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Experiential Learning – a Case Study on the Use of Computerised Stock Market Trading Simulation in Finance Education

Abstract:

Finance is an increasingly popular choice of Higher Education programmes; however, students can find the subject challenging to learn as it involves understanding complex, abstract, mathematical models and applying academic theories learned in the classroom to the real world environment. Educational simulation is an active learning method found to be useful in enhancing students' learning experience. Although the numbers of finance students are increasing, there is limited pedagogic research attention on the use of simulations in finance education within UK higher education institutions. The study reports the findings of an on-line survey providing a snapshot of the current usage of finance-related simulations in UK universities and offers further insights into the effectiveness of introducing computerised simulation into a postgraduate finance course. The case study reports an enhancement learning experience for students that has, through concrete experience and reflective observation, increased their understanding of difficult and complex finance concepts. Unfortunately, it appears that the use of simulation and the pedagogic benefits it affords are not extensive across the UK.

Keywords: finance, trading, simulations, best practice, experiential learning, higher education

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1. Introduction

Finance, a highly theoretical subject involving complex mathematical models, is a popular choice in higher education. According to the Higher Education Statistics Agency (HESA, 2012) the rate of growth in the UK for Finance in the last 18 years is significantly higher than any other business related subject (see Figure 1) and this trend in popularity is also observed worldwide with Finance featuring in the top 10 of higher education subjects (QS, 2013).

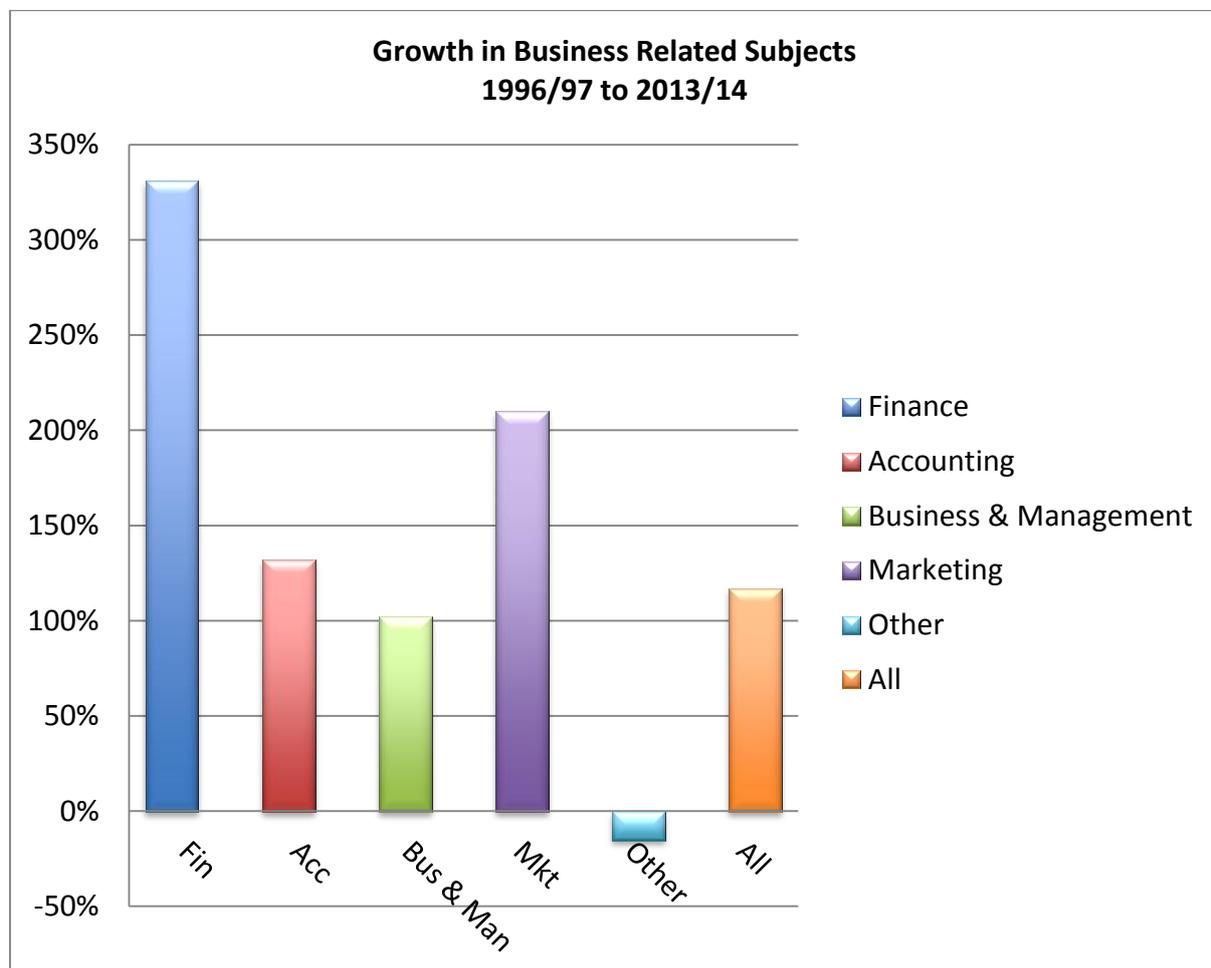


Figure 1: Growth in Student Numbers by Subject since 1996-97 (adapted from Higher Education Statistics Agency 2014)

While students learn the concepts and principles of Finance in the classroom, it can be challenging to apply these academic theories to the real world environment. For example, students can understand the financial formula used to determine the share value

theoretically but it is difficult for them to relate what they have learnt with the actual share price fluctuations. Therefore, students have to think in an abstract way how to apply academic theory in the real world. This can be difficult, especially for those students without a finance or mathematical background, and so the ability for them to think abstractly becomes an important attribute in finance education. This has provoked pedagogic challenges for finance educators to ensure that students achieve the required learning outcomes of their programmes or courses.

