_5. The direction of the relationship between the active-reflective learning style dimension (X_3) and Y_5 is positive, as predicted. As expected, there is a negative relationship between the visual-verbal learning style dimension (X_5) and Y_5 (just outside of significance). Unexpectedly there is a positive relationship between the sequential-global learning style dimension (X_6) and Y_5, and there is a negative relationship between the sensing-intuitive learning style dimension and Y_5. None of these relationships are significant. Region is also not significant in predicting Y_5.

Apart from the level of difficulty experienced managing time (X_9), none of the distance learning context variables is significant in predicting Y_5, however, the level of challenge experienced interacting with EBS faculty (X_{11}) was just outside significance.

ii)   The parsimonious model

The parsimonious model is significant and explains 35% of the variance in the level of difficulty perceived by students in understanding the relevance of theory to the real world ($\bar{R}^2 = 0.347$) (Table 5.16). Five variables are significant in the best fit model: satisfaction with Edinburgh Business School course materials in helping students understand the relevance of theory to the real world (X_{25}); the level of challenge experienced managing time (X_9); the level of challenge experienced interacting with EBS faculty (X_{11}); gender (G_1); and the visual-verbal learning style dimension (X_5). The most important influence on Y_5 is X_{25} (standardised regression coefficient = 0.463) (Table 5.16).

The unstandardized regression coefficient for X_{25} is 0.464 ($P \leq 0.001$). This means that for each additional point gained on the five point scale measuring student satisfaction with EBS course materials, the perceived level of difficulty experienced by the student in understanding the relevance of theory to the real world reduces by 0.464 on the five point level of difficulty experienced scale. The unstandardized regression coefficient on

X_9 is 0.130 (P≤0.01) meaning that for each additional point gained in the five point scale measuring the perceived level of challenge experienced managing your time, the level of difficulty experienced by the student in understanding the relevance of theory to the real world eases by 0.130 on the five point level of difficulty experienced scale.

In terms of X_{11}, the unstandardized regression coefficient is 0.109 (P≤0.05). So, for each additional point increase in the five point scale measuring the perceived level of challenge interacting with EBS faculty, the perceived level of difficulty experienced by the student in understanding the relevance of theory to the real world declines by 0.109 on the five point level of difficulty experienced scale. The unstandardized regression coefficient on G_1 is 0.260 (P≤0.05) and implies that male students report an easier experience understanding the relevance of theory to the real world than female students.

On X_5, the unstandardised regression coefficient is -0.043 (P≤0.05). This means that for every one point move on the learning style index towards a verbal learning style, the perceived level of difficulty students experience in understanding the relevance of theory to the real world theory increases by a 0.043 on the five point level of difficulty experienced scale.

Table 5.16. The parsimonious regression model with perceived level of difficulty understanding relevance of theory to the real world (Y_5) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.211	0.295		4.108	0.000
(X_{25})Satisfaction EBS course materials understanding relevance of theory	0.464	0.056	0.463	8.259	0.000
(X_9)Managing your time	0.130	0.043	0.162	2.986	0.003
(X_{11})Interacting with EBS faculty	0.109	0.046	0.131	2.384	0.018
(G_1)Gender	0.260	0.125	0.120	2.071	0.039
(X_5)Visual-Verbal	-0.043	0.022	-0.117	-1.963	0.051

F(5,221)=25.060***
$\bar{R}^2 = 0.347$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with perceived level of difficulty in understanding relevance of theory to real world as the dependent variable (Y_5). The figures in parenthesis are t values and n = 226

$$Y_5 = \quad 1.211 \quad + 0.464X_{25} + 0.130X_{29} \quad + 0.109X_{11} + 0.260G_1 - 0.043X_5$$
$$\qquad\qquad (8.259)^{***} \quad (2.99)^{**} \quad (2.38)^* \qquad (2.07)^* \quad (1.96)^*$$

Y_5 = perceived level of difficulty in understanding relevance of theory to the real world

X_{25} = satisfaction with EBS course materials in helping understand the relevance of theory to the real world

X_{29} = managing your time

X_{11} = challenge interacting with EBS faculty

G_1 = gender

X_5 = visual-verbal learning style dimension

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.17).

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Table 5.17. Correlations and collinearity statistics – perceived level of difficulty understanding relevance of theory to the real world

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_{25})Satisfaction EBS course materials understanding relevance of theory	0.533	0.486	0.444	0.920	1.087
(X_9)Managing your time	0.196	0.197	0.160	0.981	1.019
(X_{11})Interacting with EBS faculty	0.223	0.158	0.128	0.954	1.048
(G_1)Gender	0.215	0.138	0.111	0.854	1.171
(X_5)Visual-Verbal	-0.244	-0.131	-0.105	0.816	1.226

Interpretation of the results

The research results reveal that, relative to other learning challenges in the study of Economics, understanding the relevance of theory in Economics to the real world is not a major concern (Appendix I), 15% of students scoring 2 or less on the Likert scale.

The best fit model accounts for 35% of the variance in the experience of students understanding the relevance of theory in Economics to the real world. The course situation, measured by satisfaction with EBS course materials in understanding the relevance of theory in Economics to the real world, is positively and highly related to the level of difficulty experienced by students understanding the relevance of theory in Economics (H27 is supported).

In terms of the distance learning context, the study indicates that the level of difficulty experienced by students interacting with EBS faculty is an important influence on the level of difficulty perceived by students in understanding the relevance of theory in Economics (H21 is supported). This emphasises the importance of faculty engagement in topical discussion in relation to course content, for example, through the academic blog and on the course website. Active encouragement of dialogue between faculty and students on real world events and business news stories, explicitly connected to course theories and concepts, may combine to increase the sense of relevance and add a vibrancy to the EBS MBA programme.

Time is a factor in terms of the level of difficulty experienced by students understanding the relevance of Economics theory to the real world; students who are time-pressured find it more difficult to see the relevance of theory (H19 is supported). It would seem therefore, that every opportunity should be taken to add real world relevance to course materials so that students don't have to "go looking for it", a luxury time-pressured students can ill afford.

In terms of student characteristics the visual-verbal learning style dimension also proved to be significant in predicting the level of difficulty experienced by students in understanding the relevance of theory in Economics to the real world. Visual learners find understanding the relevance of theory in Economics to the real world less challenging than verbal learners (H5 is supported). The use of podcasts and online tutorials to explain the relevance of Economics theory may mitigate some of the difficulties experienced by verbal learners. Increased use of diagrams, graphs, simple pictures and the addition of infographics to online tutorials and Edinburgh Business School blog stories are likely to increase their effectiveness amongst visual learners, and allow learners to more quickly grasp the key ideas (also a benefit from a time perspective).

Gender is also a significant variable in terms of the level of difficulty experienced understanding the relevance of Economics theory to the real world, male students being better able to appreciate relevance than female students (H13 is rejected). To address this some attention should be given to the content of tutorials and blog stories to ensure a cross-section of examples and stories feature with appeal across the sexes.

5.1.8 Student Experience Linking Different theories Together in Economics

i) *Preliminary model of the perceived level of difficulty linking different theories together in Economics (Y_6)*

In the preliminary model, the variables which are hypothesised to be the most important in explaining students perceptions of the level of difficulty in linking different theories together in Economics (Y_6) are: satisfaction with EBS course materials in helping link different theories together in Economics (X_{26}); ability (X_1); previous attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2); English spoken as first language (E_1); and learning style (X_3-X_6). In the absence

of literature specific to this issue, these variables were selected based on *a priori* reasoning and experience of working with online distance learning students. The variables were entered into the model simultaneously.

In the preliminary model only two variables proved to be significant in predicting Y_6: satisfaction with Edinburgh Business School course materials in linking different theories together (X_{26}) (the direction of this relationship was positive, as predicted); and the visual-verbal learning style dimension (X_5) with a negative sign, as predicted, i.e. students with a visual learning style found the experience of linking different theories together easier than students with a more verbal learning style (Table 5.18.). The resultant model is significant and explains 35% of the variance in the perceived level of difficulty experienced linking different theories together ($\bar{R}^2 = 0.350$) (Table 5.18).

Table 5.18. Preliminary regression model with perceived level of difficulty linking different theories together (Y_6) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.074	0.543		1.977	0.049
(X_{26})Satisfaction EBS course materials linking different theories together	0.534	0.060	0.535	8.960	0.000
(X_1)Ability	0.009	0.005	0.105	1.734	.085
(Q_1)Degree Highest Qualfn	-0.183	0.125	-0.091	-1.459	0.146
(S_1)Previously Studied Economics	0.155	0.106	0.087	1.468	0.144
(G_1)Gender	-0.080	0.120	-0.042	-0.670	0.504
(X_2)Age	-0.004	0.007	-0.032	-0.531	0.596
(E_1)English First Language	-0.172	0.105	-0.097	-1.636	0.103
(X_3)Active-Reflective	0.019	0.024	0.047	0.781	0.436
(X_4)Sensing-Intuitive	0.026	0.021	0.082	1.280	0.202
(X_5)Visual-Verbal	-0.056	0.020	-0.181	-2.797	0.006
(X_6)Sequential-Global	0.010	0.024	0.027	0.423	0.673

F(11,186)=10.655***
$\bar{R}^2 = 0.350$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model there is a slight decrease in variance explained ($\bar{R}^2 = 0.341$). As well as the two variables identified in the preliminary model (satisfaction with EBS course materials in linking different theories together (X_{26}) and the visual-verbal learning style dimension (X_5)), one further variable proved to be a significant predictor of Y_6 and that is the perceived level of difficulty experienced by the student working on their own (X_7), with a positive sign, as expected.

Although not significant, the direction of the relationship is positive, as expected, between Y_6 and: ability (X_1); previous experience studying Economics (S_1); and employed status (W_1) and negative between Y_6 and age (X_2). Also not significant in predicting Y_6 are: prior attainment of a degree level qualification (Q_1); gender (G_1); English as first language (E_1); and whether passed the Economics exam at the first attempt (P_1). Unexpectedly each of these items (apart from gender (G_1) is negatively related to Y_6.

Only the visual-verbal learning style dimension (X_5) is significant in predicting Y_6 (negative direction as expected). Although not significant, the direction of the relationship between the active-reflective learning style (X_3) and Y_6 is positive, as predicted.

Apart from the level of difficulty experienced working on your own (X_7), none of the distance learning context variables proved to be significant predictors of Y_6.

ii) *The parsimonious model*

The best fit model is significant and explains 35% of the variance in the perceived level of difficulty experienced by students in linking different theories together ($\bar{R}^2 = 0.348$) (Table 5.19). In the best fit model three variables are significant in predicting Y_6: satisfaction with Edinburgh Business School course materials in linking different theories together (X_{26}); the level of challenge experienced working on your own (X_7); and the visual-verbal learning style dimension (X_5). The most important influence factor is X_{26} (standardised regression coefficient = 0.517)

The unstandardized regression coefficient for satisfaction with Edinburgh Business School course materials in linking different theories together was 0.495 (P≤0.001). This means that for each additional point increase on the five point scale measuring student satisfaction with EBS course materials, the perceived level of difficulty experienced by the student in linking different theories together decreases by 0.495 on the five point level of difficulty experienced scale.

The unstandardized regression coefficient on the visual-verbal learning style variable was -0.045 (P≤0.01) (P≤0.006). This means that for every one point increase on the learning style index towards a verbal learning style, the perceived level of difficulty students experience in understanding the theory and concepts of Economics increases by a 0.045 on the five points level of difficulty experienced scale.

The unstandardized regression coefficient on the challenge experienced working on your own was 0.106 (P≤0.01) meaning that for each additional point increase in the five point scale measuring the perceived level of challenge working on your own, the perceived level of difficulty experienced by the student in linking different theories together eases by 0.106 on the five point level of difficulty experienced scale.

Table 5.19. The parsimonious regression model with perceived level of difficulty linking different theories together (Y_6) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.458	0.212		6.869	0.000
(X_{26})Satisfaction EBS course materials linking different theories together	0.495	0.050	0.517	9.826	0.000
(X_7)Working on your own	0.106	0.035	0.158	3.011	0.003
(X_5)Visual-Verbal	-0.045	0.016	-0.144	-2.767	0.006

F(3,241)=44.337***
$\bar{R}^2 = 0.348$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with perceived level of difficulty linking different theories together as the dependent variable (Y_6). The figures in parenthesis are t values and n = 244

$$Y_6 = \quad 1.458 \quad + \quad 0.495X_{26} \quad + 0.106X_7 \quad - 0.045X_5$$
$$\qquad\qquad\qquad\qquad (9.826)^{***} \qquad (3.01)^{**} \qquad (2.77)^{**}$$

Y_6 = perceived level of difficulty experienced linking different theories together

X_{26} = satisfaction with EBS course materials helping students link different theories together

X_7 = challenge experienced working on your own

X_5 = visual-verbal learning style dimension

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.20).

Table 5.20. Correlations and collinearity statistics – perceived level of difficulty linking different theories together

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_{26})Satisfaction EBS course materials linking different theories together	0.555	0.535	0.508	0.968	1.033
(X_7)Working on your own	0.252	0.190	0.156	0.970	1.031
(X_5)Visual-Verbal	-0.202	-0.175	-0.143	0.988	1.012

Interpretation of the results

The research results reveal that, relative to other learning challenges in the study of Economics, linking different theories in Economics is of some concern to students (Appendix I), 21% of respondents scoring 2 or less on the Likert scale.

The best fit model accounts for 35% of the variance in the perceived level of difficulty experienced by students linking different theories in Economics, and the study shows that this variance is accounted for by just three variables: satisfaction with EBS course materials in helping students link different theories together; the level of difficulty experienced working on your own; and the visual-verbal learning style dimension.

Satisfaction with EBS course materials in helping students link different theories together is positively and highly related to the level of difficulty experienced by students in linking different theories together in Economics (H28 is supported). Opportunities may be present within the Economics course to improve existing course materials to better facilitate students in connecting theories together and coming to a more complete understanding of where all the elements fit into place. The use of visual aids to aid the connection of theory and concepts is to be encouraged, for example: the use of mind mapping techniques; faculty led tutorials specifically designed to draw out relevant linkages and connections; visualising linkages and connection using simple pictures, charts, infographics, etc.

Students who have problems working on their own also find it difficult to link different theories together (H17 is supported). An increased level of interface between faculty and students, for example, using synchronous and asynchronous tutorials may be

helpful in tackling some of the difficulties associated with solitary working. Also peer to peer interaction where informal discussion can be held between students to collaborate in the creation of linkages.

The visual-verbal learning style dimension is also significant in predicting the perceived level of difficulty experienced by students in linking together different theories in Economics. Visual learners find linking theories together easier than verbal learners (H5 is supported). Access to spoken explanations of how theory links together is likely to be a valuable addition to the course offering for those verbal learners who find it difficult to connect theory.

5.1.9 Student Experience Applying Skills To Specific Business Problems

i)   Preliminary model of the perceived level of difficulty applying skills to specific business problems in Economics (Y_7)

In the preliminary model, the variables which are hypothesised to be the most important in explaining students perceptions of the level of difficulty experienced applying skills to specific business problems in Economics (Y_7) are: satisfaction with EBS course materials in applying skills to specific business problems in Economics (X_{27}); ability (X_1); previous attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2); English spoken as first language (E_1); and learning style (X_3-X_6). In the absence of literature specific to this issue, these variables were selected based on *a priori* reasoning and experience of working with online distance learning students. The variables were entered into the model simultaneously.

Four variables are significant in predicting Y_7: satisfaction with Edinburgh Business School course materials in applying skills to specific business problems (X_{27}), the direction of the relationship is positive, as predicted; whether the student had previously studied Economics (S_1) (positive direction, as predicted); the sensing-intuitive learning style dimension (X_4) (positive relationship, as predicted); and the visual-verbal learning style dimension (X_5) (negative relationship, as predicted) (Table 5.27). The resultant model is significant and explains 32% in the variance in the perceived level of difficulty experienced applying skills to specific business problems ($\bar{R}^2$= 0.320) (Table 5.21.).

Table 5.21. Preliminary regression model with perceived level of difficulty applying skills to specific business problems (Y_7) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.576	0.574		2.743	0.007
(X_{27})Satisfaction EBS course materials applying skills to specific business problems	0.500	0.060	0.523	8.300	0.000
(X_1)Ability	-0.004	0.005	-0.045	-0.721	0.472
(Q_1)Degree Highest Qualfn	-0.174	0.129	-0.086	-1.346	0.180
(S_1)Previously Studied Economics	0.246	0.110	0.136	2.230	0.027
(G_1)Gender	-0.011	0.126	-0.006	-0.091	0.928
(X_2)Age	0.005	0.007	0.041	0.658	0.512
(E_1)English First Language	-0.046	0.112	-0.025	-0.411	0.681
(X_3)Active-Reflective	0.007	0.025	0.018	0.286	0.775
(X_4)Sensing-Intuitive	0.047	0.022	0.144	2.180	0.030
(X_5)Visual-Verbal	-0.043	0.021	-0.138	-2.047	0.042
(X_6)Sequential-Global	-0.023	0.025	-0.060	-0.914	0.362

$F(11,185)=9.398***$

$\bar{R}^2 = 0.320$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is slight improvement in variance explained ($\bar{R}^2 = 0.354$).

Three out of the four variables which had been significant in the preliminary model remained significant: satisfaction with Edinburgh Business School course materials in applying skills to specific business problems (X_{27}) ; whether the student had previously studied Economics (S_1) ; and the sensing-intuitive learning style dimension (X_4) . The visual-verbal learning style dimension (X_5) slipped just outside of significance when all other independent variables were added. One further variable is, however, significant and that is the perceived level of difficulty experienced interacting with EBS faculty

(X_{11}), with a positive direction in the relationship with Y_7, as predicted; students who found it easier to interact with EBS faculty also found it easier to apply their skills to specific business problems. The relationships between each of the following variables and Y_7 were not significant: ability (X_1); prior attainment of a degree level qualification (Q_1); gender (G_1); age (X_2); English as first language (E_1); employment status (W_1); and whether passed the Economics exam at the first attempt (P_1). Neither the active-reflective learning style dimension nor the sequential-global learning style was significant in predicting Y_7. Region is also not a significant predictor of Y_7. While the level of difficulty experienced interacting with EBS faculty (X_{11}) is a significant predictor of Y_7, none of the other distance learning context variables is a significant predictor.

