1. Introduction

Serious games are increasingly being used by Higher Education faculty to provide an authentic experience of the entrepreneurial process (Usart and Reomero, 2014; La Guardia et al., 2014; Panoutsopoulos and Sampson, 2014; Bellottia et al., 2012). They are seen as a convenient way to experience the complex and uncertain life-world of the entrepreneur (Gibb, 2002) in an environment that protects the student from key risks, such as bankruptcy or emotional trauma, whilst encouraging reflection through the double-loop learning of iterative game play (Moizer et al,. 2006). However, though strong evidence exists for supporting the value of game based learning (Wang et al., 2015), research concerning their impact on entrepreneurial intentions has been neglected. Whilst previous real world entrepreneurial experience has been established as one factor having a significant positive causal relationship with entrepreneurial intent, the effect of *simulated* entrepreneurial experience is unknown. It is the contention of this paper that a detailed understanding of such a relationship is critical if we are to regard serious games that simulate the entrepreneurial process as a suitable substitute for actual experience and as an effective tool for entrepreneurship education.

Utilising a quasi-experimental pre-test and post-test design, this study assesses the impact of a serious business game on the entrepreneurial intent of first year undergraduate students studying business at a UK university. The paper commences with a review of literature pertaining to the pedagogy of entrepreneurship and the potential of serious games for creating an entrepreneurial mind set. A model of entrepreneurial intent is also presented and discussed. Following a description of the study objectives and research methodology employed, the research findings are reported and analysed. The implications of the study for the use of serious games in

entrepreneurship education are explored and areas for further research are reviewed in the concluding section of the paper.

2. Developing Entrepreneurs: The Limitations of Experiential Learning in the Real World

Entrepreneurial learning has been described as the process of learning to discover and exploit opportunities (Rae, 2007) and can be considered a form of action learning. A number of authors argue that action learning is an effective pedagogic approach in developing and improving new ventures (Rae, 2009; Stewart, 2009) or at least using experiential learning to develop entrepreneurial traits (Bell, 2015). Key to action learning is the recognition of the experiential nature of learning, where learning is regarded as the creation of knowledge through transformational experience (Kolb 1984). Experience is seen as a process of interaction between the individual and their environment (*ibid*). Cowan (2006) regards this process as a continuous spiral of development, making the iterative nature of learning explicit and highlighting the critical role played by reflection. It is through reflection, either during or after an experience, that learning may occur (Schön, 1991; Bligh, 2000).

Experience may not always result in learning and requires a degree of shared meaning between the student and their environment (Light et al*.,* 2010). Indeed, a key characteristic of action learning is that it should be as authentic as possible, with complexity and ambiguity necessary components for an inclusive comprehension of the process (Jones and Holt, 2008). In the context of learning about entrepreneurship, this approach is not problem free with two particular issues presenting serious constraints.

The first relates to the possibility of business failure resulting from student learning activity. An interesting perspective in entrepreneurship is that business failure presents a critical opportunity for reflection and learning. Subject to the moderating influence of attribution bias and emotions post failure (Ucbasaran et al., 2013), a number of studies have identified the opportunities for sense-making (Cardon et al., 2011; Shepherd et al., 2009) and learning (Minniti and Bygrave, 2001; Politis, 2005; Ucbasaran et al., 2010) that arise from failure. In addition, Ucbasaran et al. (2013) propose that the process of understanding failure can give rise to a change in an entrepreneur's mental models. However, business failure is also associated with financial debt, social stigma and may be a highly traumatic and life affecting event, one that has been compared to bereavement in its impact (Shepherd 2003). Further, there is evidence that the emotional impact of failure may restrict the capacity for learning by entrepreneurs (*ibid*). Critically, given the educator's duty of pastoral care, encouraging an authentic entrepreneurial experience clearly has ethical limits. In addition, exposing students to the full emotional impact of business failure may be counterproductive from a learning perspective. This presents a key challenge in terms of encouraging the positive aspects of experiential learning whilst minimising the negative impacts.