In order to help students understand and apply abstract concepts, various approaches are used in teaching such as graphical presentations (Liu, Salvendy & Kuczek, 1999), simulation (Marriott, 2004; Mills, 2005), interactive playing (Chen 2006) and real life examples (Mvududu & Kanyongo, 2011). Among these methods, simulation is chosen in this study as it offers an opportunity to introduce concrete experiences on which students can observe and reflect, and offers the scope for active experimentation. Previous studies demonstrate that simulations are used successfully in accounting education (Sprouls, 1962; Marriott, 2004; Wynder, 2004), business education (Lamont 2001; Baglione & Tucci, 2010; Seethamraju, 2011) and other subject areas (Surdam 2009; Corbeil & Laveault, 2011). While there has been a considerable amount of research undertaken on the use of simulations in finance in the USA there has been little research based on the UK experience.

Utilising a questionnaire survey, this paper investigates the extent to which finance simulation is used in the delivery of finance courses¹ across 94 UK Higher Education institutions. It also reports the findings from a case study at one institution on the implementation of computerised simulation into a postgraduate finance course. In an age of

In this under researched area the findings will be of value to accounting educators who are designing/updating finance courses and validating new or revalidating existing programmes of study.

The findings show that there has been a significant increase in the number of students studying finance over the last 18 years but that the extensive use of simulation in the teaching of the subject reported internationally is not mirrored in the UK. The analysis of student feedback on the use of simulation in finance education has revealed the benefits of using this pedagogic tool and supports the findings reported in the international literature.

The paper begins with a general overview of educational psychology that provides the theoretical framework for the research. A review of the literature is then presented followed by an outline of the research methods used and details of the case study. The findings, discussion and conclusions are presented, limitations of the research identified and recommendations for future research provided.

2. Literature Review

With reference to the UK's Quality Assurance Agency's Subject Benchmark Statement for Finance (QAA, 2007) the subject requires students to develop an appreciation of the context

¹ The term "course" is synonymous with class, unit and module.

in which finance operates and an understanding of the financing arrangements and governance structures of business entities. In order to achieve this, students have to acquire knowledge and understanding of the major theoretical tools and theories of finance in order to interpret financial data and make decisions. Fundamental to the study of finance, therefore, is the development of students' understanding of the relationship between financial theory and empirical testing as well as an ability to understand how theory and evidence can be combined to assess the effectiveness and efficiency of financing decisions. These economic decisions involve time, uncertainty, prediction and competitive interactions and are often stumbling blocks for students who find it difficult to apply theory in practice. The learning experiences of finance students are therefore a key concern for educators.

Cognitive psychology places learning in the context of the whole knowledge acquiring process which comprises the interaction between the learner's intellectual needs and the learning environment (Dewey, 1933; Neisser, 1967). This psychological school stresses the importance of "discovery learning" where students gain intrinsic rewards once they have learned how to analyse a problem and structure the solutions accordingly (Bruner, 1966).

Different schools of educational psychology agree that students learn in different ways. Some learn by experimenting while others learn in more abstract ways. Kolb (1984) proposed four stages of learning that form a repetitive and continuous cycle of concrete experiences (CE), reflective observation (RO), abstract conceptualisation (AC) and active experimentation (AE) (see Figure 2). Learners can start this learning loop from any stage and, throughout the process of learning, move around the circle continuously. For example, students who test a theory learned (AE) gain concrete experience (CE) which they can then observe and reflect on (RO) in order to formulate new abstract concepts (AC) for re-testing. The learning loop continues with more demanding learning taking place at each subsequent cycle.