Although not significant, there is, as predicted, a positive relationship between the following distance learning context variables and Y_7: the level of difficulty experienced maintaining motivation (X_8); the level of difficulty experienced managing time (X_9); and the level of difficulty experienced building a sense of belonging to EBS (X_{10}). Unexpectedly the level of difficulty experienced in working on your own (X_7) and networking with other students (X_{12}) are each negatively related to Y_7.

ii) The parsimonious model

The parsimonious model is significant in explaining the variance in the perceived level of difficulty experienced by students in applying skills to specific business problems ($\bar{R}^2 = 0.399$) (Table 5.22.). Five variables are significant in predicting Y_7: satisfaction with Edinburgh Business School course materials in applying skills to specific business problems (X_{27}); whether the student had previously studied Economics (S_1); the level of challenge experienced interacting with EBS faculty (X_{11}); the sensing-intuitive learning style dimension (X_4); and the visual-verbal learning style dimension (X_5). The most important of these in terms of their level of influence on Y_7 is X_{27}.

The unstandardized regression coefficient for satisfaction with Edinburgh Business School course materials in applying skills to specific business problems (X_{27}) was 0.477 ($P \leq 0.001$). This means that for each one point increase on the five point scale measuring student satisfaction with EBS course materials, the perceived level of difficulty experienced by the student in applying skills to specific business problems decreases by 0.477 on the five point level of difficulty experienced scale.

The unstandardized regression coefficient on the dummy variable whether the student had previously studied Economics (S_1) is 0.257 (P≤0.05) implies that students with previous experience studying Economics benefit from this and the perceived level of difficulty experienced applying skills to specific business problems is reduced by 0.257 points on the five point level of difficulty experienced scale

The unstandardized regression coefficient on the challenge experienced interacting with EBS faculty (X_{11}) is 0.143 (P≤0.01) meaning that for each additional one point increase in the five point scale measuring the level of challenge interacting with EBS faculty, the perceived level of difficulty experienced by the student in applying skills to specific business problems building up knowledge of Economics eases by 0.143 on the five point level of difficulty experienced scale.

The unstandardized regression coefficient on the sensing-intuitive learning style variable (X_4) is 0.0510 (P≤0.01)) so for every one point move on the learning style index towards an intuitive learning style, the perceived level of difficulty students experience in applying skills to specific business problems eases by a 0.051 on the five points level of difficulty experienced scale.

The unstandardized regression coefficient on the visual-verbal learning style variable (X_5) is -0.056(P≤0.01). This means that for every one point increase in the learning style index towards a verbal learning style, the perceived level of difficulty students experience in understanding the theory and concepts of Economics increases by a 0.056 on the five points level of difficulty experienced scale.

Table 5.22. The parsimonious regression model with perceived level of difficulty applying skills to specific business problems (Y_7) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.971	0.271		3.578	0.000
(X_{27})Satisfaction EBS course materials applying skills to specific business problems	0.477	0.056	0.501	8.533	0.000
(S_1)Previously Studied Economics	0.257	0.104	0.139	2.477	0.014
(X_{11})Interacting with EBS faculty	0.143	0.045	0.186	3.188	0.002
(X_4)Sensing-Intuitive	0.051	0.019	0.151	2.719	0.007
(X_5)Visual-Verbal	-0.056	0.019	-0.169	-2.983	0.003

$F(5, 192)=27.136$***
$\bar{R}^2 = 0.399$
*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with the perceived level of difficulty experienced in applying skills to specific business problems as the dependent variable (y_7). The figures in parenthesis are t values and n = 197.

$Y_7 = \quad 0.971 + 0.477X_{27} + 0.257S_1 + 0.143X_{11} + 0.051X_4 - 0.056X_5$
$\qquad\qquad (8.53)*** \quad (2.48)* \quad\; (3.19)** \quad (2.72)** \quad (2.98)**$

Y_7 perceived level of difficulty experienced applying skills to specific business problems

X_{27} = satisfaction with EBS course materials applying skills to specific business problems

S_1 = previously studied of Economics

X_{11} = level of difficulty experienced interacting with EBS faculty

X_4 = sensing-intuitive learning style dimension

X_5 = visual-verbal learning style dimension

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.23).

Table 5.23. Correlations and collinearity statistics – perceived level of difficulty applying skills to specific business problems

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_{27})Satisfaction EBS course materials applying skills to specific business problems	0.574	0.524	0.471	0.884	1.131
(S_1)Previously Studied Economics	0.065	0.176	0.137	0.968	1.033
$(X1_1)$Interacting with EBS faculty	0.283	0.224	0.176	0.894	1.118
(X_4)Sensing-Intuitive	0.139	0.193	0.150	0.988	1.012
(X_5)Visual-Verbal	-0.258	-0.210	-0.165	0.952	1.051

Interpretation of the results

The research results reveal that, relative to other learning challenges in the study of Economics, applying skills to specific business problems is considered quite challenging (Appendix I), 23% of respondents scoring 2 or less on the Likert scale.

The best fit model accounts for 40% of the variance in the experience of students in applying skills to specific business problems in Economics. The course situation, measured by satisfaction with EBS course materials in applying skills to specific business problems in Economics, is positively and highly related to the perceived level

of difficulty experienced by students in applying skills to specific business problems in Economics (H29 is supported).

Previous study of Economics is of benefit when it comes to applying skills to specific business problems in Economics (H16 is supported) and to counteract this it might be beneficial to provide those new to Economics with additional learning resources to support applications of Economics theory to specific business problems. It might also be helpful to provide: additional content to the academic blog which has a clear focus on business applications; and also offer whiteboard tutorials which have a problem solving orientation i.e. start with a business problem and work back to the key Economics concepts and theories which are in play and then work towards a solution.

Students who find difficulty interacting with EBS faculty also tend to find applying skills to specific business problems difficult (H21 is supported).

In terms of student characteristics, the visual-verbal learning style dimension also proved to be significant in predicting the perceived level of difficulty experienced by students in applying skills to specific business problems in Economics. Visual learners find it easier than verbal learners (H5 is accepted); developing learning resources using spoken explanations to better help verbal learners would be appropriate to facilitate application of skills to business problems.

The sensing-intuitive learning style dimension is also important; more intuitive learners find it easier to apply skills to specific business problems than learners with a more sensing learning disposition (H4 is supported). To increase the capacity of sensing learners to apply skills to specific business problems it is necessary to provide a clearer connection between abstract theories and concepts to real business problems. Encouraging sensing learners to identify and explain the theories and concepts in play, starting from real world situations, will help hone their ability to apply their skills to actual business problems.

5.1.10 Student Experience Solving Complex Business Problems

    i)   Preliminary model of the perceived level of difficulty solving complex
           business problems in Economics (Y_8)

In the preliminary model, the variables which are hypothesised to be the most important in explaining students perceptions of the level of difficulty experienced solving complex business problems in Economics (Y_8) are: satisfaction with EBS course materials in solving complex business problems in (X_{28}); ability (X_1); previous attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2); English spoken as first language (E_1); and learning style (X_3-X_6). In the absence of literature specific to this issue, these variables were selected based on *a priori* reasoning and experience of working with online distance learning students. The variables were entered into the model simultaneously.

The results of the preliminary model fitting are presented in Table 5.24. Three variables proved to be significant in predicting Y_8: satisfaction with Edinburgh Business School course materials in solving complex business problems (X_{28}); whether the student had previously studied Economics (S_1); and the sensing-intuitive learning style dimension (X_4). The direction of the relationship between each of these variables and Y_8 was positive, as predicted. The resultant model is significant and explains 31% of the variance in the perceived level of difficulty experienced solving complex business problems ($\bar{R}^2 = 0.306$) (Table 5.24).

Table 5.24. Preliminary regression model with perceived level of difficulty solving complex business problems (Y_8) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.622	0.554		2.926	0.004
(X_{28})Satisfaction EBS course materials solving complex business problems	0.505	0.059	0.535	8.483	0.000
(X_1)Ability	-0.008	0.006	-0.090	-1.423	0.156
(Q_1)Degree Highest Qualfn	-0.168	0.131	-0.083	-1.284	0.201
(S_1)Previously Studied Economics	0.249	0.112	0.138	2.214	0.028
(G_1)Gender	0.042	0.127	0.022	0.331	0.741
(X_2)Age	-0.007	0.007	-0.060	-0.948	0.344
(E_1)English First Language	0.067	0.112	0.037	0.602	0.548
(X_3)Active-Reflective	-0.001	0.025	-0.002	-0.026	0.979
(X_4)Sensing-Intuitive	0.052	0.022	0.159	2.353	0.020
(X_5)Visual-Verbal	-0.011	0.021	-0.034	-0.505	0.614
(X_6)Sequential-Global	0.019	0.026	0.049	0.727	0.468

F(11,181)=8.687***
$\bar{R}^2 = 0.306$

*significant at P<0.05. **significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is only a slight improvement in variance explained ($\bar{R}^2 = 0.314$). The significant predictor variables are: satisfaction with EBS course materials in helping to solve complex business problems (X_{28}); previous study of Economics (S_1) (both with a positive direction of relationship with Y_8, as expected); and ability (X_1) (which unexpectedly

had a negative sign). It should be noted that the negative weight given to ability (X_1) in the regression is opposite in sign from its bivariate correlation with the criterion.

None of the following were significant in predicting Y_8: learning style; region; distance learning study context; employment status; whether had passed Economics at the first attempt; prior attainment of a degree level qualification; age; gender and English as first language.

    ii)   *The parsimonious model*

The best fit parsimonious model explained 33% of the variance in the perceived level of difficulty experienced by students in solving complex business problems ($\bar{R}^2$=0.329) (Table 5.25). In the model three variables were significant in predicting Y_8: satisfaction with Edinburgh Business School course materials in solving complex business problems (X_{28}), whether the student had previously studied Economics (S_1) and the sensing-intuitive learning style dimension (X_4). X_{28} is the most important in terms of level of influence on Y_8. Ability (X_1) is not significant in the parsimonious model.

The unstandardized regression coefficient for satisfaction with Edinburgh Business School course materials in solving complex business problems (X_{28}) was 0.520 (P$\leq$0.001). This implies that for each additional point increase in the five point scale measuring student satisfaction with EBS course materials, the perceived level of difficulty experienced by the student in solving complex business problems decreases by 0.520 on the five point level of difficulty experienced scale.

The unstandardized regression coefficient on the dummy variable whether the student had previously studied Economics (S_1) was 0.182 (P$\leq$0.079) meaning that students who had previously studied Economics report a significantly easier experience in solving complex business problems than students who had not; and in terms of the five point level of difficulty rating scale, previous experience studying Economics eases the experience of solving complex business problems by 0.182 points.

The unstandardized regression coefficient on the sensing-intuitive dimension (X_4) was 0.063 (P$\leq$0.001). This means that for every one point increase in the learning style index towards an intuitive learning style, the perceived level of difficulty experienced by students in solving complex business problems reduces by a 0.063 on the five point level of difficulty experienced scale.

Table 5.25. The parsimonious regression model with perceived level of difficulty solving complex business problems (Y_8) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.819	0.216		3.794	0.000
(X_{28})Satisfaction EBS course materials solving complex business problems	0.520	0.054	0.551	9.665	0.000
(S_1)Previously Studied Economics	0.182	0.103	0.101	1.766	0.079
(X_4)Sensing-Intuitive	0.063	0.019	0.192	3.385	0.001

F(3,206)=35.221***
$\overline{R}^2 = 0.329$

*significant at P<0.05. **significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

The best fit regression equation, therefore, is:

$$Y_8 = \quad 0.8129 \ + 0.520X_{28} \quad + 0.182S_1 \quad + 0.063X_4$$
$$\qquad\qquad (9.665)^{***} \quad (1.76) \qquad (3.385)^{**}$$

Y_8 = perceived level of difficulty experienced solving complex business problems

X_{28} = satisfaction with EBS course materials solving complex business problems

S_1 = previous study of Economics

X_4 = sensing-intuitive learning style dimension

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables.

Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.26.) .

Table 5.26. Correlations and Collinearity Statistics – perceived level of difficulty solving complex business problems

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_{28})Satisfaction EBS course materials solving complex business problems	0.542	0.559	0.547	0.986	1.014
(S_1)Previously Studied Economics	0.030	0.122	0.100	0.986	1.015
(X_4)Sensing-Intuitive	0.195	0.230	0.192	0.999	1.001

Interpretation of the results

Solving complex business problems is the most difficult aspect of the Economics study experience, relative to the other learning challenges considered in the research study (Appendix I), 32% of respondents scoring 2 or less on the Likert scale. This is hardly surprising given that this is a higher order learning outcome and particularly challenging for students who are in the early stages of the MBA programme.

The course situation, measured by satisfaction with EBS course materials in solving complex business problems in Economics, is positively and highly related to the perceived level of difficulty experienced by students solving complex business problems in Economics (H30 is supported).

As with applying skills to specific business problems in Economics, previous study of Economics continues to be of benefit in solving complex business problems (H16 is supported). To an extent there may be some level of shared solutions to helping students better address these higher order learning challenges. As previously mentioned, this implies the development of new learning resources to support problem solving, including whiteboard tutorials, online case teaching, and Economics related problem-oriented feature articles on the academic blog.

The sensing-intuitive learning style dimension is also significant in solving complex business problems (H4 is supported). Intuitive learners find it easier to link between business problems and abstract theories and concept. Additional learning resources which begin with real business problems and work back through to theory (identifying relevant theories and concepts which pertain to the problem and applying these to the case situation) towards a solution will benefit sensing learners. Online case teaching, whiteboard tutorials designed around business decision dilemmas or problems each potentially provide a rich environment to tackle the difficulties experienced by students.

5.2 Performance Outcomes – Economics Exam

5.2.1 Summary Results – Overall Performance in Economics Exam

With regard to academic achievement in Economics, models were calibrated for the following dependent variables: the overall result in the Economics exam (Y_9); result in multiple choice questions in the Economics exam only (Y_{10}); result in the case study question in the Economics exam only (Y_{11}); and result in essay questions in the Economics exam only (Y_{12}). The regression analysis took into account a wide set of independent variables, including those relating to: *student characteristics*; the *teaching context* (student satisfaction with EBS course materials); the *online distance learning study context* (student perceptions of challenges faced); and *teaching-learning processes* (learning challenges experienced in the study of Economics).

An overview of the research findings is provided in Table 5.27., and illustrated in Figure 5.5. 3P-e Full Theoretical Framework – Research Findings. Full details of the analysis in relation to overall performance in the Economics (as well as performance in particular aspects of the exam i.e. mcq, case and essay questions only) are provided in 5.2.3.-5.2.6.

The overall fit of the model developed to explain variation in overall performance in the Economics exam is good ($\bar{R}^2 = 0.41$). In terms of student characteristics, as expected, student ability (Hypothesis 31) and visual-verbal learning style (Hypothesis 35) are positively and significantly associated with overall performance in the Economics exam. Region (Africa), as expected, is also significantly but negatively related to overall performance in the Economics exam (Hypothesis 39 is accepted). Also significant, and positively related to overall performance in the Economics exam are two aspects of the *student learning experience:* the level of difficulty experienced by student in understanding numerical calculations, the level of difficulty experienced applying theory to business problems (Hypotheses 55 and 56 are accepted). The level of difficulty experienced applying skills to business problems is also significantly related to overall performance in the Economics exam, but the relationship is negative and this was not predicted (Hypothesis 59 is rejected).

The following variables were not statistically significant in predicting overall performance in the Economics exam: age (Hypothesis 32); active-reflective learning style (Hypothesis 33); sensing-intuitive learning (Hypothesis 34); sequential-global

learning style (Hypothesis 36); Region (with the exception of Africa) (Hypotheses 37-38, Hypothesis 40); English spoken as first language (Hypothesis 41); employment status (Hypothesis 42); gender (Hypothesis 43); First attempt (Hypothesis 44); Prior degree level qualification (Hypothesis 45); previous experience in study of Economics (Hypothesis 46); online distance learning study context variables (Hypotheses 47-52); learning challenges experienced in the study of Economics (Hypotheses 53-54, Hypothesis 57-58, Hypothesis 60).

Details of the variables which were significant in explaining performance in particular aspects of the Economics exams (mcq, case, essay) are provided in Sections 5.2.3.-5.2.6.