The second disadvantage of entrepreneurship education through real-world experience is the available timescale. The Higher Education context imposes fixed timescales on entrepreneurial initiatives, with undergraduate programmes taking place over 3-4 years and most modules lasting no more than 30 weeks. Whilst initiatives such as Graduate Enterprise (Gibb 1996; Fletcher 1999) in the UK have utilised this potential barrier to contain the condensed lifecycle of an enterprise, academic timescales represent a continuing constraint for this form of learning. Given this problem, and the ethical issues associated with entrepreneurial learning in a real world

setting, educators have looked towards the entrepreneurial classroom (DeTienne and Chandler, 2004) as an appropriate means through which students can experience and learn from entrepreneurial activity.

2.1 The Role of Entrepreneurial Serious Games

The expression 'Serious Games' came to prominence in the book of the same name by Clark Abt (1970), who suggested that such games are distinguished by the fact that they are intended primarily for education and not entertainment. Serious games can be entertaining, but they move beyond 'edutainment' to a purpose that is more serious and focused on education, training, skills development or attitudinal and behavioural change (Michael and Chen, 2005; Susi et al., 2007). The term has been contested with some regarding serious games as a sub-set of simulation games, whilst others position them on different points of a continuum. Crookall (2010) suggests that serious games are used in the education community to denote simulation games that make use of computing technology and video graphics and are focused upon learning and training. Alternatively Ricciardi and De Paolis (2014) position serious games and simulation games at different points on a continuum, where serious games are distinguished by their higher level of realism.

Within the classroom, both serious games and simulation games have been used across a number of contexts to provide students with an authentic learning experience (Hainey et al., 2011). As they are able to address some of the constraints that impact upon real-world experiential learning, they are regarded as a key tool in action learning (Lean et al., 2006). Serious games may contain an active role-play element where the student is expected to model the behaviours

of a given character which they then act out, according to role, within a rule-based setting (Sutcliffe, 2002). Here support for learners throughout a gaming experience is important to enhancing their learning (Leemkuil and De Jong, 2012) as serious games are not self-teaching. Serious games have been employed in fields as diverse as history (Corbeil and Laveault, 2011), engineering (Kumar and Labib, 2004) and even health and diet (Orji and Mandryk, 2014) but have become prevalent in digital education (Law and Sun, 2012) and specifically business and management education (Lin and Tu, 2012). Serious games in the field of entrepreneurship provide a mechanism to experience the entrepreneurial process in an environment that aims to be as cognitively authentic or meaningful as possible (Huebscher and Lendner, 2010). Hence, the advantages of experiential learning can be gained whilst the disadvantages of actually running a business can be eliminated. Free from the consequences that failure in the real world might bring, students are able to experiment more freely and try out ideas that they may be more cautious about in a real business setting (Salas et al., 2009). At the same time, the positive learning benefits of 'virtual' failure can be gained, relatively unclouded by the potential influences of attribution bias and emotional response to failure (Shepherd, 2004). Meanwhile, the restrictive timescales of academia can be 'simulated out', with accelerated business cycles allowing students to gain a rich experience, practicing their analytical and decision-making skills within a complex environment (Gilgeous and D'Cruz, 1996). Serious games and simulation games also provide the opportunity for more immediate feedback on the decision making process allowing double-loop learning to occur (Argyris, 2002; Bartunek, 2014; Moizer et al., 2004, 2006;) as well as enhanced understanding through confronting simulated critical incidents (Salas et al., 2009; Lean et al., 2014). Importantly, they provide multiple opportunities for generative

learning by allowing students to make connections between knowledge imparted through the classroom and the experience gained through gaming (Zantow et al., 2005).