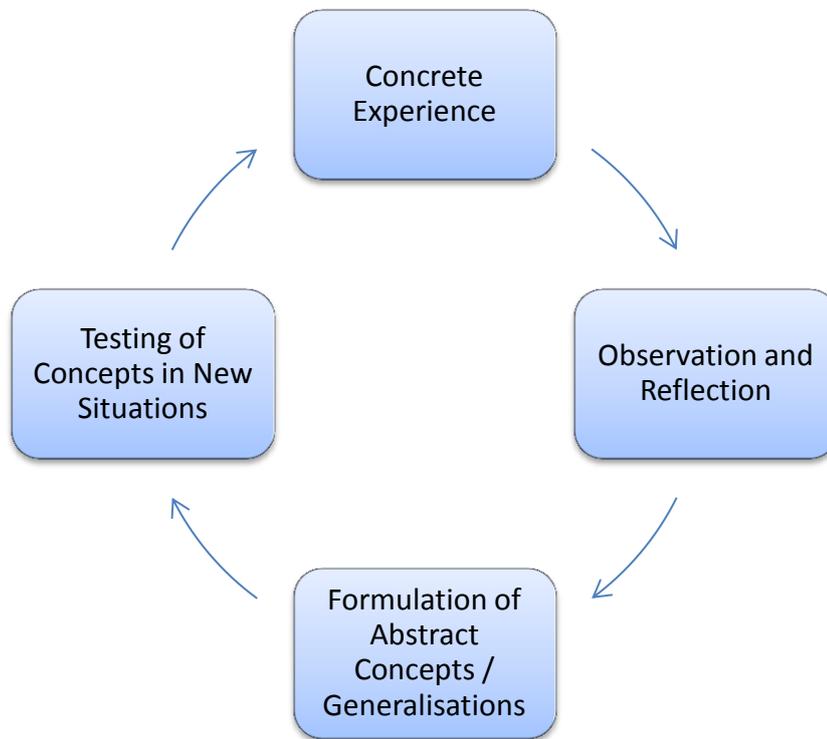


Figure 2: Kolb Learning Loop (1984) (continuous)

When considering the pedagogic approaches that engage with Kolb's (1984) learning loop, and the idea that students' learn through experience, instructional methodologies such as presentations, case studies and role playing have been found to promote deeper learning (Smart & Csapo, 2007) and to be more engaging (O'Leary & Stewart, 2012). These approaches have proved successful in various academic disciplines including Accounting (Sprouls, 1962), Marketing (Razzouk, Seitz & Rizkalla, 2003), Business (Faria & Wellington, 2004), IT skills (Carte, Dharmasiri & Perera, 2011) and Economics (Schmidt, 2003; Ghosh, 2013).

2.1 Simulation as an Instruction Tool in Finance

In higher education, the vast majority of students learn solely within the university environment with limited real world experiences on which to base or apply their learning. For finance students, knowledge and understanding is based on theoretical understanding of concepts that remain abstract, i.e. formed in the mind of the learner. For example, the determination of share prices are taught using Gordon Growth model, Capital Asset Pricing Model and the Efficient Market Hypothesis require an algorithmic thinking approach and abstract conceptualisation (Ijiri, 1983). The formulation of abstract concepts enables students to bridge the gap that can exist between theory and practice. However, the formulation of abstract concepts is only one part of the learning cycle and consequently simulation has been used for many years to promote students' learning in an active way that

offers opportunities to introduce concrete experiences on which students can observe and reflect, leading to active experimentation, new learning and further learning experiences.

From the early work of Sprouls (1962), who investigated the usefulness of computer simulations in accounting education, the ability of students to gain real world experience from finance simulations has been documented. Marriott (2004) highlighted the difficulty students face with understanding 'abstract concepts' and how important it is for students to learn from the mistakes they make in their decision making. He also emphasises the value of the protected environment that simulation offers compared with the real world of finance when mistakes can have dire consequences. Further examples of the use of simulations includes studies linked to Monte Carlo simulations for the calculation of risk (Hoyt, Powell & Sommer, 2007; Cheung & Powell, 2012; investments (Branch, 1975; Hatfield, 1993; Angel, 1994; Fischer & Madden, 1979; Wood, O'Hare & Andrews, 1992; Dicle & Levendis, 2011), portfolio management (McDonald, 1970; Burns & Burns, 1982; Dyckman, Philbrick & Stephan 1984; Fluck, Malkiel & Quandt 1997; Coval, Gadzik & Stafford, 2007), financial asset markets (Shrader & Helgeson, 1993), option pricing theory and trading (Boyle, 1977; Grant, Vora & Weeks, 1995; Cooper & Grindler, 1997; Pavlik & Nienhaus, 2004) and futures trading (Alonzi, Lange & Simkins, 2000).

Simulations provide a conceptual approach to understanding markets and have been used over the past 40 years as a mechanism to promote active and cooperative learning (Cameron, 1998; Weiser & Schug, 1992). They offer opportunities for students to interact with the concepts of market microstructures (Ascioglu & Kugele, 2005) and to engage in higher order learning through the application of theory to practice (Burns & Burns, 1982; Wolmarans, 2005; Kumar & Lightner, 2007; Jankowski & Shank, 2010). Lundy (1991) concludes that students' cognitive learning is positively influenced by the use of non-competitive games and simulations. Seaton and Boyd (2008) found that the development of students' critical thinking and team working skills is enhanced through the use of simulations. These skills, together with the ability to communicate and make decisions, are identified by Pivec and Dziabenko (2009) as essential if games-based learning is to be effective.

Research suggests that the learning experiences of students within the discipline of finance are enhanced through the use of simulations. Burns and Burns (1982), Koppenvaer (1993) and Alonzi *et al* (2000) all find that students' learning and enjoyment are enhanced by this hands-on approach. Similarly, Ascioglu and Kugele (2005) report an average score of 4 (on a 5-point Likert scale) relating to students' enjoyment of a simulation case that demonstrated fundamental microstructure concepts. Although simulations help students to understand key finance topics, preparation can be time consuming (Breen & Boyd, 1976) and the technical support and structure of teaching allocation can be barriers to the implementation of educational simulations (Cuban, Kirkpatrick & Peck, 2001, cited in Kenny & McDaniel 2011). However, overall it appears that by "bringing course material to life" (Cebula & Toma, 2002) and "deriving by doing" (Coval *et al*, 2007) simulation in finance education has been productive in moving students away from being passive listeners and towards becoming proactive participants in a dynamic learning cycle. The ability of students to apply their theoretical knowledge in a practical way provides the concrete experiences they need to enhance their understanding of topic areas, allows them to reflect on past actions and assimilate new information, thereby creating new experiences (see Figure 3).