Table 5.27. Summary of Parsimonious Models - Regression Analysis (standardised coefficients)

	Model 9 Overall Economics exam mark (Y_9)	Model 10 Economics mcq mark (Y_{10})	Model 11 Economics case mark (Y_{11})	Model 12 Economics essay mark (Y_{12})
Significant Variables - Standardised Regression Coefficients				
Student characteristics				
Ability	0.568***	0.434***	0.290***	0.551***
Sequential-global learning style				
Visual-verbal learning style	-0.104**	-0.127*		
Gender		0.126*	-0.140*	
Region (Africa)	-0.143**	-0.234***		
Region (North America)			0.184**	
English first language			-0.221***	
Challenges experienced studying Economics				
Understanding numerical calculations				
Applying theory to business problems	0.231***	0.245***	0.206**	
Applying skills to business problems	0.153**		0.250**	0.110*
	-0.152*		-0.337***	
F	34.263***	28.667***	10.439***	49.436*
$\overline{R}^2$	0.484	0.390	0.261	0.310

*significant at P<0.05 **significant at P<0.01
***significant at P<0.0001

Figure 5.5. 3P-e Full Theoretical Framework – Research Findings

Presage   **Teaching –Learning Processes**   **Product**

Student
Characteristics

Visual-verbal learning style

Region Africa

Ability

-ve

-ve

+ve

Understanding numerical
calculations (Y₃)

_____

Applying theory to business
problems (Y₄)

_____

Applying skills to specific
business problems (Y₇)

+ve

+ve

-ve

Academic
Achievement

Online Distance
Learning Study
Context

NS
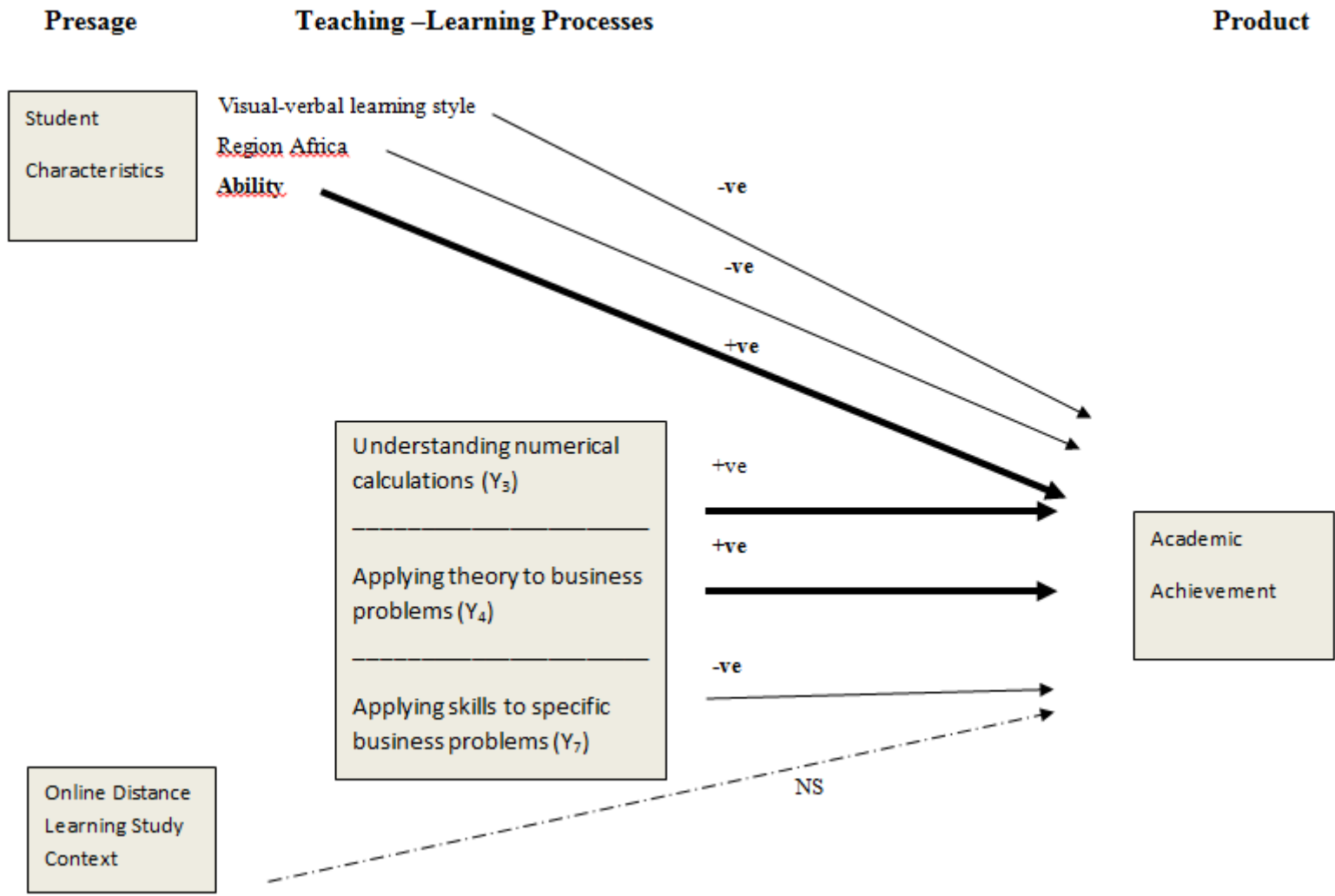
5.2.2 Descriptive Statistics

Table 5.28. provides a summary descriptive analysis together with the potential scoring range of the continuous and ordinal variables.

Table 5.28. Summary Descriptive Analysis and the Potential Scoring Range of Continuous and Ordinal Variables

	N	Mean	Standard Deviation	Range
Measure				
Dependent Variables:				
Performance Outcomes:				
(Y_9) Overall Economics exam %	225	59.78	12.23	0-100
(Y_{10}) MCQ %	225	57.47	16.56	0-100
(Y_{11}) Case Study %	225	71.58	25.56	0-100
(Y_{12}) Essay mark %	225	58.59	12.78	0-100
Independent Variables:				
Student characteristics				
(X_1) Ability	236	61.07	10.01	0-100
(X_2)Age	255	36.49	7.76	unbounded
Learning style				
(X_3)Active-Reflective learning style	254	6.91	2.30	1-12
(X_4)Sensing-intuitive learning style	254	5.86	2.73	1-12
(X_5)Visual-verbal learning style	254	4.70	2.75	1-12
(X_6)Sequential-global learning style	254	6.33	2.32	1-12

	N	Median		Range
Online distance learning study context				
(X_7)Working on your own	253	3.00		1-5
(X_8)Maintaining your motivation	254	3.00		1-5
(X_9)Managing your time	254	3.00		1-5
(X_{10})Building sense of belonging to EBS	248	3.00		1-5
(X_{11})Interacting with EBS faculty	235	3.00		1-5
(X_{12})Networking with other students	234	2.00		1-5

Learning challenges experienced in the
study of Economics:

(X_{23}) Building up knowledge of Economics	255	3.00	1-5
(X_{24}) Understanding theory and concepts	254	3.00	1-5
(X_{25}) Understanding numerical calculations	252	4.00	1.5
(X_{26}) Applying theory to business problems	251	3.00	1-5
(X_{27}) Understanding relevance of theory to real world	252	4.00	1-5
(X_{28}) Linking different theories together	252	3.00	1-5
(X_{29}) Applying skills to specific business problems	251	3.00	1-5
(X_{30}) Solving complex business problems	247	3.00	1-5

Fully detailed descriptive statistics for both dependent and independent variables are provided in Appendix I Descriptive Statistics Dependent and Independent Variables

5.2.3 Economics exam – overall result %

i)   *Preliminary model of overall percentage mark in the Economics exam (Y_9)*

The variables which are hypothesised to be most important in explaining a student's overall percentage mark in the Economics exam (Y_9) are: ability (X_1); prior attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2), English as a first language (E_1); and whether or not the student had passed the exam on the first sitting (P_1). These variables were selected based on the findings of previous research in the literature review in relation to overall academic performance in MBA study (Section 2.7.). The variables were entered into the model simultaneously.

Only one variable proved to be significant in predicting overall performance: mean exam score (all core subject exams taken, excluding Economics) (X_1) which is the proxy variable for IQ. As expected X_1, has a positive effect on overall Economics exam performance. The resultant model is significant and accounts for 41% of the variance in exam marks in Economics ($\bar{R}^2 = 0.408$) (Table 5.29).

Table 5.29. Preliminary regression model with overall economics exam mark (Y_9) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.209	6.241		0.514	0.608
(X_1)Ability	0.761	0.073	0.631	10.470	0.000
(Q_1)Degree Highest Qualfn	1.188	1.586	0.044	0.749	0.455
(S_1)Previously Studied Economics	-0.280	1.399	-0.012	-0.200	0.842
(G_1)Gender	1.685	1.478	0.065	1.140	0.256
(X_2)Age	0.147	0.091	0.093	1.608	0.110
(E_1)English First Language	-1.218	1.379	-0.051	-0.884	0.378
(P_1) Passed Exam 1st Time	3.772	2.610	0.084	1.445	0.150

$F(7,182)=19.609$***

$\bar{R}^2 = 0.408$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is a moderate increase in variance explained ($\bar{R}^2 = 0.495$). In addition to ability (X_1), certain challenges experienced in the study of Economics proved to be significant predictors of overall Economics exam performance (Y_9). The level of challenge experienced both in understanding numerical calculations (X_{15}) and in applying theory to business problems (X_{16}), are each significant and positively related to Y_9. Furthermore, the level of challenge experienced in applying skills to business problems (X_{19}) is significant but inversely related to Y_9.

Two further variables are of significance in predicting Y_9: the dummy variable African region (N_3) which has a negative sign indicating that African students, as expected, perform less well than the reference group, European students; and the visual-verbal learning style dimension (X_5) (as expected, students with a visual learning style performed better than students with a more verbal learning style in relation to Y_9).

Although not significant, the direction of the relationships are positive, as predicted, between the following students characteristics and Y_9: prior attainment of a degree (Q_1); previous experience studying Economics (S_1); whether passed the Economics exam at the first attempt (P_1). Unexpectedly, there is a positive relationship between both age (X_2) and gender (G_1) and Y_9, but neither of these relationships is significant. English as first language (E_1) and employment status (W_1) were also not significant; and unexpectedly, the direction of the relationship between each of these items and Y_9 is negative.

In terms of learning style, although not significant in predicting overall performance in the Economics exam (Y_9), the direction of the relationships between the active-reflective learning style dimension (X_3) and the sensing-intuitive learning style dimension (X_4) and Y_9 are positive, as predicted. Also, as predicted, there is a negative relationship between the sequential-global learning style dimension (X_6) and Y_9, but this is not significant. None of the variables relating to the online distance learning study context was significant in predicting Y_9. Also not significant in predicting Y_9 were the level of challenge faced by students: building up knowledge of Economics (X_{13}); understanding the theory and concepts of Economics (X_{14}); understanding the relevance of theory to the real world (X_{17}); linking different theories together (X_{18}); and solving complex business problems (X_{20}).

ii)   The parsimonious model

The parsimonious model explains 48% of the variance in overall performance in the Economics exam ($\bar{R}^2 = 0.484$) (Table 5.30). The following variables were significant in predicting overall performance in the Economics exam: ability (X_1); African region (N_3); visual-verbal learning style dimension (X_5); the level of difficulty experienced in the study of Economics relating to understanding numerical calculations (X_{15}); the level of difficulty experienced in the study of Economics relating to applying theory to business problems (X_{16}); the level of difficulty experienced in the study of Economics applying skills to specific business problems (X_{19}).

Ability (X_1) is the most important influence factor on Y_9 (standardised regression coefficient = 0.568), followed by the level of difficulty experienced understanding numerical calculations (standardised regression coefficient = 0.231)

The unstandardized regression coefficient for the proxy variable for ability (X_1) i.e. mean exam score (excluding Economics) was 0.690 meaning that for each 1 percentage point increase in mean score across all core exams (excluding Economics) students will improve their overall mark in the Economics exam by 0.7 percentage points. The unstandardized regression coefficient for African region (N_3) is -3.586 ($P \leq 0.01$). This implies that in terms of overall performance in the Economics exam, African students score on average 3.6% percentage points less than students from other regions.

On the visual–verbal learning style dimension (X_5) the unstandardized regression coefficient is -0.464 ($P \leq 0.05$). This means that for every ILS scale point increase towards a visual learning style, it is predicted that students will perform better by a margin of almost 0.5 percentage points in terms of their overall performance in the Economics exam.

In terms of the learning challenges experienced studying Economics, the results reveal a positive relationship between ease of understanding numerical calculations (X_{15}) and Y_9. The unstandardized regression coefficient is 2.646 ($P \leq 0.001$). For every rating scale increase towards an easier experience understanding numerical calculations, the Economics exam mark increases by 2.65 percentage points.

There is a positive relationship between the level of ease experienced in the study of Economics in relation to applying theory to business problems (X_{16}) and Y_9. The unstandardised regression coefficient is 2.052 ($P \leq 0.05$), so, for each rating scale increase towards an easier experience in relation to applying theory to business problems, a 2 percentage point improvement in performance in the Economics exam mark increases is predicted.

Interestingly there is a negative relationship between the level of ease experienced in applying skills to specific business problems and performance in the Economics exam. The unstandardized regression coefficient is -2.038 ($P \leq 0.05$). For each rating scale increase towards an easier experience in applying skills to specific business problems, a 2 percentage point drop in performance in the Economics exam is predicted. The Economics exam is not specifically designed to test application of skills to specific business problems.

Table 5.30. The parsimonious regression model with overall economics exam mark (Y_9) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	11.170	4.729		2.362	0.019
(X_1)Ability	0.690	0.062	0.568	11.121	0.000
(N_3)Region AFRICA	-3.586	1.252	-0.143	-2.864	0.005
(X_5)Visual-Verbal	-0.464	0.223	-0.104	-2.078	0.039
(X_{15})Understanding numerical calculations	2.646	0.600	0.231	4.413	0.000
(X_{16})Applying theory to business problems	2.052	0.946	0.153	2.170	0.031
(X_{19})Applying skills to specific business problems	-2.038	0.943	-0.152	-2.161	0.032

$F(6,207)=34.263$***

$\bar{R}^2 = 0.484$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with overall performance in the Economics exam as the dependent variable (Y_9).

$$Y_9 = 11.170 + 0.690\ X_1 - 3.586\ N_3 - 0.464X_5 + 2.646\ X_{15} + 2.052X_{16} - 2.038X_{19}$$
$$(11.10^{***})\quad (2.86^{**})\quad (2.08^*)\quad (4.41^{***})\quad (2.17^*)\quad (2.16^*)$$

Y_9 = overall performance in the Economics exam
X_1 = ability
N_3 = Region Africa
X_5 = visual verbal learning style dimension
X_{15} = level of challenge experienced understanding numerical calculations
X_{16} = level of challenge experienced applying theory to business problems
X_{19} = level of challenge experienced applying skills to specific business problems
*significant at P<0.05. **significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.31).

In terms of linearity, several alternative transformations of the variables were tested, including double logs, and semi-log transformations. In this particular model (Y_9), there was no improvement in the model so the percentage on percentage is retained (Appendix K Log Transformations).

Table 5.31. Correlations and collinearity statistics – overall economics exam mark

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_1)Ability	0.634	0.612	0.547	0.930	1.076
(N_3)Region AFRICA	-0.219	-0.195	-0.141	0.972	1.029
(X_5)Visual-Verbal	-0.089	-0.143	-0.102	0.970	1.030
(X_{15})Understanding numerical calculations	0.346	0.293	0.217	0.887	1.127
(X_{16})Applying theory to business problems	0.110	0.149	0.107	0.491	2.037
(X_{19})Applying skills to specific business problems	-0.007	-0.149	-0.106	0.492	2.034

Interpretation of the results

The analysis shows that both student characteristics and learning challenges experienced in the study of Economics are significantly related to examination performance in

Economics. Interestingly, there is no significant relationship between any of the online distance learning study context variables and examination performance.

The student characteristics which are significant in influencing examination performance: are: ability; whether or not the student is from Africa; and learning style preference on the visual-verbal dimension. Unsurprisingly students of higher ability perform better in the Economics exam than those of lower ability (H31 is supported). Students from African region perform less well than non-African students (H39 is supported), and students with a more visual learning style preference outperform students with a more verbal learning style preference (H35 is supported).

The findings suggest that African students may require additional support from EBS to address some of the difficulties they are experiencing. Further investigation is required on the nature of the particular difficulties experienced by African students; it may be possible to provide additional support through the provision of online tutorials to address conceptual bottlenecks.

The study also shows that examination performance is significantly related to particular learning challenges experienced in the study of Economics, specifically the level of difficulty experienced by students both in understanding numerical calculations (H55 is supported) and in applying theory to business problems (H56 is supported). From an EBS policy perspective, addressing these challenges is a priority and should be the focus of new learning resource development.

5.2.4 Economics Exam – Multiple Choice Questions Only

i) *Preliminary model of multiple choice question only mark in the Economics exam (Y_{10})*

The variables which are hypothesised to be most important in explaining a student's multiple choice questions mark in the Economics exam (Y_{10}) are: ability (X_1); prior attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2), English spoken as a first language (E_1); and whether or not the student had passed the exam on the first sitting (P_1). These variables were selected based on the findings of previous research in the literature review in relation to overall

academic performance in MBA (Section 2.7.). The variables were entered into the model simultaneously.

Three variables (X_1, G_1 and X_2) are significant in predicting performance in the multiple choice questions in the Economics (Y_{10}). In terms of X_1, students with higher ability (i.e. higher mean score across core exam subjects, excluding Economics) performed better in the multiple choice questions. In terms of G_1, unexpectedly male students performed better than female students and, also unexpectedly, in terms of X_2, older students performed better than younger students. The resultant model is significant and accounts for 32% of the variance in Y_{10} ($\bar{R}^2 = 0.315$) (Table 5.32).

Table 5.32. Preliminary regression model with economics multiple choice questions exam mark (Y_{10}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-10.705	9.005		-1.189	0.236
(X1)Ability	0.799	0.105	0.494	7.612	0.000
(Q1)Degree Highest Qualfn	1.910	2.288	0.053	0.835	0.405
(S1)Previously Studied Economics	-2.965	2.019	-0.092	-1.468	0.144
(G1)Gender	6.125	2.133	0.177	2.872	0.005
(X2)Age	0.314	0.132	0.149	2.382	0.018
(E1)English First Language	-3.196	1.989	-0.099	-1.606	0.110
(P1)Passed Exam 1st Time	6.306	3.766	0.105	1.674	0.096

$F_{(7,182)}=13.395$***

$\bar{R}^2 = 0.315$ *Significant at $p<0.05$. **Significant at $p<0.01$. ***Significant at $p<0.001$

When all other independent variables are added to the preliminary model, there is moderate improvement in the variance explained ($\bar{R}^2 = 0.423$). As well as the student characteristic ability (X_1), certain challenges experienced in the study of Economics

proved to be significant predictors of performance in the multiple choice questions in the Economics exam (Y_{10}). These include the levels of challenge experienced both in understanding numerical calculations (X_{15}) and in solving complex business problems (X_{20}), each positively related to Y_{10}. In addition the level of challenge experienced applying skills to specific business problems is significant but inversely related to Y_{10}.

As far as other student characteristics are concerned, three variables are of significance in predicting Y_{10}: the variable African region (N_3) has a negative sign indicating that, as expected, African students fared less well than the reference group, European students; the visual-verbal learning style dimension (X_5) which also has a negative sign (as expected students with a visual learning style performed better than students with a more verbal learning style in the Economics exam); and finally the active-reflective learning style dimension (X_3) which has a positive sign, as expected. Students with more reflective learning styles performed better than students with more active learning styles in the multiple choice questions in the Economics exam.