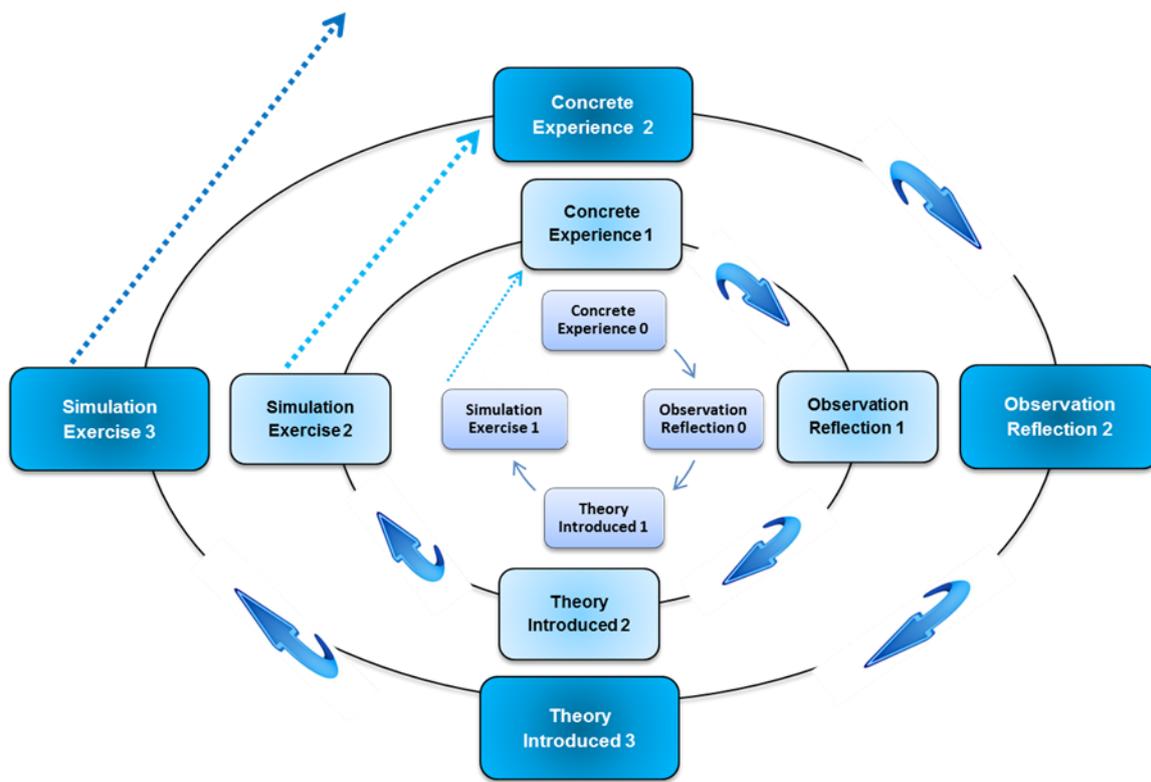


Figure 3: Finance Simulation and Kolb's Learning Loop (1984)

2.2 Simulation as an Assessment Tool in Finance

In addition to the delivery of course content, simulations can be incorporated into the assessment of students' learning. By incorporating simulations into the assessment of students, Marks (1998) concludes that student's performance is enhanced and Levkin (2005) finds that simulation is capable of assessing skills not tested by traditional coursework. Wills and Clerkin (2009) propose that these skills can be enhanced further if students' experience in simulation includes a reflective writing component. The benefits of a practical approach to assessment are reported by Moffit, Stull and McKinney (2010) who, using a pre and post-simulation matched pair test, report significant gains in students' knowledge of financial markets, especially those with limited background knowledge of the subject area. Curtin *et al* (2011) echo the benefits of educational simulation claiming that computer-based simulation helps to improve students' skills and confidence, contributing to the achievement of learning outcomes. Helliard, Michaelson and Sinclair, (2000) and Foster *et al* (2004) report evidence that a market-share game can improve student learning in undergraduate finance courses.

Caution regarding the use of simulation for assessment is noted by Chin, Dukes and Gamson (2009) who suggest that the game itself does not contribute to learning. However, Leemkuil and De Jong (2012) counter this and state that learning can be optimised if

students are allowed to re-play the simulation in order to test and re-test their knowledge of the concepts developed.

2.3 Practical Considerations for Simulation in Finance

Although simulations play an important role in students' learning, the traditional lecturing of underlying subject principles cannot be ignored especially when it covers knowledge required in the simulations. When students learn the general principles before engaging in the simulations, they apply those underlying principles in the simulated decision making process (Schmidt, 2003) and this is the central component of simulations – to bridge the gap between theory and practice. The requirement of students to provide responses to a dynamic virtual world enhances their cognitive growth (Albrecht, 1995) but there is a danger that they become overloaded by massive data and do not know where to focus their attention (Nelson & Erlandson, 2008).