Although not significant, the direction of the relationship was, as expected, positive between the following variables and Y_{10}: prior attainment of a degree (Q_1); and whether passed the Economics exam at the first attempt (P_1). Also not significant, but with an unexpected negative relationship with Y_{10} are the following: English as a first language (E_1), previous experience studying Economics (S_1), and employment status (W_1). Unexpectedly, a positive relationship is noted between both age (X_2) and gender (G_1) and Y_{10} but these relationships are not significant.

Neither the sensing-intuitive learning style dimension (X_4), nor the global-sequential learning style dimension (X_6) is significant in explaining Y_{10}. African region aside, region also did not prove to be a significant explanatory variable of Y_{10}.

None of the distance learning study context proved to be significant in explaining Y_{10}. The relationships between the level of challenge experienced working on your own, the level of challenge experienced maintaining your motivation, and the level of challenge experienced interacting with EBS faculty and Y_{10}, although positive, were not significant. Students who experienced less difficulty in relation to each of these performed better in multiple choice questions in the Economics exam.

The level of challenge experienced managing time, building a sense of belonging to EBS, and interacting with other students were also not significant in explaining Y_{10}, and the direction of the relationship was negative in each instance, which was not expected.

In terms of learning challenges, apart from the perceived level of challenge both understanding numerical calculations and solving complex business problems, none of the learning challenge variables were significant in explaining Y_{10}.

ii)   The parsimonious model

The best fit model is significant with an $\bar{R}^2$ of 0.390 (Table 5.33.). The five variables which are significant in predicting performance in the multiple choice questions in the Economics exam are: ability (X_1); the level of difficulty the student had experienced in the study of Economics in relation to understanding numerical calculations (X_{15}); dummy variable Africa (N_3); visual-verbal learning style (X_5) and gender (G_1).

The most important factor in explaining Y_{10} is ability (X_1) (Standardised regression coefficient = 0.434). The unstandardized regression coefficient for the proxy variable for ability (X_1) is 0.718 ($P \leq 0.001$) implying that for each 1% increase in the mean score across all core course exams (excl Economics), students will improve their mark in the multiple choice question in Economics by 0.7%.

The ease of understanding numerical calculations (X_{15}) is the next most important independent variable; the results reveal a positive relationship between ease of understanding numerical calculations and performance in the multiple choice questions in the Economics exam. The unstandardized regression coefficient for X_{15} is 3.812 ($P \leq 0.001$), implying that for every rating scale increase towards an easier experience in understanding numerical calculations, the Economics multiple choice questions mark increases by 3.8 percentage points.

The unstandardized regression coefficient for African region (N_3) is -7.943, ($P \leq 0.001$) This means that compared to students from other regions, African students are predicted

to score 7.9 percentage points less in the multiple choice questions in the Economics exam.

On the visual–verbal learning style dimension (X_5) the unstandardized regression coefficient is -0.771 ($P \leq 0.05$). This means that for every ILS scale point moved towards a visual learning style, it is predicted that students will perform better, by almost 0.8 percentage points, in the multiple choice questions in the Economics exam. As far as gender (G_1) is concerned the unstandardized regression coefficient is 4.370 ($P \leq 0.05$). This implies that males score, on average, 4.4 percentage points more than females in multiple choice questions in the Economics exam.

Table 5.33. The parsimonious regression model with economics multiple choice question exam mark (Y_{10}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	3.463	6.361		0.544	0.587
(X_1)Ability	0.718	0.091	0.434	7.874	0.000
(G_1)Dummy Gender	4.370	1.993	0.126	2.192	0.029
(X_5)Visual-Verbal	-0.771	0.343	-0.127	-2.250	0.026
(N_3)Region AFRICA	-7.943	1.843	-0.234	-4.311	0.000
(X_{15})Understanding numerical calculations	3.812	0.855	0.245	4.461	0.000

$F(5,211)=28.667***$
$\bar{R}^2 = 0.390$

*Significant at p<0.05. **Significant at p<0.01. ***Significant at p<0.001.

The best fit regression equation

Regression equation with performance in the multiple choice questions in the Economics exam as the dependent variable (Y_{10}). The figures in parenthesis are t values and n = 216.

$$Y_{10 =} \ 3.463 \quad + 0.718 \ X_1 \quad + 4.37 G_1 \ - \ 7.943 N_3 \ - \ 0.771 \ X_5 \quad + 3.812 X_{15}$$
$$\quad\quad\quad\quad (7.87**) \quad (2.19*) \quad (4.31**) \quad (2.25*) \quad (4.46**)$$

Y_{10} = overall performance in multiple choice questions in the Economics exam
X_1 = ability
G_1 = gender
N_3 = region Africa
X_5 = visual verbal learning style dimension
X_{15} = level of challenge experienced understanding numerical calculations

*Significant at $p<0.05$. **Significant at $p<0.01$. ***Significant at $p<0.001$.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.34.) .

In terms of linearity, because the model features interval variables as both dependent and independent variables, several alternative transformations of the variables were tested, including double logs, single (dependent variable) and single logs (independent variable). In this particular model (Y_{10}), for X_1 the single log (dependent variable) showed a marginal improvement; the correlation coefficient increased from r=0.504 to r=0.512 and adjusted R^2 increased from 0.390 to 0.395. Given that the improvement is only marginal it was decided to retain the percentage on percentage alternative in the best fit model (Appendix K Log Transformations).

Table 5.34. Correlations and collinearity statistics –economics multiple choice questions exam mark

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_1)Ability	0.499	0.477	0.418	0.927	1.079
(G_1)Gender	0.137	0.149	0.116	0.849	1.178
(X_5)Visual-Verbal	-0.172	-0.153	-0.120	0.880	1.137
(N_3)Region AFRICA	-0.273	-0.285	-0.229	0.962	1.040
(X_{15})Understanding numerical calculations	0.346	0.294	0.237	0.932	1.072

Interpretation of the results

There is a statistically significant relationship between certain student characteristics and performance in the multiple choice questions in the Economics exam, namely: ability; gender, their learning style preference on the visual-verbal dimension; and whether or not the student is from Africa. In addition, there is a statistically significant relationship between performance in the multiple choice questions and the level of difficulty experienced in the study of Economics in understanding numerical calculations.

Students of higher ability perform better than those of lower ability in the multiple choice questions (H31 is supported), and male students perform better than female students (H43 is rejected). Students with a more visual learning style preference outperform students with more verbal learning tendencies (H35 is supported), and students of African region do not perform as well in the multiple choice questions as non-African students (H39 is supported).

In terms of the learning challenges experienced in the study of Economics only one variable is significant as a predictor of performance in the multiple choice questions and that is the level of difficulty experienced understanding numerical calculations; students who struggle with numerical calculations in Economics do not perform well in the multiple choice questions in the Economics exam (H55 is supported). None of the distance learning study context variables is significant in predicting performance in the multiple choice questions in the Economics exam.

In terms of the implications of these findings, again, it looks to be appropriate to develop EBS learning resources to better help students to overcome the difficulties they face in understanding numerical calculations. The solutions should endeavour to address students learning style preferences across the visual-verbal continuum, voiced whiteboard tutorials tackling numerical questions and working through calculations together with the student would likely be helpful, Also synchronous tutor-led tutorials tackling numerical calculations would likely be of benefit.

5.2.5 Economics Exam – Case Study Question Only

i)   *Preliminary model of case study only mark in the Economics exam (Y_{11})*

The variables which are hypothesised to be most important in explaining a student's case study percentage mark in the Economics exam are: ability (X_1); prior attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2), English as a first language (E_1); and whether or not the student had passed the exam on the first sitting (P_1). These variables were selected based on the findings of previous research in the literature review in relation to overall academic performance in MBA (Section 2.7.). The variables were entered into the model simultaneously.

The variables were entered into the model simultaneously and three variables are significant in explaining Y_{11}: ability (X_1); gender (G_1); and whether English is the student's first language (E_1). As expected, there is a positive relationship between X_1 and Y_{11}. In terms of G_1, the findings are also as expected: there is a significant negative relationship between male gender and Y_{11}, meaning females performed better than males in the case study question in the Economics exam (in contrast to multiple choice questions).

An unexpected finding is that is there is a negative relationship between E_1 and Y_{11}; students for whom English is not their first language perform better in the case study question in the Economics exam than students who do speak English as their first language.

The resultant model accounts for only 17% of the variance in performance in the case question in the Economics exam ($\bar{R}^2$=0.171) (Table 5.35).

Table 5.35. Preliminary regression model with economics exam case mark % (Y_{11}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	16.848	15.442		1.091	0.277
(X_1)Ability	0.891	0.180	0.353	4.950	0.000
(Q_1)Degree Highest Qualfn	3.052	3.924	0.054	0.778	0.438
(S_1)Previously Studied Economics	2.176	3.463	0.043	0.628	0.530
(G_1)Gender	-7.458	3.658	-0.138	-2.039	0.043
(X_2)Age	0.059	0.226	0.018	0.259	0.796
(E_1)English	-11.422	3.411	-0.227	-3.348	0.001
(P_1)Passed 1st Time	6.048	6.458	0.065	0.936	0.350

$F(7,182)=6.579$***
$\bar{R}^2 = 0.171$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all the other independent variables are added to the preliminary model, there is a marked improvement in variance explained ($\bar{R}^2 = 0.340$). Ability (X_1) and English as first language (E_1) are both significant. Ability is, as expected, positively related, to Y_{11}, however, unexpectedly the direction of the relationship is negative between English as first language and Y_{11}. This implies that students for whom English is not their first language perform better in the case study question in the Economics exam than students who do speak English as their first language.

As far as other student characteristics are concerned, one further variable proved to be of significance in predicting Y_{11} and that is the variable North American region (N_1) which has a positive sign, indicating that North American students fared better than European students (the reference group) in the case study question in the Economics exam.

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The following challenges experienced in the study of Economics also proved to be significant predictors of Y_{11}: the level of challenge experienced understanding numerical calculations (X_{15}) (positive relationship, as expected); and the level of challenge experienced applying skills to specific business problems (X_{19}) (unexpectedly a negative relationship).

North American region aside, region is not a significant variable in predicting T_{11}. The distance learning context variables were also not significant in predicting Y_{11}. Although not significant in predicting Y_{11}, as expected, a positive relationship was found between each of the following learning challenges and Y_{11} : understanding the theory and concepts of Economics; applying theory to business problems; understanding the relevance of theory; linking different theories together; and solving complex business problems. Also not significant is the relationship between building up knowledge of Economics and Y_{11}; unexpectedly the direction of this relationship is negative.

ii)   The parsimonious model

The parsimonious model has an $\bar{R}^2$ of 0.261 (Table 5.36). In all, seven variables are of significance in predicting Y_{11}: ability (X_1); gender (G_1); English as first language (E_1); North America region (N_1); the challenges the student had experienced in the study of Economics in relation to understanding numerical calculations (X_{15}); the challenges the student had experienced in the study of Economics in relation to applying theory to business problems (X_{16}); and the challenges the student had experienced in the study of Economics in relation to applying skills to specific business problems (X_{19}) (Table 5.36).

The unstandardized regression coefficient for ability (X_1) is 0.737 ($P \leq 0.001$) implies that for each 1% increase in mean score across all core exams (excluding Economics) students will improve their mark in the case study question in the Economic exam by 0.74 percentage points. The unstandardised regression coefficient for gender (G_1) is -7.616 ($P \leq 0.05$). This means that female students are predicted to score 7.6 percentage points higher than male students in the case study question in the Economics exam.

The regression coefficient for English as first language (E_1) is -11.213 (P≤0.001) which means that students for whom English is their first language perform less well and are predicted to score 11.2 percentage points less in case study questions in the Economics exam than those students who do not speak English as their first language. In terms of the variable North America region (N_1), the unstandardized regression coefficient for North America is 14.019 (P≤0.01). This implies that in terms of performance in case study questions in the Economics exam, North America students score on average 14.0 percentage points more than students from other regions.

As far as the learning challenges experienced studying Economics are concerned, the positive relationship between the level of difficulty experienced understanding numerical calculations (X_{15}) (unstandardized regression coefficient is 5.086 (P≤ 0.01) and also applying theory to business problems (X_{16}) (unstandardized regression coefficient is 6.993(P≤ 0.01) implies that for every rating scale increase towards an easier experience understanding numerical calculations, the Economics case study exam mark increases by 5.1 percentage points; and for every rating scale increase towards an easier experience applying theory to business problems, the Economics case study exam mark increases by 7.0 percentage points.

With regard to the learning challenge studying Economics in applying skills to specific business problems (X_{19}) a quite unexpected finding is that there is a negative relationship between the level of ease experienced by the student and Y_{11}. For every rating scale increase towards an easier experience applying skills to specific business problems, the Economics case study exam mark decreases by 9.5 percentage points.

Table 5.36. The parsimonious regression model with economics exam case mark % (Y_{11}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	24.904	12.331		2.020	0.045
(X_1)Ability	0.737	0.166	0.290	4.443	0.000
(G_1)Gender	-7.616	3.500	-0.140	-2.176	0.031
(E_1)English First Language	-11.213	3.351	-0.221	-3.346	0.001
(N_1)Region N AMERICA	14.019	4.959	0.184	2.827	0.005
(X_{15})Understanding numerical calculations	5.086	1.712	0.206	2.971	0.003
(X_{16})Applying theory to business problems	6.993	2.549	0.250	2.743	0.007
(X_{19})Applying skills to specific business problems	-9.532	2.596	-0.337	-3.671	0.000

$F(7,180)=10.439$

$\bar{R}^2 = 0.261$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with performance in the case question in the Economics exam as the dependent variable (Y_{11}). The figures in parenthesis are t values and n = 187.

$Y_{11} = 24.904 + 0.737\ X_1 - 7.616\ G_1 - 11.213E_1 + 14.02N_1 + 5.086X_{15} + 6.993X_{16} - 9.532X_{19}$
$\qquad\qquad$ (4.44***) (2.28**) (3.35***) (2.83**) (2.97**) (2.74**) (3.67***)

Y_{11} = overall performance in the case study question in the Economics exam
X_1 = ability
G_1 = gender
E_1 = English 1st language
N_1 = region North America
X_{15}= level of challenge experienced understanding numerical calculations
X_{16}= level of challenge experienced applying theory to business problems
X_{19}= level of challenge experienced applying skills to business problems
*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.37.) .

In terms of linearity, because the model features interval variables as both dependent and independent variables, several alternative transformations of the variables were tested, including double logs, single (dependent variable) and single logs (independent variable). In this particular model (Y_{11}), there was no improvement in the model so the percentage on percentage is retained (Appendix K Log Transformations).

Table 5.37. Correlations and collinearity statistics –economics case mark

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_1)Ability	0.346	0.314	0.279	0.926	1.080
(G_1)Gender	-0.136	-0.160	-0.137	0.958	1.044
(E_1)English First Language	-0.165	-0.242	-0.210	0.908	1.101
(N_1)Region N AMERICA	0.144	0.206	0.178	0.931	1.074
(X_{15})Understanding numerical calculations	0.209	0.216	0.187	0.822	1.216
(X_{16})Applying theory to business problems	0.024	0.200	0.172	0.474	2.110
(X_{19})Applying skills to specific business problems	-0.170	-0.264	-0.231	0.468	2.135

Interpretation of the results

The analysis shows that there is a statistically significant relationship between performance in the case study question in the Economics exam and particular student characteristics and specific learning challenges experienced in the study of Economics. None of the distance learning study context variables is significant in predicting performance in the case study question in the exam.

As with performance in the multiple choice questions, ability is significantly related to performance in the case study question (H31 is supported). With regard to gender, however, female students outperformed male students (H43 is supported) (the opposite is the case with reference to multiple choice questions).

Performance in the case study question is also affected by whether or not the student is from North America; students who are North American outperform those who are not (H37 is rejected). Interestingly, English as first language also proved to be a significant variable but not in the way expected; students for whom English is NOT their first language outperformed English as first language speakers in the case study question (H41 is rejected).

The study shows that performance in the case study question in the Economics exam is significantly related to the level of difficulty experienced by students both in understanding numerical calculations and applying theory to business problems (both H55 and H56 are supported).

The analysis also reveals that the level of difficulty students experience in applying skills to specific business problems is inversely related to performance in the case study question (H59 is rejected); the case study question is not based on applying skills to specific Economics problems in industry so this is not surprising.

From an EBS policy perspective the consistent emergence of the learning challenges associated with understanding numerical calculations and applying theory to business problems reinforce the importance of taking action to address these difficulties; there is a clear need to develop the EBS course offering.

5.2.6 Economics Exam – Essay Question Only

i)   Preliminary model of essay only mark in the Economics exam (Y_{12})

The variables which are hypothesised to be most important in explaining student performance in the essay questions only in the Economics exam (Y_{12}) are: ability (X_1); prior attainment of a degree level qualification (Q_1); previous study of Economics (S_1); gender (G_1); age (X_2), English as a first language (E_1); and whether or not the student had passed the exam on the first sitting (P_1). These variables were selected based on the findings of previous research in the literature review in relation to overall academic performance in MBA study (Section 2.7.). The variables were entered into the model simultaneously.

Only two variables are significant in predicting Y_{12}: ability (X_1); and whether English was the student's first language (E_1). As expected, there was a positive relationship between both X_1 (ability) and E_1 and Y_{12}. The resultant model is significant and accounts for 31% of the variance in performance in the essay questions in the Economics exam ($\bar{R}^2 = 0.308$) (Table 5.38).