The influence the tutor's involvement has on enhancing the cognitive learning of students (Lundy, 1991) is therefore significant as it can help students manage the information by providing them with assignments that guide their learning, enabling them to concentrate on key aspects of the simulation at each stage (Leemkuil & De Jong, 2012) (see Figure 3). Pre-simulation briefings allow tutors to explain to students the simulation process and the expectations of the activities (Raehsler & Haggerty, 1996). Post-simulation debriefing sessions help students draw conclusions from their performance and reflect on their learning (Garris, Ahlers, & Driskell, 2002; Leemkuil & De Jong, 2012) as well as linking their experience gained from a simulation with a real-life situation (Peters & Vissers, 2004).

With advances in technology and the introduction of more sophisticated simulation software innovative simulation environments are developing that will enhance further students' learning experiences, engagement, motivation and performance. To date the majority of research in this area reports the findings of work undertaken outside the UK. This paper aims to address the paucity of UK based research by investigating the extent to which Finance simulations are integrated into the teaching of Finance across the UK. In addition to this overview, the results of a case study are presented.

3. Methodology

3.1 Extent to which Simulation is used in Finance Education across the UK

In order to quantify the extent to which finance simulation is being integrated into the teaching of finance across the 97 UK Higher Education institutions offering Accounting and Finance programmes, a two-tiered analysis was completed. The universities were identified by using the Universities Central Admissions System (UCAS) database and an initial interrogation of the universities' web pages was undertaken followed by the distribution of an on-line questionnaire to academics involved in the delivery of finance courses.

3.2 Case study on the use of Simulation in Finance Education

The use of a case study approach is widely used in pedagogic research and allows the researchers to explore further particular topics of interest. Marriott (2004) reports the use of a case study relating to computerised business simulations and spread sheet models in accounting education; Storrs and Inderbitzin (2006) presents their case study on using role-play simulation in liberal education; Flores, Ritchie and Wolfe's (2008) case studies, based at two universities, explores the effectiveness of running business simulations via the internet. In this paper, a case study approach is adopted to investigate the introduction of a computerised stock market simulation package into the teaching and assessment of a finance course in a mid-ranking university based in the South of England. The information collated from the reflective reports submitted by students is analysed using NVivo. Students were assured of anonymity and all agreed for the data to be collected, analysed and reported in this study.

4. Findings of and Discussion on the Extent to which Simulation is used in Finance Education across the UK

The initial web-based search of Universities offering finance degrees produced a sample of 30 institutions. The information extracted from these web pages revealed the level of the programmes on which the simulation is used and also the name of the simulation tools used. In order to be consistent with the information obtained from the webpages the questionnaire survey asked three questions:

- (1) Do you incorporate finance simulations in the teaching of your finance modules. If yes:
- (2) At what level – undergraduate, postgraduate or both.
- (3) Name the simulation tools you use.

The survey obtained responses from a further 46 universities which resulted in a total sample of 76 Universities out of the 97 Universities with Accounting and Finance departments across the UK, yielding a response rate of 75%. See Table 1 for a breakdown of the results.

Table 1 – Analysis of the Use of Financial Simulations in UK Universities

	Number	Percentage
Used at undergraduate Level	10	13
Used at postgraduate Level	27	36
Used at both undergraduate and postgraduate	12	16
Not used	27	35
	76	100
Thompson Reuters Database	14	23
Trading Simulation Software	4	7
Both Thompson Reuters & Simulation Software	38	65
Not-disclosed	3	5
	76	100

The 49 Universities using finance simulation use it at both undergraduate and postgraduate levels but with predominance at masters level. The simulation software and finance databases disclosed were Bloomberg, Thomson Reuters, TraderEx and Stock-Track. Bloomberg electronic trading platform offers users access to comprehensive real-time financial data such as analysis, financial news and share prices. It also enables users to trade securities online. Thomson Reuters, however, is a business data provider that allows users access to a wide variety of information ranging from real-time financial data and news to accounting, healthcare, science, and others. The TraderEx simulation software is available on-line and has been developed for the purpose of learning and teaching in securities trading. Stock-track is market simulation software that enables users to create portfolios from over 20 global exchanges using the virtual cash that is provided by the software.

The aim of the survey was to obtain a snapshot of the use of simulation in finance education across the UK. It appears that the utilisation of this advanced technology in teaching is an attractive feature of 30 university programmes of study that is deemed worthy of prominent placement on the universities' websites. This may be indicative, but not tested in this study, of the pedagogic value placed on the use of simulations in the teaching of finance. Combined with the feedback from 46 questionnaires the overall utilisation of finance simulation in the UK from the sample of 76 universities is 64% (49 out of 76). Although this rate represents over half of the sample population it does not reflect the extensive use of simulation internationally. Even if the assumption is made that the remaining 23 universities all use simulation the utilisation rate would still be under three quarters (74%).

5. Case Study Description and Findings

The trading simulation is incorporated into the teaching of *Investments and Behavioural Finance*, a postgraduate course on the MSc Accounting and Finance postgraduate degree programme. The simulation took place in Semester 2 and involved 37 students enrolled on the module in 2012/2013. Prior to implementing the trading simulation, the tutor delivered a "one-off" taster session to the students in Semester 1. The main purposes of this session were to introduce the simulation to students and stimulate their interest in the subject. The trading simulation was new to the students and they found the session interesting and were looking forward to its full implementation in Semester 2 when it would constitute a major part of the course content and assessment.

In Semester 2, the *Investments and Behavioural Finance* course is delivered for 3 hours per week over twelve weeks with four weeks (1/3) allocated to the trading simulation activities. The first two weeks consider the underlying principles of trading, followed by a mock simulation in the third week and an assessment using the simulation scheduled in week four. During the first two trading sessions, students have the opportunity to experience share trading using a stand-alone mode of simulation in which students interact with only the software (similar to playing a computer game). This allows students to familiarise themselves with the software and builds up their confidence on the simulated trading floor. At the end of the stand-alone session, the tutor discusses with students their trading performance and areas for improvement. Printed hand-outs are used to draw students'

attention to the key performance indicators such as closing position, profit / (loss), market share and other measurements.

Once the students are confident with the principles of trading, they all participate in a network simulation trading in the virtual market and interact with each other in the simulated trading environment. This mode of simulation enables students to learn how share prices are affected by decisions of other traders and financial news. A mock trading session is organised for students which allows them to experience the overall simulation task without the fear of poor performance. They were encouraged to record their performance during the mock simulation and discuss it with the tutor if they have any doubts about the simulation. After three weeks of practical experience, students were formally assessed using the network simulations' platform. Students were required to prepare a self-reflection report following the assessed simulation and this report provided feedback that enabled the tutor to assess the value of the simulation in terms of student learning, i.e. do student learn or just play the game? For the assessment, grades were not awarded for students' trading performance during the simulation but for the learning demonstrated in their self-reflection report. In each trading session, the tutor spent about 15 minutes for the pre-simulation session, which covered the opening screen of TraderEx, key areas for attention during the simulation and what is required of the students. See Table 2 for a summary of the delivery of the simulation activities.

Table 2 – Delivery of the Stock Market Trading Simulation

Features	
Programme	Postgraduate
Purpose-built trading room	Yes
Number of students	37
Compulsory simulation activity	Yes
Pre-simulation briefings	Yes
Post-simulation briefings	Yes
Trading simulation teaching time	3 hours for 1 week in Semester 1 3 hours per week for 4 weeks in Semester 2
Play and re-play sessions	Yes
Stand-alone simulation trading	Yes
Network simulation trading	Yes
Formal assessment of trading	Yes

6. Findings and Discussion of Case Study

5.1 Tutor Reflections

From the analysis of the key issues relating to the delivery of trading simulations identified in the literature, and discussions with the finance tutor, a number of aspects have been highlighted.

5.1.1 Pre and post-simulation briefings

It is important that students understand the underlying principles of trading before embarking on trading activity (Schmidt, 2003) in order for information overload to be avoided (Nelson & Erlandson, 2008). The tutor's involvement in this is important and so prior to the simulations the tutor spent time discussing with students the basic trading concepts and mechanisms and explaining how to read and interpret the opening screen of TraderEx. In line with the findings of Raehsler and Haggerty (1996) students found this pre-simulation session useful in their understanding of the simulation and in clarifying what is expected of them. Additionally, using assignment guides that are directly related to the simulation help draw students' attention to key performance measurements (Leemkuil & De Jong, 2012). This is especially useful and essential if the assessment is closely linked to the simulation.

After each round of simulations the tutor uses a debriefing session to encourage students to reassess what they have learned during the role play. In accordance with previous studies (Garris, Ahlers, & Driskell, 2002; Peters & Visser, 2004 and Leemkuil & De Jong, 2012), the debriefing sessions are found useful as they enabled students to draw conclusions from their simulation plays, compare their performance with other students, reflect upon their learning and develop a set of concepts for the next round of simulation play.

5.1.2 Assessment improves engagement in simulation activity

There is potential for students to view computer-based simulations as computer games. However, if the simulation is incorporated into course assessment, students become serious about their engagement with the simulation activities. The students' positive engagement was evidenced by the production of detailed critical reflections on their learning experience and use of the trading software, their trading performance and understanding of the subject. This is consistent with Curtin *et al* (2011) that simulation can contribute to achieving learning outcomes.

The formal assessment of the simulation focussed on the network session enabling the tutor to incorporate the four essential learning domains of simulation activity (critical thinking, team working, communication and decision making) suggested by Pivec and Dziabenko (2009). To ensure that students focussed on the learning process and not the outcome it was the students' reflections that were being assessed and not their trading performance. In accordance with Lundy (1991), by not grading the trading performance of students the competitive element was removed which allowed students to focus on their learning, critical analysis and decision making.

In the case study, simulation is an integral part of the finance course but the tutor regarded the limited amount of time allocated to the simulation sessions was detrimental to optimising the learning potential of the software. This concurs with Cuban, Kirkpatrick and Peck (2001) who regarded a restricted lesson structure to be one of the impediments for implementing an educational simulation.