Table 5.38. Preliminary regression model with economics exam essay mark % (Y_{12}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	10.801	6.964		1.551	0.123
(X_1)Ability	0.690	0.081	0.554	8.496	0.000
(Q_1)Degree Highest Qualfn	0.146	1.770	0.005	0.082	0.935
(S_1)Previously Studied Economics	1.051	1.562	0.042	0.673	0.502
(G_1)Gender	0.645	1.650	0.024	0.391	0.696
(X_2)Age	0.042	0.102	0.026	0.407	0.685
(E_1)English First Language	2.895	1.538	0.116	1.882	0.061
(P_1)Passed Exam 1st Time	1.566	2.913	0.034	0.538	0.591

F(7,182)=12.994**

$\bar{R}^2 = 0.308$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is a slight improvement in variance explained ($\bar{R}^2 = 0.311$). The significant predictors of Y_{12} are: ability (X_1); the challenges the student had experienced in the study of Economics in relation to understanding theory and concepts (X_{14}); and the challenges the student had experienced in the study of Economics in relation to applying theory to business problems (X_{16}). For the level of challenge experienced applying theory to business problems, the direction of the relationship is positive, as expected, however, with regard to the level of challenge understanding theory and concepts, the direction of the relationship is negative, which is unexpected.

The relationship between the following student characteristics and Y_{12} were not significant: prior attainment of a degree level qualification; age; gender; employment status; previous experience studying Economics; English as a first language; and whether passed the Economics exam at the first attempt. Learning style is not significant in predicting Y_{12}. The distance learning context variables are also not significant in predicting Y_{12}.

ii) The parsimonious model

The parsimonious model explains 31% of the variance in the Economics exam essay mark (Y_{12}) ($\bar{R}^2 = 0.310$) (Table 5.39.). Only two variables are of significance in predicting Y_{12} and these are: ability (X_1); and the challenges the student had experienced in the study of Economics in relation to applying theory to business problems (X_{16}). Ability (X_1) is the most important independent variable (standardised regression coefficient = 0.551). The unstandardized regression coefficient for ability is 0.696 ($p\leq0.001$) meaning that for each 1% increase in mean score across all core exams (excluding Economics) students will improve their mark in the essay questions in the Economic exam by 0.7 percentage points.

In terms of the learning challenges experienced studying Economics, the results reveal a positive relationship between the level of ease experienced in relation to applying theory

to business problems and Y_{12}. The unstandardised regression coefficient is 1.542 ($P \leq 0.053$), so for every rating scale increase towards an easier experience applying theory to business problems, the Economics exam essay mark is predicted to increase by 1.5 percentage points. Ability (X_1) is, however, the most important independent variable as shown by the standardised regression coefficient.

Table 5.39. The parsimonious regression model with economics exam essay mark % (Y_{12}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	10.763	5.172		2.081	0.039
(X_1)Ability	0.696	0.071	0.551	9.747	0.000
(X_{16})Applying theory to business problems	1.542	0.792	0.110	1.948	0.053

F(2,214)=49.436*
$\bar{R}^2 = 0.310$

*significant at P<0.05. **significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with performance in the multiple choice questions in the Economics exam as the dependent variable (Y_{12}). The figures in parenthesis are t values and n = 216.

$Y_{12} = 10.763 \quad + 0.696 \, X_1 \quad + 1.542 \, X_{16}$
$\qquad\qquad\quad (9.747^{***}) \qquad (1.95)$

Y_{12} = overall performance in the essay questions in the Economics exam
X_1 = ability
X_{16}= level of difficulty experienced applying theory to business problems
*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.
Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and

multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 5.40.) .

In terms of linearity, because the model features interval variables as both dependent and independent variables, several alternative transformations of the variables were tested, including double logs, single (dependent variable) and single logs (independent variable). In this particular model (Y_{12}), for X_1 the single log (independent variable) showed a marginal improvement; the correlation coefficient increased from r=0.551 to r=0.561 and adjusted R^2 increased from 0.310 to 0.321. Given that the improvement is only marginal it was decided to retain the percentage on percentage alternative in the best fit model (Appendix K Log Transformations).

Table 5.40. Correlations and collinearity statistics – economics exam essay mark %

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_1)Ability	0.551	0.554	0.551	1.000	1.000
(X_{16})Applying theory to business problems	0.111	0.132	0.110	1.000	1.000

Interpretation of the results

The analysis reveals that there are statistically significant relationships between only two of the variables considered and performance in the essay questions in the Economics exam. These are: ability; and the level of difficulty experienced applying

theory to business problems. None of the distance learning context variables were significant.

Ability is positively related to performance in the essay questions in the exam (H31 is supported) and is the most important independent variable as shown by the standardised regression coefficient (.551). The level of difficulty experienced in applying theory to business problems is also positively related to Y_{12} (H56 is supported); students who find it difficult to apply theory to business problems do less well in the essay questions in the Economics exam.

Chapter 6 Econometric Analysis – Other Core Subjects

6.1 Summary Results – Performance in Other Core Subjects

As noted in Section 4.4., in order to provide a point of comparison, analysis was undertaken in relation to academic achievement in the other core courses on the MBA programme. However, in the absence of data on the learning challenges experienced by students in studying other core subjects, this analysis was restricted to student characteristics and online distance learning study context as potential explanatory variables of academic achievement in those subjects (see Figure 4.6. Theoretical Framework Other Core Course).

Whereas in Economics the level of explanation of academic achievement was $\bar{R}^2 =$ 0.41, for other core subjects lower levels of explanation of academic achievement were achieved (See Table 6.1). Interestingly, even with a restricted set of variables, the level of explanation achieved for Finance was $\bar{R}^2 = 0.47$. For all of the core courses, (excluding Marketing), just a single variable accounted for variation in academic achievement and that was student ability (measured by performance across all core courses on the MBA excluding the course being considered as the dependent variable) (Hypothesis 61 is accepted across all other core courses).

With regard to Marketing the other variables which proved to be significant and positively related to examination performance are: English as first language (H71 is supported); level of difficulty building a sense of belonging to EBS (H80 is supported); level of difficulty experienced interacting with EBS faculty (H81 is supported); and finally employment status proved to be significant (H 72 is supported).

In relation to Organisational Behaviour, as well as student ability, gender also proved to be a significant variable in predicting examination performance, with females outperforming males in the Organisational Behaviour examination (H73 is supported).

Table 6.1. Summary of Parsimonious Models Other Core Exams- Regression Analysis (standardised coefficients)

	Model 13 Project Mgmt Exam (Y_{13})	Model 14 Acctg Exam (Y_{14})	Model 15 Finance Exam (Y_{15})	Model 16 Marketing Exam (Y_{16})	Model 17 Org Behaviour (Y_{17})
Significant Variables Standardised Regression Coefficients					
Student characteristics					
Student Ability	0.535***	0.589***	0.689***	0.520***	0.539***
English as first language				0.271***	
Employed				0.146*	
Gender					-0.147*
Online distance learning study context					
Interacting with faculty				-0.284***	
Building sense of belonging to EBS				0.182*	
F	59.662***	80.884***	118.116***	14.774***	46.338***
$\bar{R}^2$	0.281	0.343	0.470	0.352	0.309

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

6.2 Descriptive Statistics

Table 6.2. provides a summary descriptive analysis together with the potential scoring range of the continuous variables. Fully detailed descriptive statistics for both dependent and independent variables are provided in Appendix I.

Table 6.2. Summary Descriptive Analysis and the Potential Scoring Range of Continuous and Ordinal Variables

	N	Mean	Standard Deviation	Range
Measure				
Dependent Variables:				
Performance Outcomes:				
(Y_{13}) Project Management exam %	151	65.13	11.98	0-100
(Y_{14}) Accounting exam %	155	63.65	14.10	0-100
(Y_{15}) Finance exam %	133	60.59	15.74	0-100
(Y_{16}) Marketing exam %	160	60.73	10.11	0-100
(Y_{17}) Organisational Behaviour exam %	209	61.63	9.36	0-100

	N	Mean	Standard Deviation	Range
Independent Variables:				
Student characteristics				
(X_1) Ability	236	61.07	10.01	0-100
(X_2)Age	255	36.49	7.76	unbounded
Learning style				
(X_3)Active-reflective learning style	254	6.91	2.30	1-12
(X_4)Sensing-intuitive learning style	254	5.86	2.73	1-12
(X_5)Visual-verbal learning style	254	4.70	2.75	1-12
(X_6)Sequential-global learning style	254	6.33	2.32	1-12

	N	Median		
Online distance learning context				
(X_7)Working on your own	253	3.00		1-5
(X_8)Maintaining your motivation	254	3.00		1-5
(X_9)Managing your time	254	3.00		1-5
(X_{10})Building sense of belonging to EBS	248	3.00		1-5
(X_{11})Interacting with EBS faculty	235	3.00		1-5
(X_{12})Networking with other students	234	2.00		1-5

6.3 Project Management Exam – Overall Mark

i)   *Preliminary model of overall percentage mark in the Project Management exam (Y$_{13}$)*

The variables which were hypothesised to be of most statistical relevance in predicting a student's overall mark in the Project Management exam are: ability (X$_1$); prior attainment of a degree level qualification (Q$_1$); gender (G$_1$); age (X$_2$); and English spoken as a first language (E$_1$). These variables were selected based on the findings of previous research in the literature review in relation to overall academic performance in MBA study (Section 2.7.). The variables were entered into the model simultaneously.

Only one variable is significant in predicting Y$_{13}$: ability (X$_1$). As expected this variable has a positive effect on performance in the Project Management exam. The resultant model is significant and accounts for 26% of the variance in overall performance in the Project Management exam ($\bar{R}^2 = 0.263$) (Table 6.3.).

Table 6.3. Preliminary regression model with overall Project Management exam mark (Y$_{13}$) as dependent variable.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	29.150	7.560		3.856	0.000
(X$_1$)Ability	0.614	0.093	0.499	6.566	0.000
(Q$_1$)Degree Highest Qualfn	2.451	1.952	0.100	1.255	0.212
(G$_1$)Gender	0.045	1.859	0.002	0.024	0.981
(X$_2$)Age	-0.050	0.111	-0.035	-0.447	0.656
(E$_1$)English First Language	-2.470	1.788	-0.106	-1.382	0.169

F(5,125)=10.279***

$\bar{R}^2 = 0.263$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all independent variables are added to the preliminary model, there is a decrease in the level of variance explained ($\bar{R}^2 = 0.187$). Only ability (X_1) (mean score across the core subjects excluding Project Management) proved to be significant, and the direction of the relationship with Y_{13} is, as expected, positive.

Although not significant in explaining variation on $Y_{13,}$ the direction of the relationship between prior attainment of a degree level qualification (Q_1) and performance in the Project Management exam is positive, as expected. Unexpectedly there is a positive relationship between male gender (G_1) and $Y_{13,}$ and a negative relationship between English as first language (E_1) and Y_{13}. Age (X_2) is not significant in explaining Y_{13}, the direction of the relationship is negative, as expected.

Neither learning style nor region is significant in predicting Y_{13}.

Furthermore, none of the distance learning context variables are significant in predicting Y_{13}. All distance learning context variables have a positive relationship with the dependent variable, as expected, but with two exceptions: the level of difficulty managing time (X_9); and the level of difficulty working on your own (X_7), both of which are negatively related to $Y_{13.}$

ii)   The parsimonious model

The parsimonious model is significant with $r^2 = 0.281$ (Table 6.4.). Only ability (X_1) is significant in predicting $Y_{13.}$ The unstandardized regression coefficient for the proxy variable for ability i.e. mean exam score (excluding Project Management) is 0.670 ($P \leq 0.001$) meaning that for each 1 percentage point increase in mean score across all core exams (excluding Project Management) students can expect to increase their overall mark in the Project Management exam by 0.7 percentage points.

Table 6.4. The parsimonious regression model with overall Project Management exam mark (Y_{13}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	23.763	5.418		4.386	0.000
(X_1)Ability	0.670	0.087	0.535	7.724	0.000

F(1,149)=59.662***
$r^2 = 0.281$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with overall performance in the Project Management exam as the dependent variable (Y_{13}). The figures in parenthesis are t values and n = 150.

$$Y_{13} = 23.763 + 0.670 \, X_1$$
$$(7.72***)$$

Y_{13} = overall performance in the Project Management exam
X_1 = ability (mean score across all core subjects (excluding Project Management))

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots.

In terms of linearity, because the model features interval variables as both dependent and independent variables, several alternative transformations of the variables were tested, including double logs, single (dependent variable) and single logs (independent variable). In this particular model (Y_{13}), there was no improvement in the model so the percentage on percentage is retained (Appendix K Log Transformations).

6.4 Accounting Exam – Overall Mark

> i) *Preliminary model of overall percentage mark in the Accounting exam (Y_{14})*

The variables which were hypothesised to be most important in explaining a student's overall mark in the Accounting exam are: ability (X_1); prior attainment of a degree level qualification (Q_1); gender (G_1); age (X_2); and English spoken as a first language (E_1). These variables were selected based on the findings of previous research in the literature review in relation to overall academic performance in MBA study (Section 2.7.). The variables were entered into the model simultaneously.

Only one variable proved to be significant in predicting overall performance: ability (mean score across all core subject exams excluding Accounting). As expected ability has a positive effect on performance in the Accounting exam. The resultant model was significant ($\bar{R}^2 = 0.352$) in explaining variance in overall performance in the Accounting exam (Table 6.5.)

Table 6.5. Preliminary regression model with overall Accounting exam mark (Y_{14}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	7.509	8.889		0.845	0.400
(X_1)Ability	0.997	0.116	0.612	8.567	0.000
(Q_1)Degree highest qualfn	-2.871	2.258	-0.094	-1.272	0.206
(G_1)Gender	1.831	2.104	0.062	0.870	0.386
(X_2)Age	-0.133	0.133	-0.072	-0.994	0.322
(E_1)English First Language	-0.310	2.075	-0.011	-0.149	0.882

$F(5,127)=15.361$***
$\bar{R}^2 = 0.352$
*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is a slight deterioration in the level of variation explained ($\bar{R}^2 = 0.345$). Only ability (mean score across the core subjects excluding Accounting) (X_1) proved to be significant, and the direction of the relationship with Y_{14} is, as expected, positive.

Although not significant in explaining variation on Y_{14}, the direction of the relationship between both English as first language (E_1) and employment status (W_1) and performance in the Accounting exam is positive, as expected. Unexpectedly there is a positive relationship between gender (G_1) and Y_{14} (males perform better than females), and a negative relationship between both prior attainment of a degree level qualification (Q_1) and Y_{14}. Age (X_2) is not significant in explaining Y_{14}, the direction of the relationship is negative, as expected.

Neither learning style nor region is significant variable in predicting Y_{14}.

ii)   The parsimonious model

The parsimonious model has an $r^2 = 0.343$ and only ability (X_1) is significant in predicting Y_{14} (Table 6.6.).

The unstandardized regression coefficient for our proxy variable for Ability i.e. mean exam score (excluding Accounting) (X_1) is 0.939 ($P \leq 0.001$) meaning that for each 1 percentage point increase in mean score across all core exams (excluding Accounting) students can expect to increase their overall mark in the Accounting exam by 0.9 percentage points (Table 6.6.).

Table 6.6. The parsimonious regression model overall Accounting exam mark (Y_{14}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	5.450	6.550		0.832	0.407
(X_1)Ability	0.939	0.104	0.589	8.994	0.000

F(1,152)=80.884***
$r^2 = 0.343$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with overall performance in the Accounting exam as the dependent variable (Y_{14}). The figures in parenthesis are t values and n = 152.

$Y_{14} = 5.450 + 0.939 X_1$

                (8.99***)

Y_{14} = overall performance in the Accounting exam

X_1 = Ability (mean score across all core subjects (excl Accounting)

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots.

In terms of linearity, because the model features interval variables as both dependent and independent variables, several alternative transformations of the variables were tested, including double logs, single (dependent variable) and single logs (independent variable). In this particular model (Y_{14}), for X_1, the single log (Independent variable) showed a marginal improvement; the correlation coefficient increased from r=0.589 to r=0.590. Given that the improvement is only marginal it was decided to retain the percentage on percentage alternative in the best fit model (Appendix K Log Transformations).

6.5 Finance Exam – Overall Mark

        i)   *Preliminary model of overall percentage mark in the Finance exam (Y_{15})*

The variables which were hypothesised to be of most statistical relevance in predicting a student's overall mark in the Finance exam are: ability (X_1); prior attainment of a degree level qualification (Q_1); gender (G_1); age (X_2); and English spoken as a first language (E_1). These variables were selected based on the findings of previous research in the

literature review in relation to overall academic performance in MBA (Section 2.7). The variables were entered into the model simultaneously.

Only one variable proved to be significant in predicting Y_{15}: ability (mean score across all core subject exams excluding Finance) (X_1). As expected this variable has a positive effect on performance in the Finance exam. The model is significant ($\bar{R}^2 = 0.453$) in explaining variance in overall performance in the Finance exam (Table 6.7.).

Table 6.7. Preliminary regression model with overall Finance exam mark (Y_{15}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-26.790	10.370		-2.583	0.011
(X_1)Ability	1.285	0.135	0.660	9.499	0.000
(Q_1)Degree Highest Qualfn	3.491	2.368	0.104	1.474	0.143
(G_1)Gender	3.052	2.235	0.095	1.366	0.175
(X_2)Age	0.025	0.139	0.013	0.181	0.857
(E_1)English First Language	0.773	2.183	0.025	0.354	0.724

F(5,111)=20.235***
$\bar{R}^2 = 0.453$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is a slight deterioration in the level of variance explained ($\bar{R}^2 = 0.426$). Only ability (mean score across the core subjects excluding Finance) (X_1) proved to be significant, and the direction of the relationship with Y_{15} is, as expected, positive.

Although not significant in explaining variation in Y_{15}, the direction of the relationship between prior attainment of a degree level qualification (Q_1) and performance in the Finance exam is positive, as expected. Unexpectedly there is a positive relationship between gender (G_1) and Y_{15} (males perform better than females), and a negative relationship between each of English as first language (E_1), employment status and Y_{15}.

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Age (X_2) is not significant in explaining Y_{15}, the direction of the relationship is negative, as expected.

Learning style is not significant in predicting Y_{15}. Furthermore, none of the distance learning context variables are significant in predicting performance in the Finance exam.

ii) *The parsimonious model*

In the parsimonious model, which excludes all insignificant variables, only ability (X_1) is significant in predicting Y_{15} with $r^2 = 0.470$ (Table 6.8). The unstandardized regression coefficient for our proxy variable for ability (X_1) i.e. mean exam score (excluding Finance) is 1.322 (P$\leq$0.001) meaning that for each 1 percentage point increase in mean score across all core exams (excluding Finance) students can expect to increase their overall mark in the Finance exam by 1.3 percentage points.