5.1.3 Enhancing the knowledge transferability of finance concepts

Included in the benchmark statement for finance (QAA, 2007) are the requirements for students to develop an appreciation of the context in which finance operates, to acquire knowledge and understanding of the major theoretical tools and theories of finance and to

develop an ability to put financial theory into practice. During the simulations, students play the role of stock trader/dealer participating in day trading with a target pre-determined final trading position (net buyer/seller or zero book i.e. day or “prop” trader) . They learn to continuously assess their position during the day and react to changes in the market. This active learning approach enables students to apply various finance concepts, such as portfolio risk and return, short vs. long position, volume weighted average price and bid-ask spread, all in the context of a real-world setting during the simulation. These concepts are reinforced when students prepare for the reflection report and undertake the simulation assessment.

Additionally, re-playing the simulations allows students to establish a more solid foundation for understanding the subject area (Leemkuil & De Jong, 2012). Students become confused with overwhelming information and ever-changing data in their initial round of the simulation; hence they implement the trial-and-error method at this stage. By the time they have developed a sense of understanding, the simulation ends. Therefore, allowing students to re-play the simulation is helpful to their learning as they have a second chance of testing the ideas/concepts formed in the previous simulation play.

5.1.4 Simulation selection, technical support and contingencies

There is a wide variety of simulation software available and educators have to choose the software that meets the needs of teaching. Among the many factors that affect software selection is the level of technical support provided by the software supplier. Simulation software is very complex and specialist knowledge is required when problems are encountered. Also, the technical support available from the university needs to be robust both during the installation stage and in the continuous running of the software as updates are frequently required and unexpected technical issues and hardware problems can occur.

The web-based feature of this software means that the operation of simulations is highly dependable on the stability and speed of the internet and technical issues during the simulation can interrupt and hinder students learning. This can be a major problem if the online software fails to operate during the assessment session when a network platform is being used. Although not required in this case study, a contingency set of assessment questions were prepared to enable students to continue the simulation in a stand-alone mode.

5.2 Student Reflections

The use of simulation in finance education has been described as “discovery learning” (Bruner, 1966), “bringing course material to life” (Cebula & Toma, 2002) and “deriving by doing” (Coval *et al*, 2007) and the ‘real-world’ experience (Sprouls, 1962) provided by the simulation is something that the students commented on favourably.

“Trader Ex is a valuable tool to experience some of the challenges traders have to face, such as working under pressure and sudden sharp price movements.”

Student 4

Owing to the TraderEx simulation, I was exposed to the real trading environment and experienced the intense psychological activities to be a

dealer, which deepens my understanding of financial knowledge. It is really a stimulating learning process.

Student 14

“Through experiencing this TradeEx simulation, it makes me understand how the markets are structured, how investors bring their orders to a market and how the dealers make market.”

Student 34

Enabling students to put theory into practice (Burns & Burns, 1982; Wolmarans, 2005; Kumar & Lightner, 2007; Jankowski & Shank, 2010) is a feature of the simulation that students identified.

“To conclude, even though I did not do well in the trading, I am still very impressed about this module because I had a chance to exercise what I did learn in class.”

Student 15

“This exercise provided an insightful look at my understanding and application of finance and investment theory. It has emphasised areas to improve on and highlighted some of my psychological biases.”

Student 22

One aspect of Kolb's (1984) learning loop is the opportunity for students to observe and reflect. The simulation activity helped students identify their trading strategy and reflect on their approach to trading.

“My trading strategy was initially a conservative strategy but then my weakness was that I rushed to achieve my target”.

Student 1

“Examining the timing of my transactions, I appear to be impatient. Three times during the simulation I used market orders unnecessarily. In each instance, my quote became favourable soon after I used an unfavourably price market order. In future I would like to be more cautious in this area.”

Student 12

“My performance in the assessed TraderEx simulation shows me that I am a risk averse investor. My risk aversion has never been tested before and this has taught me that for future investments I will have to take this into consideration.”

Student 19

“Poor timing in setting orders, coupled with my delay in decision making, adversely affected both my market volume and general performance in the days' trading.”

Student 26

For the majority of students this reflection enabled them to identify their mistakes and weaknesses.

"I did not measure and manage my risk well."

Student 18

"My attempts to mitigate the loss by holding a minimal spread in the more stable marketplace were unfortunately adopted too late and reduced my loss by only a very small percentage."

Student 27

"A further area of weakness is my inability to predict the market tendency though market news".

Student 28

According to Kolb (1984), through observation and reflection new abstract concepts can be formulated and future learning can be enhanced. For the students the ability to re-examine their approach and performance revealed significant changes in how they would approach their trading activity in future.

"I would also be more aggressive to my max reservation prices to increase my volumes of trades and I would be more flexible to changes in the market and re-act quickly to changes in the market."

Student 3

"If I were to repeat the simulation I would most likely tend to follow a more risky approach in order to widen my bid-ask-spread."

Student 4

"In order to improve my trading performance in the future I strongly believe that 'reservation price and time management' are two key factors for me."

Student 10

"I found I bought and sold shares before the price went to the best position. In future I would be more patient."

Student 15

The students were keen to discuss the specific changes they would make to their trading activity implying that the simulation promoted active and cooperative learning (Cameron, 1998; Weiser & Schug, 1992) and stimulated their cognitive growth in dealing with the dynamic virtual world they were engaged in (Albrecht, 1995). Typical responses referred to price, market information and timing:

"If I were to engage in this simulation again, I would try to decrease the level of my average buying price to a greater extent and I would follow a

less aggressive approach by using more limit orders and less market orders.”

Student 4

“In future I would pay more attention to the market place in terms of news and events rather than focussing solely on getting to the target.”