Table 6.8. The parsimonious regression model with overall Finance exam mark (Y_{15}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-23.387	7.791		-3.002	0.003
(X_1)Ability	1.322	0.122	0.689	10.868	0.000

F(1,131)=118.116***
$r^2 = 0.470$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with overall performance in the Finance exam as the dependent variable (Y_{15}). The figures in parenthesis are t values and n = 132.

Y_{15} = -23.387 + 1.322 X_1

                  (10.87***)

Y_{15} = overall performance in the Finance exam

X_1 = Ability (mean score across all core subjects (excl Finance)

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots.

In terms of linearity, because the model features interval variables as both dependent and independent variables, several alternative transformations of the variables were tested, including double logs, single (dependent variable) and single logs (independent variable). In this particular model (Y_{15}), there was no improvement in the model so the percentage on percentage is retained (Appendix K Log Transformations).

6.6 Marketing Exam – Overall Mark

> *i)*   *Preliminary model of overall percentage mark in the Marketing exam (Y_{16})*

 The variables which were hypothesised to be of most statistical relevance in predicting a student's overall mark in the Marketing exam were: ability (X_1); prior attainment of a degree level qualification (Q_1) ; gender (G_1); age (X_2); and English as a first language (E_1). These variables were selected based on the findings of previous research in the literature review in relation to overall academic performance in MBA study (Section 2.7.). The variables were entered into the model simultaneously.

The resultant model is significant ($\bar{R}^2$ = 0.305) in explaining variance in overall performance in the Marketing exam (Table 6.9.). Three variables proved to be significant in predicting Y_{16}: Ability (mean score across all core subject exams excluding Marketing) (X_1); English as first language (E_1); and gender (G_1). As expected, both X_1 and E_1 have a positive relationship with Y_{16}, and G_1 is negatively related to Y_{16} i.e. female students perform better than male students.

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Table 6.9. Preliminary regression model with overall Marketing exam mark (Y_{16}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	30.961	5.863		5.280	0.000
(X_1)Ability	0.505	0.074	0.502	6.863	0.000
(Q_1)DUMMY HQ	0.889	1.634	0.041	0.544	0.587
(G_1)Dummy Gender	-3.161	1.524	-0.152	-2.074	0.040
(X_2)Age	-0.048	0.092	-0.039	-0.522	0.602
(E_1)DUMMY English	3.764	1.452	0.191	2.593	0.011

$F(5,130)=12.832$***

$\bar{R}^2 = 0.305$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is a moderate improvement in variation explained ($\bar{R}^2 = 0.395$). The significant predictors of Y_{16} are: ability (X_1); English as first language (E_1); gender (G_1); the level of difficulty experienced working on your own (X_7) ; the level of difficulty experienced building a sense of belonging to EBS (X_{10}); and the level of difficulty experienced interacting with EBS faculty (X_{11}). As expected there is a positive relationship between both X_1 and E_1 and Y_{16}. Also, as expected, there is a negative relationship between G_1 and Y_{16}, meaning that female students perform better than male students in the Marketing exam. As far as the level of difficulty experienced both in working on your own (X_7) and in building a sense of belonging to EBS (X_{10}) , each is, as expected, positively relate to Y_{16}. Unexpectedly, however, the direction of the relationship between the level of challenge experienced interacting with EBS faculty (X_{11}) and Y_{16} is negative.

Although not significant in predicting Y_{16}, the direction of the relationship between the following student characteristics and performance in Marketing exam are, as expected, positive: prior attainment of a degree level qualification (Q_1); and employment status (W_1). Age (X_2) is not a significant predictors of performance in the Marketing exam. However, as expected, the direction of the relationship between X_2 and the dependent variable is negative.

Both learning style and region are not significant in predicting performance in the Marketing exam.

The following distance learning context variables are also not significant in predicting Y_{16}: the level of challenge experienced maintaining your motivation (X_8); the level of challenge experienced managing your time (X_9); and the level of challenge experienced networking with other students (X_{12}).

ii)   The parsimonious model

The parsimonious model, which excludes all insignificant variables, is significant with $\bar{R}^2 = 0.352$ (Table 6.10.). In all, five variables are of significance in predicting Y_{16}: ability (X_1); English spoken as first language (E_1); the level of difficulty experienced building a sense of belonging to EBS (X_{10}); the level of difficulty experienced interacting with EBS faculty (X_{11}); and employed status (W_1).

The unstandardized regression coefficient for ability (X_1) is 0.54 ($P \leq 0.001$) meaning that for each 1% increase in mean score across all core exams (excluding Marketing) students can expect to increase their overall mark in the Marketing exam by 0.5 percentage points. In terms of English spoken as first language (E_1), the unstandardized regression coefficient is 5.371 ($P \leq 0.001$) which implies that students for whom English is their first language perform better and are predicted to score on average 5.4 percentage points more in the Marketing exam than those students for whom English is not their first language.

There is a positive relationship between the level of difficulty experienced building a sense of belonging to EBS (X_{10}) and Y_{16}. The unstandardised regression coefficient is 1.678 ($P \leq 0.05$) which implies that for every rating scale increase towards an easier experience developing a sense of belonging to EBS, the Marketing exam mark will increase by 1.7 percentage points. Unexpectedly there is a negative relationship between the level of difficulty experienced interacting with EBS faculty (X_{11}) and Y_{16}. The unstandardised regression coefficient is -2.311 ($P \leq 0.001$) which suggests that for every rating scale decrease towards a more challenging experience interacting with EBS faculty, the Marketing exam mark increases by 2.3 percentage points. A possible explanation for this is that better performing students place greater demand on faculty

interaction and are therefore in a better position to criticise this aspect of the learning experience.

Finally, there is a positive relationship between employed status (W_1) and performance in the Marketing exam (unstandardized regression coefficient is 3.905 ($P \leq 0.05$)) which implies that students who are employed score on average 3.9 percentage points more in the Marketing exam than students who are not employed.

Table 6.10. The parsimonious regression model with overall Marketing exam mark (Y_{16}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	23.527	5.357		4.392	0.000
(X_1)Ability	0.540	0.075	0.520	7.166	0.000
(E_1)English First Language	5.371	1.461	0.271	3.677	0.000
(X_{10})Building a sense of belonging to EBS	1.678	0.715	0.182	2.346	0.021
(X_{11})Interacting with EBS faculty	-2.311	0.642	-0.284	-3.602	0.000
(W_1)Employed	3.905	1.955	0.146	1.998	0.048

F(5,122)=14.774***
$\bar{R}^2 = 0.352$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with overall performance in the Marketing exam as the dependent variable (Y_{16}). The figures in parenthesis are t values and n = 132.

$Y_{16} = 23.527 + 0.54\, X_1 + 5.371\, E_1 + 1.678\, X_{10} - 2.311\, X_{11} + 3.905 W_1$

$\qquad\qquad$ (7.17***) (3.68***) (2.35*) (3.60***) (1.99*)

Y_{16} = overall performance in the Marketing exam

X_1 = ability (mean score across all core subjects (excl Marketing)

E_1 = English first language

X_{10} = level of difficulty building a sense of belonging to EBS

X_{11} = level of difficulty interacting with EBS faculty

W_1 = employed either full-time or part-time

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies underlying assumptions of normality, linearity, homoscedasticity, independence of errors and multicollinearity. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate Correlations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 6.11.) .

In terms of linearity, because the model features interval variables as both dependent and independent variables, several alternative transformations of the variables were tested, including double logs, single (dependent variable) and single logs (independent variable). In this particular model (Y_{16}), for X_1, the double log showed a marginal improvement; the correlation coefficient increased from r=0.512 to r=0.521. Given that the improvement is only marginal it was decided to retain the percentage on percentage alternative in the best fit model (Appendix K Log Transformations).

Table 6.11. Correlations and collinearity statistics – overall Marketing exam mark

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_1)Ability	0.493	0.544	0.512	0.969	1.032
(E_1)English First Language	0.230	0.316	0.263	0.941	1.062
(X_{10})Building a sense of belonging to EBS	0.140	0.208	0.168	0.852	1.174
(X_{11})Interacting with EBS faculty	-0.094	-0.310	-0.257	0.820	1.219
(W_1)Employed	0.044	0.178	0.143	0.956	1.046

6.7 Organisational Behaviour Exam – Overall Mark

i)   *Preliminary model of overall percentage mark in the Organisational Behaviour exam (Y_{17})*

The variables which were hypothesised to be of most statistical relevance in predicting a student's overall mark in the Organisational Behaviour exam (Y_{17}) are: ability (X_1); prior attainment of a degree level qualification(Q_1); gender (G_1); age (X_2); and English spoken as a first language (E_1). These variables were selected based on the findings of previous research in the literature review in relation to overall academic performance in MBA (Section 2.7). The variables were entered into the model simultaneously.

Only one variable proved to be significant in predicting Y_{17}: and that is ability (X_1) As expected this variable has a positive effect on performance in the Organisational Behaviour exam (Table 6.12). The resultant model is significant ($\bar{R}^2 = 0.294$) in explaining variance in overall performance in the Organisational Behaviour exam (Table 6.12).

Table 6.12. Preliminary regression model with overall Organisational Behaviour exam mark (Y_{17}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	36.733	4.850		7.574	0.000
(X_1)Ability	0.474	0.057	0.532	8.298	0.000
(Q_1)Degree Highest Qualfn	0.079	1.366	0.004	0.058	0.954
(G_1)Gender	-2.771	1.265	-0.140	-2.190	0.030
(X_2)Age	-0.064	0.081	-0.052	-0.787	0.433
(E_1)English First Language	0.829	1.224	0.044	0.677	0.499

$F(5,170)=15.553$***

$\bar{R}^2 = 0.294$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

When all other independent variables are added to the preliminary model, there is a slight deterioration in the level of variance explained ($\bar{R}^2 = 0.278$).

Only two variables: ability (mean score across the core subjects excluding Organisational Behaviour) (X_1); and the level of difficulty experienced by students managing their time (X_9), proved to be significant. The direction of each of these relationships with Y_{17} is, as expected, positive.

Although not significant in explaining variation on Y_{17}, the direction of the relationship between both English as first language (E_1) and prior attainment of a degree level qualification (Q_1) and Y_{17} is positive, as expected, and the relationship between both gender (G_1) and age (X_2) and Y_{17} is negative, also as expected.

Region is also not significant in predicting Y_{17}. As expected, there is a negative direction in the relationship between each of the non-European countries (with the exception of the rest of the world category) and Y_{17}. Unexpectedly the rest of the world category (N_4) is positively related to Y_{17}. Although not significant, unexpectedly there

is a negative relationship between employment status (W_1) and Y_{17}. Learning style is not significant in predicting Y_{17}.

Apart from the level of difficulty managing your time, none of the distance learning context variables were significant in predicting Y_{17}.

ii)   The parsimonious model

The parsimonious model, which excludes all insignificant variables, has $\bar{R}^2 = 0.309$ and two significant variables, ability ($X_{1)}$ and gender (G_1) (Table 6.13.).

The unstandardized regression coefficient for X_1 is 0.483 meaning that for each 1% increase in mean score across all core exams (excluding Organisational Behaviour) students can expect to increase their overall mark in the Organisational Behaviour exam by 0.5 percentage points. For G_1, the unstandardised regression coefficient is -2.896. This implies that females score, on average, 3 percentage points more than males in the Organisational Behaviour exam.

Table 6.13. The parsimonious regression model regression statistics –with overall Organisational Behaviour exam mark (Y_{17}) as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	34.130	3.348		10.195	0.000
(X_1) Ability	0.483	0.052	0.539	9.238	0.000
(G_1)Gender	-2.896	1.146	-0.147	-2.526	0.012

F(2,201)=46.388***

$\bar{R}^2 = 0.309$

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

The best fit regression equation

Regression equation with overall performance in the Organisational Behaviour exam as the dependent variable (Y_{17}). The figures in parenthesis are t values and n = 203.

$Y_{17} = $ 34.130+ 0.483 X_1 -2.896G_1

               (9.238***)   (2.526*)

Y_{17} = overall performance in the Organisational Behaviour exam

X_1 = ability (mean score across all core subjects (excl Organisational Behaviour))

G_1 = gender

*Significant at P<0.05. **Significant at P<0.01. ***Significant at P<0.001.

Analysis of residuals indicates that the regression model satisfies the underlying assumptions of normality, linearity, homoscedasticity, and are independent of errors. The assumptions of normality, linearity and homoscedasticity were tested through the following regression plots: histogram of standardised residuals, normal probability plot and standardised residuals/ predicted values plots. At the first stage the correlation matrix (Appendix J Bivariate orrelations) was examined to identify whether there are any high correlations between the independent variables. Since this is not an adequate test of multicollinearity, the variance inflation factor (VIF) and tolerance statistics were estimated to establish whether a predictor has a strong linear relationship with other predictors. All variance inflation factors were less than 10 (Myers, 1990) and all tolerance values were above 0.2 (Menard, 1995) so the assumption of multicollinearity is satisfied (Table 6.14) .

In terms of linearity, because the model features interval variables as both dependent and independent variables, several alternative transformations of the variables were tested, including double logs, single (dependent variable) and single logs (independent variable). In this particular model (Y_{17}), for X_1, the single log (dependent variable) showed a marginal improvement; the correlation coefficient increased from r=0.542 to r=0.543. Given that the improvement is only marginal it was decided to retain the percentage on percentage alternative in the best fit model (Appendix K Log Transformations).

Table 6.14. Correlations and collinearity statistics – overall Organisational Behaviour exam mark

Model	Correlations			Collinearity Statistics	
	Zero-order	Partial	Part	Tolerance	VIF
(X_1)Ability	0.542	0.546	0.539	1.000	1.000
(G_1)Dummy Gender	-0.159	-0.175	-0.147	1.000	1.000

6.8 Interpretation of the results – all core exams excluding Economics

Whereas the regressions for performance in the Economics exam included subject specific insights on the learning challenges experienced by students, unfortunately no such insights are available for the other core subjects. As a result the models developed for other subjects do not explain as much of the variation in examination performance as that developed for Economics. For Economics, using the wider set of variables, the parsimonious model explained 48% of variation in examination performance whereas using the limited set of variables as potential explanatory factors, the parsimonious model for Project Management accounted for 28% of variation in examination performance, and for 34% of variation in examination performance in Accounting . In Finance, despite not being able to take into consideration the learning challenges experienced by students in the study of Finance, the parsimonious model accounted for 47% of variation in examination performance. In Project Management, Accounting and Finance, subjects which are definitional and quantitative in character, the only significant variable, among those tested to predict examination performance, is ability; students of higher ability performed better in examination than students of lower Ability (H61 is supported in each case)..

With regard to the more discursive subjects of Marketing and Organisational Behaviour, again no insights are available on the learning challenges experienced by students in the study of these subjects, but using the limited set of variables, the parsimonious models explained 30% and 31% of examination performance respectively.

In Marketing the variables which proved to be significant and positively related to examination performance are: ability (H61 is supported); English as first language (H71 is supported); level of difficulty building a sense of belonging to EBS (H80 is supported): students who find it easier to build a sense of belonging to EBS do better in the Marketing examination; level of difficulty experienced interacting with EBS faculty (H81 is supported), students who find it easy to interact with EBS faculty do better in the Marketing exams; and finally employment status proved to be significant (H 72 is supported): students who are in employment (either full-time or part-time) perform better in the Marketing examination than students who are not employed.

In Organisational Behaviour, ability is a significant and positive indicator of examination performance (H61 is supported). In addition gender also proved to be a

significant variable in predicting examination performance, with females outperforming males in the Organisational Behaviour examination (H73 is supported).

It would appear, therefore, that the development of more sophisticated regressions in relation to the other core subjects requires consideration of a wider set of variables, to include the subject specific learning challenges experienced by students in relation to each core subject. This should be the subject of further research.

Chapter 7 Interpretation and Policy Implications

The absence of a single model to explain how e-learning functions (Oliver & Conole, 2003), combined with the diversity of students who choose to study online (Rayner & Cools, 2011; Charlesworth, 2009), make it challenging for educators to take an evidence-based student needs focus to educational enhancement in the online domain. In this study an adaptation of the Biggs 3P model has been used as the theoretical framework to determine which factors influence both the student learning experience and academic achievement.

The adaptation of the Biggs 3P model, referred to as 3P e-learning (3P-e), takes into consideration the online learning context and is positioned at course-level (study of Economics). This is to allow more accurate assessment to be made of student educational needs and so provide direction to the development of course resources, both in terms of their design and targeting.

The 3P-e model consists of two elements: the first relates to an intermediate outcome, represented by variables influencing the student learning experience; and the second element relates to academic achievement as the dependent variable. The student learning experience lies at the heart of model and this was deconstructed at course level using an eight level developmental hierarchy of understandings (derived from Bloom's taxonomy), from the lower-level challenges of building knowledge, through to higher order complex problem solving in Economics (see Section 4.5.4.). Regression models were calibrated to determine which factors influence both the student learning experience and academic achievement.

The literature review was instrumental in identifying a wide set of antecedent variables which might potentially influence the student learning experience and academic achievement in the online setting. Due to gaps in the knowledge regarding online learning, variables were also included in the study based either on *a priori* reasoning or because of their importance in the classroom based learning setting. The antecedent variables included in the study related to various student characteristics, satisfaction with the course resources and a range of behavioural items associated with online study. The wide range of antecedent variables included in the research, and the detailed consideration given to the student learning experience at course level (across eight

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different levels in a hierarchy of understandings), are key features of the study in terms of its contribution to the knowledge.

Summary Results

The most important finding of the research is that developmental aspects of the student learning experience help to explain variation in academic achievement of students studying online.

In the regression model built to explain variation in academic achievement in the Economics exam, in the parsimonious model ($\overline{R}^2 = 0.48$), student ability (measured by mean score across all core courses taken excluding Economics) proved to be the dominant significant predictor variable ($\beta = 0.57$). The next most important variables of significance relate to aspects of the student learning experience, specifically the level of difficulty perceived in understanding numerical calculations ($\beta = 0.23$), and the level of difficulty perceived in applying theory to business problems ($\beta = 0.15$) (See Table 5.30.). In terms of student characteristics, also significant (but less important than the aforementioned) in predicting academic achievement in the Economics exam were region (students from Africa fared less well than non-African students) and learning style (students with a verbal learning preference fared less well than students with a visual learning preference).

A further contribution of the research is the insights gained through the 3P-e theoretical framework on the characteristics and behaviour of the students who experience difficulty. The research results reveal that students perceive that the most difficult aspects of the student learning experience in the study of Economics lie in applying theory; linking different theories together and solving business problems. (Appendix I). The regression models developed for these difficult aspects of the student learning experience show that, when interaction effects between variables are taken into account, only a small number of antecedent variables are significant in explaining variation in the level of difficulty perceived (see Sections 5.1.3.–5.1.10.). For example: in the regression model calibrated to explain the level of difficulty perceived in solving complex business problems ($\overline{R}^2 = 0.33$), only three variables were significant:

- satisfaction with EBS course resources ($\beta = 0.55$)
- sensing-intuitive learning style dimension ($\beta = 0.19$)
- previous study of Economics ($\beta = 0.10$) (see Table 5.25.).

In the regression model built to explain the level of difficulty perceived in applying theory to business problems ($\bar{R}^2 = 0.28$), only two variables were significant:

- satisfaction with EBS course resources ($\beta = 0.50$)
- sensing-intuitive learning style dimension ($\beta = 0.19$) (see Table 5.13.).

Additional antecedent variables which proved to be significant in predicting the level of difficulty perceived in relation to other aspects of the student learning experience included: the visual-verbal learning style dimension; difficulty interacting with faculty and difficulty working on your own.

In interpreting the findings of the regression analyses it should be kept in mind that there is a possibility that the links between variables may be bi-directional, for example, the level of challenge perceived in solving complex business problems in Economics may influence student satisfaction with EBS course materials.

Course-related developmental aspects of the student learning experience may also be key in explaining academic achievement in other post-graduate management education subjects. The multiple regression models developed for the other core courses (See Chapter 6), provide a much lower level of explanation of academic achievement (with the exception of Finance – see Section 6.5.) than that developed for Economics. For example, in Marketing and Organisational Behaviour, the level of explanation was 30% and 31% of examination performance. These models were built using a more limited set of variables, and did not include insights on the student learning experience in tackling those particular subjects. It is anticipated that a higher level of explanation of academic achievement in other core courses would be achieved through the inclusion of insights on course related learning difficulties and it is recommended that further research be undertaken in this regard.

As well as identifying the key points of difficulty in relation to developmental aspects of the student learning experience, the 3P-e theoretical framework also provides insight on the students most affected. The research reveals that the students who are most disadvantaged in relation to the course-related learning difficulties identified are: students with no previous experience in the study of Economics; students with certain learning styles (sensing and verbal); and students who find it challenging both to interact with faculty and to work on their own.

According to the research findings, students who have no *previous experience* in the study of Economics make up 50% of the EBS student base. Lack of previous experience in the study of Economics is significant in predicting: the level of difficulty experienced building up knowledge of Economics; understanding theory and concepts of Economics; applying skills to specific business problems; and solving complex business problems (see Sections 5.1.3., 5.1.4., 5.1.9., and 5.1.10.).

Learning style is a significant predictor of the level of difficulty perceived by students in relation to six of the eight learning challenges experienced in the study of Economics. Students with a more *verbal* learning style (representing 24% of EBS student) experience higher levels of difficulty in relation to understanding the following: the relevance of Economics theory (Section 5.1.7.); how to link different theories together (Section 5.1.8.); and how to apply skills to business problems (Section 5.1.9.). 61% of EBS students tend towards a sensing learning style. The *sensing-intuitive* learning style dimension was significant in relation to the following learning challenges experienced in: understanding the theory and concepts of Economics (Section 5.1.4.); applying theory to business problems (Section 5.1.6.); applying skills to business problems (Section 5.1.9.); and solving complex business problems (Section 5.1.10.). The research findings indicate therefore, that whilst learning style may not be a significant influence factor in relation to academic success (Arbaugh, 2010a), they are important in relation to the student learning experience (Zapalski & Brozik, 2006; Davis & Bostrom, 1993; Fleming, 2006).

Variations in the level of difficulty experienced by students in relation to different aspects of the study of Economics are also explained by some *behavioural factors*. The level of difficulty experienced *interacting with faculty* at Edinburgh Business School is significantly related to: understanding the theory and concepts of Economics; understanding the relevance of theory; and applying skills to business problems (see Sections 5.1.4., 5.1.7., and 5.1.9.). This supports the research of Marks & Sibley (Marks, Sibley & Arbaugh, 2005) and Arbaugh & Rau (Arbaugh & Rau, 2007) who found instructor-student interaction to have positive effects on student perceptions of learning. Difficulty *working on your own* is significantly related to the level of difficulty experienced by students in: building up your knowledge of Economics and linking different theories together (Sections 5.1.3. and 5.1.8.).

The identification of key points of difficulty in relation to the student learning experience and the insights gained on the students most affected combine to provide the basis for a student needs based focus to the development of EBS educational resources. It is to interventions to better address the identified student needs that we now turn, taking into account:

I *Proposed new course resources*
II *Augmentation of existing course resources*

I Proposed New Course Resources

The learning challenges identified are at the higher levels of the development scale used to examine the student learning experience (as adapted from Bloom's taxonomy). Whilst, in the past, technology has been used in service of the transmission model of learning (Laurillard, 2002a), the proposed new course resources seek to deliver address the higher level educational needs identified (applying theory, linking theory and problem solving) using new technologies.

Online case method teaching

The case method of teaching was used first in business education in the early 1900s at the Harvard Graduate School of Business Administration (Burgoyne, 2001). A business case provides a narrative description of a real management dilemma and students are invited to assume the role of the protagonist in the case, undertaking analysis using relevant concepts and analytical tools, and devising an action plan. Case studies have been found to be the most effective way for developing critical thinking (Pithers & Soden, 2000; McEwen, 1994). The case method approach is consistent with the principles of constructivism and also the premise that discussion and social dialogue are key to adult learning (Vygotskiĭ, 1978; Baker, Jensen & Kolb, 2002). According to Brooke: "the case approach promotes social change in that students reflectively and critically examine their own thoughts in relation to the course material and other student responses."(Brooke, 2006; p.145). The case method of teaching can be adapted to the virtual classroom to promote critical thinking and can contribute to a 'valuable learning experience' in online management education (Watson & Sutton, 2012; p.818; Brooke, 2006). Faculty need to model the critical thinking process and also engage students in a 'productive dialogue' (Pithers & Soden, 2000).

It is proposed that Edinburgh Business School introduces problem/decision focused case method teaching into its online course offering. The problem/ decision focused case is distinct from other case based approaches in that students become fully immersed in the situation and are required to state what they would do in the circumstances described. This is in contrast to using cases as a way to test understanding (the case being presented directly after a topic has been taught), and using cases to provide an example of theory (Savery & Duffy, 1995)

The *inductive* approach (starting with the specifics of the case and moving to the general) is recommended as it encourages critical thinking processes and the role of the instructor is to evolve a framework for the discussion and, by using questions to guide the discussion and challenge student thinking, the instructor coaxes the student down a path to reach a certain point of understanding. The questions posed by the instructor should be designed around the basic challenge of having students identify the important issues in the case, addressing these issues through analysis, and determining lessons that can be taken from the case and applied more broadly. For example:

1. How was Company X able to grow from a small company with a low quality product to one which challenges the market leader within 6 years?
2. How well did the Marketing Director deal with the problems he inherited?
3. What other solutions were available? Which would you have chosen and why?
4. What action can Company X take to avoid the same situation occurring in the future?
5. Could Company X realise its growth objectives by buying Company Y?

Students use their analytical skills when dissecting and understanding the case, refine their judgement skills when they identify and evaluate assumptions and alternatives, and develop synthesis skills as the re-build the scenario. This approach correlates with the higher levels of Bloom's Taxonomy of Educational Objectives (Braun, 2004).

A key issue in delivering online case method teaching is whether the online case classes should be delivered asynchronously or synchronously. There are benefits and drawbacks associated with each approach. *Asynchronous* delivery of online case teaching has the advantage of giving students time to provide thoughtful, critical responses (Hrastinski, 2008; Watson & Sutton, 2012; Rollag, 2010); students can also engage in the case discussion at their own convenience (Rollag, 2010). In this way

technology can help students to strengthen the links between theory and practice by providing 'safe places for examination and reflection on material at their own time and space' (Price & Kirkwood, 2011; p.25).

Challenges include the amount of faculty time taken to prepare, facilitate and conclude asynchronous case discussion. According to Rollag, at Babson College in the USA, instructors spend up to twice as much time on online case discussion than they do on face-to-face case discussion, but he acknowledges that the time demand is significantly reduced the second or third time round a case is taught online (Rollag, 2010). Teaching presence is important in asynchronous case discussion to create a "vibrant online learning community" (Rollag, 2010; p.503) and this may require faculty to monitor and facilitate the case discussion several times a day since each case is likely to be several days in duration. A balance is required between frequent instructor facilitation (which students appreciate as this keeps the conversation moving forward in a well-ordered manner) and time for students to facilitate their own conversations. Instructors also have to pay careful attention to timing and sequencing strategies so that discussion questions are released at appropriate points, and to ensure that the discussion flows in an orderly fashion. In facilitating discourse, instructors should note agreement/ disagreement as well as encourage and reinforce contributions (Arbaugh, 2010b). Furthermore, there are limits to the number of students who can respond to specific questions as the number of postings may lead to the discussion becoming unmanageable and disconnected from the learning objectives (Rollag, 2010). In case method teaching delivered asynchronously, participants may interact using discussion boards, Twitter, email, podcasts, blogs, and wikis.

Synchronous delivery of online cases means that participants interact at the same time but from remote locations using 'live' tools (see Figure 7.1). The synchronous approach is more like the classroom taught case as the instructor and students are involved in discussing the case simultaneously. This is beneficial from a student interaction perspective and also because students receive immediate feedback. Furthermore the time frame for the online case class is clearly defined (Watson & Sutton, 2012) but working across time zones is likely to be a challenge. It is more difficult for the instructor to support and build structure around peer group discussions in a synchronous forum; careful structuring of the session is required with ground-rules set in advance (Laurillard, 2012). According to Brooke (2006), on-line case classes should comprise

no more than 25 students, Laurillard, however, sees up to 5 participants as ideal (2012).
Social constructivism can be difficult to achieve if class sizes are too large
(Ladyshewsky & Taplin, 2013). Using synchronous delivery, interaction between
participants can occur using video conferencing tools such as Adobe Connect,
Blackboard Collaborate. Wimba Live Classroom, and Cisco WebEx. Essentially these
programmes provide a central website to log into the software and instructors and
students broadcast themselves via a webcam. Those participating in the discussion can
see themselves and the other participants and audio is provided using voice over internet
protocol (VOIP) . Other features may include: text chat, content sharing options,
collaborative tools, polling functions, audio-video sharing options, personal status icons
and a list of participants.

Figure 7.1. Example Video Conferencing Tool

Another option in delivering case method teaching online is to *combine asynchronous
and synchronous interaction*. For example, prior to attending the live case class,
students are required to read the case study and submit an assignment, for example, take
a position on a core decision/ issue in the case (*asynchronous*). The instructor can then
facilitate the case discussion using the assignment responses and electronically 'calling'
on students, to support or argue their point during the live case class (*synchronous*).
During the case discussion the instructor will outline the theory which underpins the
case assignment. However, the session may be recorded and made available to other
students who can observe and learn from the case process without directly participating
in the case discussion. Some training of faculty will be required to help navigate the
technology and to ensure student engagement.

It is proposed that the approach taken to case method teaching online be subject to further research in order to establish which approach provides most added value to the student and which can also be delivered on a wide scale.

Introduction of a dedicated problem-solving resource – 'Solve This'

It is suggested also that all course websites should include an area dedicated to problem solving (Freire & Shor, 1987; Stepien & Gallagher, 1993). Problem based learning "prepares students to think critically and analytically" (Brooke, 2006, p.142). The *Solve This* zone would comprise: a bank of challenging problems drawn from across the course (with an indication given of degree of difficulty to assist metacognition); self-assessment resources; and a discussion board dedicated to supporting students as they work through the specific problems. An aim of the *Solve This* zone is to provide students with more opportunities to practice application and critical thinking - according to Feltovich : "All the paths to expert performance appear to require substantial extended effortful practice." (Ericsson, 2006, p.61).

One issue that students face in problem solving is that they focus on the superficial structure of a problem, whilst its deep structure remains concealed. In developing a more learner-centred approach, it is important to recognise that students require metacognitive skills (ability to regulate their own thoughts) to help them direct the learning process and to become aware when they should be penetrating below the surface towards the deep structure of a problem (Willingham, 2007; Bandura, 2001).

It is proposed, therefore, that aids to facilitate metacognition accompany a selected set of self-assessment problems and case assignments on each course website. This facility might be offered at different levels, for example, from a simple flag to indicate that critical thinking is required, to student activated problem labelling, ranging from "Problem X is similar to Problem Y", to the more explicit "Problem X deals with factory gate pricing".

A key finding of the research is that the level of difficulty experienced by students in interacting with EBS faculty is significantly and positively related to the level of difficulty experienced by students understanding theory and concepts, understanding the relevance of Economic theory, and applying Economics skills to specific business problems (see Sections 5.1.4., 5.1.7. and 5.1.9).

A further aim of the *Solve This* zone is to increase interaction between faculty and students by providing a meeting point, through the use of online asynchronous discussion forums, where students can work through problems along with other students and also receive support from faculty when it is needed. It is a place where 'proximal learning', the transfer of individual experiences into group knowledge, can occur (Vygotskiĭ, 1978).

These forums should help students, in particular those with a more verbal learning style, to develop and apply critical thinking skills; they are effective places for instructors to coach and develop deeper and more reflective learning because they place emphasis on the elements of an argument and the exchange of ideas (MacKnight, 2000). An important role for faculty in problem-based learning is to interact with students and engage students in productive dialogue (Strang, 2012). The socio-cultural perspective of learning indicates that dialogue between instructors and students is key to support cognitive development; the act of articulating an idea contributes to what it means to know the idea (Vygotsky, *1962*). In the online, this is facilitated using email, chat rooms and discussion forums (Chen, Chen & Tsai, 2009).

In line with the social constructivism approach to learning, faculty should adopt the role of facilitator, and not teacher, in the problem-based online discussion forums in order to allow the learner to play an active role in developing his or her own understanding of the deep structures of the problems under discussion. In the capacity of facilitator, faculty would not simply provide explanations to students but instead support effective thinking through questioning techniques.

In generating dialogue, asking the right question does not fall solely to the instructor. Another proposal is that critical thinking be promoted by developing within the student a disposition for, and a skill in, questioning. Whereas the instructor is familiar with the difference between convergent and divergent questioning techniques, the student is unlikely to know. Convergent questions apply to Bloom's lower levels of *knowledge, comprehension,* and *application* and seek specific answers to questions like 'Define monopoly', 'Explain the concept of equilibrium price' and 'Solve the equation for the value of X'. Divergent questions are generally open-ended and apply to the higher levels of Bloom's taxonomy i.e. *analysis, synthesis,* and *evaluation* and examples might be: 'What would happen if…'; and 'What difference does it make?' To stimulate students to engage in Socratic dialogue some instruction is required in relation to

questioning techniques. According to Toledo , if we can teach students to ask questions '…we set the stage for critical thinking to occur.' (2006; p.150). Stepien (2005) developed a set of five question types: clarification, assumptions, reasons and evidence, viewpoints or perspectives, and implications and consequences. Toledo considers these question types to provide many opportunities to move learning beyond content mastery into critical thinking (2006). The importance of asking the right questions is emphasised by Knowlton (2001; p.5) '…summarizing, paraphrasing, and regurgitating will not move students to the upper level of Bloom's taxonomy.'

In facilitating online discussions to promote application of theory and critical thinking, asking the right questions is therefore essential to encourage higher level thought processes. Clearly the questions should be devised to reflect the particular learning objectives associated with the individual problems and cases under discussion. As many Edinburgh Business School courses already contain problem-based learning resources, it may not be a significant task to build a dedicated *Solve This* resource. Some faculty training and exchange of best practice may be required to develop a more facilitative approach to discussion board moderation.

Students do not necessarily interact with each other just because the infrastructure is in place so some direction may be required to encourage them to engage in meaningful dialogue. The instructional methods used influence the quality of the postings students make in online discussions and it has been found that the highest levels of critical discourse to take place when students engage in web-based inquiry and debating activities and where they have to adopt and defend a certain position, including through role play (Kanuka, Rourke & Laflamme, 2007). Laurillard's Conversational Framework (see page 20) can be used as a point of reference to measure the extent to which the iterative dialogue results in higher learning (2009).

'Expert' whiteboard screencast – 'Discover This'

A screencast is essentially a video recording of movement on a computer screen accompanied by audio narration. Screencast recordings allow the learner to follow the instructor's thinking step by step and to do so at a pace which suits the learner in any location and at any time. A further benefit is that learners can download screencasts and play them back offline, pausing and replaying the screencast as often as required (Loch & McLoughlin, 2011).

It is proposed that a portfolio of 'expert' whiteboard screencasts be developed. To facilitate independent learning, it is important that the learning objectives for each screencast be explicitly stated and that each screencast is positioned at carefully selected points in the specific course domain to ensure that the appropriate level of educational support is in place before students attempt to engage in higher level critical thought processes (Loch & McLoughlin, 2011).