Student 20

“If I was engaged in this simulation again, I will change my trading strategy and not blindly buy a large number of stocks at the beginning of the trading day.”

Student 33

For all of the students the simulation activity provided the opportunity to gain valuable experience of stock market trading that they considered important to enhancing their understanding of the principles and process of the subject.

“There is much room for improvement as this was my first experience of stock market trading.”

Student 21

“My profits were minimal; I did not reach my net position and was only partially superior to the VWAP². However, I feel that I learnt a lot more about stock market trading using the simulation than any other assignments I have undertaken”.

Student 19

“From this [trading simulation], I have learnt that though getting to the target is an imperative goal, the process by which one obtains the shares is also significant in trading.”

Student 21

“The experience gained from this simulation activity shows that sometimes you cannot win them all, but with trading practice my understanding of the subject and my trading performance will improve in the future.”

Student 26

For the more discerning students, however, there was recognition that the simulation package could not mimic completely the complexities of the real world.

In the simulated trading we ignore all the risks and transaction. However, in real-world trading these factors cannot be ignored.

² VWAP refers to volume weighted average price – if the price of a buy trade is lower than the VWAP then it is a good trade.

Student 2

It is not possible to directly relate all theories of behavioural finance to the TraderEx simulation program.

Student 8

The only negative comments received relate to technical issues. There were a small number of students reported problems of delays in getting their orders executed at times when there were high levels of trading activity. There was also a breakdown in connection to the internet during one session which some students raised as a problem. Whilst these issues are not desirable they are of a technical nature and outside the control of the tutor although they were communicated to the software company and to the university IT department.

5.3 Summary

The case study has reported the views of the tutor and postgraduate students engaged in the use of the TraderEx stock market trading simulation package on a finance module. The analysis of tutors' experiences of using simulation in teaching has highlighted the pedagogic benefits and practical limitations of using the software. These comments include the use of pre- and post-simulation briefings, the method of assessment used during the simulation, how simulation enhances the knowledge transferability of finance concepts and practical considerations relating to software selection, technical support and contingency planning. These observations offer best practice guidelines for academics considering implementing simulations into their own teaching. From a student perspective the benefits of simulation in terms of offering a 'real-world' experience, although not incorporating all its complexities, have been reported. Combining theory and practice has enable the students to recognise the positive benefits observation, reflection and experimentation can have on identifying their weaknesses, improving their understanding and changing their future trading behaviour. This has enabled them to understand difficult and complex finance concepts as evidenced by the extensive and insightful comments they offered on how they would change their trading strategy to enhance their future performance.

7. Conclusions

Finance as a discipline has been increasing in popularity both in the UK and internationally. It is a challenging subject as fundamental to the study of finance is the development of students' understanding of the relationship between financial theory, empirical testing and their ability to understand how theory and evidence can be combined to assess the effectiveness and efficiency of financing decisions. For many students, especially those without a finance or mathematical background, this can be difficult and poses a pedagogic challenge for accounting and finance educators.

According to cognitive psychology learning takes place when there is an interaction between the learner's intellectual needs and the learning environment. Prior research and the findings from this case study suggest that the use of simulation in finance education helps bring

course material to life and offers students the opportunity of learning by doing by providing students with the concrete experience they need to observe, reflect and experiment. It could be argued, therefore, that the use of simulation should be observed across all the 97 universities offering finance courses in the UK.

The extent of the use of finance simulation within the UK has, until now, been unreported and, as a first-in-the-field investigation of the use of simulation in finance education in the UK, this study makes a contribution to reducing the paucity of research in this area. The paper also adds to the limited literature in the area by presenting the case study results.

In support of the findings of the extant literature the case study reports students' increased engagement in the subject. Simulation has provided an opportunity for students to participate in real-world, multi-faceted and challenging activities that require them to understand and apply their subject knowledge, to use their intuition and judgement in their decision making processes and to observe and reflect on their decisions in ways that inform their future actions and decision making. This active approach to learning is transformative and has provided students with a learning experience that is valuable, enriching and meaningful. Unfortunately, the paper reveals that just 49 out of the 76 universities in the sample are using simulation in the delivery of finance courses (a utilisation rate of 65%). If the 23 non-responding universities are included and assumed to be engaging in the use of simulation, at best the overall figure could increase to 74% (72 out of 97). However, at worst, it could plummet to just 50% (49 out of 97). Given the considerable benefits of integrating simulating into the finance curriculum there is a significant gap in its use across the UK. The authors therefore call for accounting educators to reflect on their pedagogy and the way in which they encourage students to engage in their subjects and how they encourage students to develop the depth and breadth of understanding required for success in a challenging area of study.

This study has conducted a basic survey of the use of finance simulation across the UK and focussed on just one case study so there are limitations to this work. The scope for further work could involve institutions within the UK and overseas allowing for an international comparison to be obtained. A more detailed questionnaire survey could be issued to gather information relating to implementation strategies, assessment practices and tutor perceptions of the pedagogic benefits of using simulation. Replicating the work of Moffit, Stull and McKinney (2010) in the context of UK finance courses could provide an analysis of the progress of students through pre- and post-simulation testing and more detailed views of students regarding the use of simulation could be captured through questionnaires, focus groups and/or interviews.

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