The 'expert' whiteboard screencasts would seek to replicate live classroom based whiteboard working. The pedagogic focus is constructivism and the intention is to leverage the 'expert' role of instructors to model application of theory (Bandura, 1977; 2001) and critical thinking processes, making patterns and connections explicit and potentially easier to understand (Kinchin & Cabot, 2010). The whiteboard screencasts, with their emphasis on visual representation, will help students to build their own meaning. New technology provides some innovative options to allow such instructor modelling of application and critical thinking, and a starting point is the Khan Academy style video presentations (Figure 7.2.). In their present form, the Khan Academy videos focus on building knowledge and understanding (the lower elements of Bloom's taxonomy). However, the proposed 'expert' whiteboard screencasts will address higher order learning needs, specifically applying theory, linking theories together and problem solving.

In the 'expert' whiteboard screencasts, the instructor will map out problems and model application of theory and critical thinking process in a highly integrative and visual way with extensive use of hand drawn pictures and diagrams (to meet the needs of visual learners who make up the majority of online distance learning students). The simplicity and immediacy of pictures drawn in real time can help to distil complicated concepts into more easily explained parts and provide the potential for powerful insights and moments of discovery (see constructivism, page 16). The aural aspect, listening and following the logic of the instructors thinking will better serve the needs of verbal learners (Felder & Soloman, 2000). Self-assessment assignments should accompany the 'expert' screencast resources to allow the student to attempt problems similar to those covered in the screencast and also measure their performance in terms of the stated desired learning objectives.
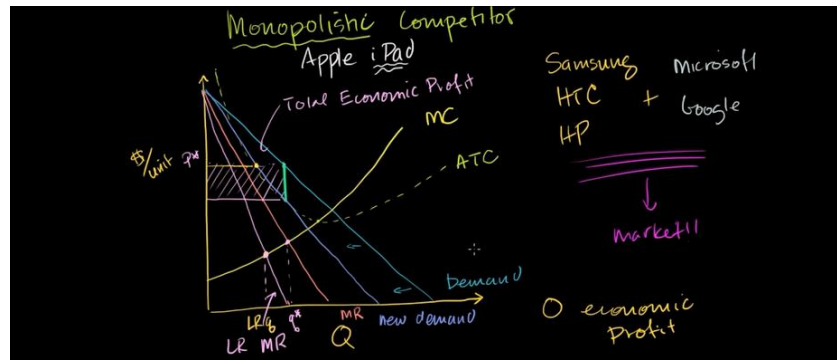
Figure 7.2. Khan Academy style whiteboard screencast

Key concept video tutorials – 'Visualise This'

To provide additional tuition to students who experience difficulty with basic key concepts (conceptual bottlenecks), it is proposed that a portfolio of video tutorials be developed. Edinburgh Business School faculty should identify the key conceptual bottlenecks on the basis of questions raised on the faculty boards on the course websites.

Given that three-quarters of students are visual learners (see Appendix I Descriptive Statistics), it is recommended that a highly visual approach is taken in tackling the conceptual bottlenecks. However, this should be combined with audio to facilitate learning among students with a more verbal learning style. The video tutorials are a more transmissive style of teaching; their role is to support students who have no previous experience in the study of Economics (a significant variable in explaining the level of difficulty students experience in building up knowledge and understanding of the theory and concepts of Economics, as well applying skills to and solving complex business problems in Economics). There is also a significant relationship between degree of difficulty understanding numerical calculations and performance in the Economics exam (overall exam mark, multiple choice questions only and case study question only) (See Sections 5.2.3.-5.2.5.). It is recommended that steps be taken to address specifically these difficulties in the key concept video tutorials.

The video tutorials should be positioned at appropriate points in the online course text and presented together with self-assessment assignments or exercises specifically designed to test whether the student has managed to master the concept. There should be a clear distinction between assessments which test declarative (knowing what) knowledge and procedural (knowing how) knowledge. Students with previous

experience studying Economics are likely to move much more quickly to tests of procedural knowledge and the flexibility of the system should be such that fast tracking is accommodated whilst not compromising the needs of disadvantaged learners (who have no previous experience in the study of Economics) to build up knowledge, understanding and application at their own pace.

II Augmentation Existing Course Resources

Hyper-links to provide real world contextualisation

There is a significant relationship between a sensing learning style and higher levels of difficulty experienced in understanding the theory and concepts of Economics, applying theory to business problems, applying skills to business problems, and solving complex business problems (see Sections 5.1.4., 5.1.6., 5.1.9., and 5.1.10.).

Students with a sensing learning style tend not to be comfortable with abstraction and require real world context to engage in learning. To help sensing learners, more links should be built in to the course website to provide real world contextualisation before the introduction of abstract concepts. For example, a link to a newspaper article or video clip which discusses a real world instance of applied theory.

These links can be embedded into the online course text and a monitoring system should be introduced to ensure these links do not break over time. The academic blog is also a potentially very useful resource for sensing learners who need real world contextualisation of academic theories to engage in learning.

Concept mapping tools

Concept mapping is a teaching tool which links well with the constructivism theory of learning and reveals the cognitive structures that people use to structure and organise their thoughts (Hay & Kinchin, 2006; Kinchin, Hay & Adams, 2000). Students with a tendency towards a global learning style (representing 48% of EBS students) find understanding the theory and concepts of Economics more difficult than those with a sequential learning style (see Section 5.1.4.). It is proposed therefore that concept mapping tools be incorporated on the course website to facilitate those students with a global learning style in the development of concept maps (Figure 7.3.).

A concept map is a visual depiction of relationships among ideas and can be a useful tool for all students, but global learners in particular, to build their knowledge structures and to see how concepts and propositions fit together. Concept maps allow student to synthesize their learning in a way that replicates the network model of memory (see cognitive learning theory page 16) and which allows new concepts to be connected with prior knowledge schema. They make use of dual coding which means that students learn from the text labels on the map as well as the visual representation. There is evidence that concept map building can increase knowledge retention and is appropriate for use in collaborative and cooperative learning (Nesbit & Adesope, 2006).
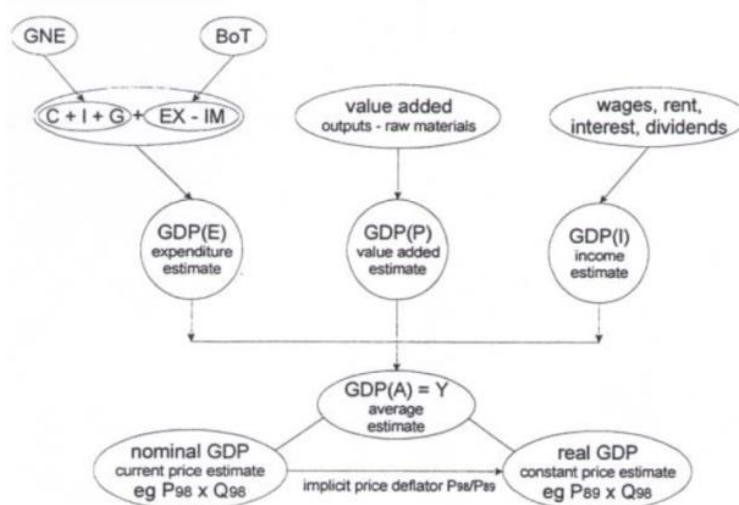
Figure 7.3. Illustrative example – concept map

Identify student learning style profiles

Learning style is significant in influencing many aspects of the student learning experience in the study of Economics. Sensing learners have more difficulty understanding the theory and concepts of Economics, applying theory to business problems, applying skills to business problems, and solving complex business problems (see Sections 5.1.4., 5.1.6., 5.1.9., and 5.1.10.).. There is a significant relationship between verbal learning style and higher levels of difficulty experienced understanding the relevance of theory, linking different theories together and applying skills to business problems (see Sections 5.1.7., 5.1.8., and 5.1.9.). Students with a global learning style finding understanding the theory and concepts of Economics more difficulty than students with a sequential learning style (see Section 5.1.4.).

The literature reveals that learning style preferences may be more important in e-learning than in traditional classroom instruction (Manochehr, 2006). Technology opens up many new possibilities in terms of tailoring instructional design to match with learning style preferences, the so-called 'matching hypothesis'. An argument against the 'matching hypothesis' is that one of the aims of education is to provide 'rounded learners' i.e. students who are able to approach tasks from different angles which may not necessarily reflect their learning style preference. According to 'fluid trait' theories, learning styles may change over time and learning tasks and processes may be designed to encourage the development of more 'rounded' or independent learners.

A useful starting point in the development of independent learners is to provide students with an insight on their learning style preferences as they enter the Edinburgh Business School MBA programme (Sandman, 2014). The Felder & Solomon's Index of Learning Styles (ILS) may be embedded in the student's personal learning environment, and upon completion of the online questionnaire, students will be provided with insights on their learning styles together with some guidance on the type of learning resources which will best fit with their learning style. This will provide students with better self-awareness and control over their own learning (metacognition) which they can use to adjust their study strategy.

As students work through the programme, various activities, tasks and assignments (*learning paths*) may be offered which are clearly flagged as 'developmental' to encourage students to move towards a more balanced approach to learning. In this way customisation of the programme is not restrictive in the sense of pigeon holing and catering to learners according to their learning style, but instead identification of learning style preferences becomes a constructive tool, which is used to stretch and develop learners so that they may become more independent learners and better prepared for the real world.

This approach supports the Personalisation element of McLoughlin's vision of the Pedagogy 2.0. framework whereby through the provision of options and choices, learners are given more self-direction and control over the learning process, but within a secure course structure (McLoughlin & Lee, 2008). This initiative is important in moving away from a course-centric learning management system to the development of a more personal learning environment which focuses on the learning experience.

Students can access materials which fit with their preferred learning style or which push them into learning environments or situations with which they are less comfortable. Such tailoring of instruction has the potential to provide for an enhanced learner experience.

Faculty Board Enhancement

The perceived level of difficulty in interacting with EBS faculty is significantly and positively related to the level of difficulty students experience in understanding the theory and concepts of Economics, understanding the relevance of theory and applying skills to business problems (see Sections 5.1.4., 5.1.7., and 5.1.9.).

In terms of instructor-student interaction, some re-engineering of existing course website resources is proposed to create a more inviting and vibrant meeting area in which faculty and student can engage. Reference has already been made to initiatives which will serve to provide additional opportunities for instructor-student interaction (see online case method teaching and 'Solve This' discussion board). Another suggestion is to increase 'social presence (See Community of Inquiry framework, page 17) by introducing a welcome area on each course website, perhaps a short video clip featuring an appropriate member of faculty who discusses the course, contextualises what the student is about to learn (important for sensing learners), talks about key features and provides study guidance. The introduction of flags and faces to the profiles of individuals (including faculty) who participate in faculty board discussions should help to create a better sense of connection between faculty and students.

Attention should also be given to increasing 'cognitive presence' (see Community of Inquiry framework, page 18) by developing more pro-active participation by Edinburgh Business School faculty. Instructor-initiated communications are required to address specific difficulties in understanding the theory and concepts of Economics as well as difficulties in application. To a certain extent some of these difficulties may be addressed through the short videos designed to tackle conceptual bottlenecks (*see Key concept video tutorials – Visualise This).*

Furthermore, consideration should be given to the tone of voice used by faculty when interacting with students to ensure that there is an appropriate level of approachability combined with authority. Instructors need to be aware of the importance of their role in

guiding students through any difficulties they experience both in understanding key theories and concepts, and in applying these to particular problems.

Social Study groups

It is proposed that an infrastructure of social study groups be developed . While student networking is not highlighted as a point of difficulty in the research, students with a verbal learning style find various aspects of the leaning experience more difficult (understanding the relevance of Economics theory to the real world, linking different theories together, and applying skills to specific business problems - see Sections 5.1.7., 5.1.8., and 5.1.9.) and also perform less well in the Economics exam (see Section 5.2.3.). The level of difficulty perceived working on your own is also significantly and positively related to the level of difficulty experienced building up knowledge of Economics and also linking different theories together.

The literature suggests that working adults may not place as much value on interaction with other students due to perceptions of time inefficiency, interaction dysfunction, and intrusion on flexibility (Kellogg & Smith, 2009). However, according to the principles of social constructivist learning, effective learning is conversational in nature and requires a social dimension. Engagement with peers is also seen to be key in emerging theories of learning such as knowledge management theory and connectivism. The introduction of study groups reflects the social aspect of learning whereby communication with others in the learning environment is seen to be a critical aspect of cognitive development (Vygotskiĭ, 1978).

Changes in the technological and social environment provide several new possibilities in terms of delivering a more interactive and socially mediated learning experience. New social network tools facilitate the process and enhance the participation model of learning (McLoughlin & Lee, 2007). Social software (i.e. tools such as discussion boards, wikis, blogs, Twitter, etc) can be embedded in the learning environment to allow students (in particular verbal learners) to connect, interact and share learner-generated materials which can stimulate and support peer to peer learning. It is proposed that a study group infrastructure can be established, organised around specific courses to provide students with an opportunity to learn from each other through peer discussions.

Online line synchronous discussions are not only considered to be an effective learning tool, but they also serve to provide a means for students to exchange information, be

social and also support each other (Chen, Chen & Tsai, 2009). However, according to Chen et al, social sharing and learning do not happen automatically, rather they need to be planned and facilitated by a moderator (2009; Laurillard, 2012). Laurillard combines the results from a number of studies and concludes that for peer discussions to be effective:

'students need to:

- take a particular position in respect to a concept or conjecture
- consider or respond to counter arguments; share and critique each other's ideas
- reflect on their own perspective in relation to others;
- work towards an agreed output, negotiating meaning, or collaborating on a decision;
- apply what they have learned' (2012; p.143).

Collaborative writing and editing tools, such as Writeboard, and Google Docs may prove useful in this context. In addition to supporting learning, the formation of social study group space provides students with an opportunity, if they wish to take it, to move beyond the prescribed curriculum and content of the EBS programme. EBS would continue to provide the necessary structure and scaffolding for each course and examinations would reflect this. An interesting aspect surrounding the creation of social study groups is the international character of students enrolled on the online MBA programme. This provides the opportunity for a potentially very stimulating dynamic within the groups, an interactive learning experience which is available on few other MBA programmes in the world and which can also make a major contribution to a distinctive value proposition built around the learner experience.

The creation of social study groups should also be helpful in tackling the problems experienced by students in working on their own, which is related significantly to the level of difficulty experienced by students both in building up knowledge of Economics and linking different theories together (see Sections 5.1.3., 5.1.8).

Conclusions

The main purpose of this study has been to develop and test a conceptual framework (the 3P-e model) of the antecedents of academic achievement in online learning. A key finding of the research is that, aside from student ability, the most important factors in

influencing academic achievement lie in specific course-level challenges. In the study of Economics these challenges relate specifically to application of theory to business problems and understanding numerical calculations.

These educational needs, and the insights gained in the research on who experiences most difficulty across these and other aspects of the student learning experience, give direction to the design and targeting of new course resources to enhance student learning.

Specific enhancements to EBS learning resources to address the key learning challenges faced by students are discussed: first in relation to a range of proposed new course resources; and second in relation to a range of proposed augmentations to existing course resources.

The proposed interventions leverage on developments in new technology and provide a the basis for the development of a value proposition which is built on detailed understanding of student educational needs. It is anticipated that these proposals, if adopted, will provide for an enhanced student learning experience and improved performance outcomes.

A summary of recommended developments to Edinburgh Business School course resources is provided in Tables 7.1.-7.2. below, including a priority rating using a Likert type scale, for each together with an assessment of faculty and IT resource implications. The priority ratings reflect the importance of the item in influencing the students learning experience and learning outcomes, in addition to the author's perceptions of the likely contribution of the development to achievement of the objective set.

Limitations and Further Research

There are several limitations to this research. First, the data is drawn exclusively from students studying on the Edinburgh Business School MBA online distance learning programme. Therefore, the findings may not be generalizable to other institutions. Further, the research focuses primarily on the study of Economics, so, in order to build predictive models in other subjects, it will be necessary to undertake further research to develop an understanding of student perceptions of the key learning challenges in each of those subjects. In so doing, it is anticipated that a better level of explanation of academic achievement will be achieved for those subjects.

A further limitation of the research is its focus on academic achievement (measured through examination performance) which relates to the skills-based objectives of the online distance learning Edinburgh Business School MBA Economics course. The skills-based objectives are that students should develop: a systematic approach to problem-solving; an analytical approach to decisions on resource allocation; and the ability to apply the economic analytical framework to consumer and firm resource allocation problems. No attempt is made (and nor would it be appropriate) to consider wider learning outcomes, for example, transferable skills such as communication, and leadership, which may be realised in a traditional classroom learning environment.

In terms of the policy implications of the research, a variety of developments to Edinburgh Business School course resources is proposed. Each of these initiatives should be subject to further research at each stage of the development process to ensure that each achieves its stated aims. In addition, and with reference to Table 7.1., further research is required to set priorities for development.

Table 7.1. Proposed new course resources

Objective	Strategy	Priority (High, Medium, Low)	Faculty / IT Resources*
Improve application of theory and critical thinking capability	Online case method teaching	Medium	Faculty ££££ It ££
	Dedicated problem-solving resource – 'Solve This' - New self-assessment problems - New problem-based discussion boards	High	Faculty ££££ IT ££
	Expert whiteboard style videos – "Discover This"	High	Faculty ££££ IT ££
To address difficulties understanding and applying key concepts and theories	Key concept video tutorials 'VisualiseThis'	High	Faculty ££ Video Production ££££ IT £

*Resource Implications – score £ = low, £££££ = high

Table 7.2. Augmentation existing course resources

Objective	Strategy	Priority (High, Medium, Low)	Faculty / IT Resources
To better support sensing learners	Use hyper-links to provide more real world contextualization before abstract concepts are introduced in the course text	High	Faculty ££ IT ££
To better support students with a global learning style	Provide concept mapping tools on the course websites	Low	IT £
To provide a more customized learning experience for students	Identify student learning style profiles to assist with metacognition	Medium	IT £
	Create learning paths for student who wish to accommodate and/ or develop their learning styles to become more rounded learners	Medium	Faculty £££ IT ££
To improve instructor-student Interaction	Create a more inviting faculty board	High	Faculty ££ IT££
To improve student-student interaction	Create a study group infrastructure	Medium	Faculty £ IT ££

*Resource Implications – score £ = low, £££££ = high

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