Whilst the learning benefits of serious games are documented extensively in the literature, their role within the developing context of Entrepreneurship Education (EE) is less well understood. In what ways do serious games prepare students for a future entrepreneurial career path and, critically, what impact do they have on entrepreneurial intentions? Interestingly, research on the learning benefits of serious games has resulted in mixed evidence when comparing across genders (Towler et al., 2009; Coffey, and Anderson, 2006). Might it also be the case that gender affects intentionality outcomes associated with a game-based entrepreneurship intervention? Through answering these questions, educators may gain a clearer perspective on how entrepreneurship serious games might be used most effectively within a programme of study.

2.1.1 Measuring the Impact of Serious Games in Entrepreneurship

Given multiple options and limited resources available to educators, Fayolle et al. (2006) argue that a common framework is necessary to evaluate the design of EE programmes. They specify Entrepreneurial Intent (EI) as the key dependant variable in measuring impact in such programmes.

Based on the Theory of Planned Behaviour (Ajzen, 1991), the models of Entrepreneurial Intent (Linan et al,. 2011; Kolvereid and Isaksen, 2006) argue that venture creation behaviour is directly related to intent, which is in turn based on 3 motivational factors: Personal Attitude to business start-up, Perceived Behavioural Control over their behaviour, and the effect of Perceived Social Norms. Personal Attitudes (PA) influence whether individuals give a positive

or negative evaluation of an intention toward a specific behaviour (Ajzen 1991). As individuals also make judgements regarding feasibility, Perceived Behavioural Control (PBC) also influences their intentions (Ajzen, 2002). Perceived Social Norms (PSN) influence intentions towards behaviour (Ajzen 1991), with approval from the family (Scherer et al., 1989), peer group or wider society (Linan, et al., 2011) strengthening the desirability for future entrepreneurial behaviour.

Studies using the model of EI have shown strong support for the model's predictive validity (Kolvereid and Isaksen 2006; Krueger et al., 2000; Linan et al., 2011). They have also shown that PA and PBC have a strong direct relationship with EI, and that PSN is a moderating influence through PA and PBC.

FIGURE 1 ABOUT HERE

As Figure 1 shows, these motivational factors are influenced by situational factors, such as the effect of role models, gender, age, work experience, previous entrepreneurial experience and EE. The strength of these relationships varies between studies.

Role models are individuals that provide a guide for others to emulate, or 'model' through socialisation (Bandura, 1997; Van Auken et al., 2006). They may be parents (Scherer et al., 1989), family, friends, employers (Linan, et al., 2011) or celebrities (Swail et al., 2013). Entrepreneurial role models have been shown to impact EI both directly and indirectly, through their influence on self-efficacy / PBC (Krueger, 1993; Linan et al., 2011). Individuals may internalise the identity of the role model, which may provide a useful benchmark for future

behaviour, or as a result of entrepreneurial experience incongruous with that of the role model, result in identity conflict (Shepherd and Haynie, 2009).

Women are under-represented in populations of start-up business (Marlow, 2002; Moore and Butner, 1997), where an entrepreneurial career is often regarded as a male choice (Ahl, 2006; Sánchez Cañizares and Fuentes Garcia, 2010) and this is reflected in lower levels of EI (Wilson et al., 2007; Joensuu et al*., 2013;* Piperopoulos, 2012). Higher education programmes have been shown to lead to a marked decrease in EI for women (Joensuu et al*.,* 2013). Women may perceive different barriers to entrepreneurship, such as fear of failure, lower self-efficacy and a lack of support (Shinnar et al*.*, 2012). They may also have less work experience and fewer role models (Dyer, 1994). Differences may however be gendered, with men and women that scored high on male gender identification scales reporting higher EI than those with low scores (Gupta et al., 2009). A skew towards higher levels of EI in males compared to females as a result of a business simulation intervention has also been observed (Aucher and Kriz, 2013).

The typical profile for individuals to start a business is middle age (Reynolds et al., 2002), with age being regarded as a predictor in EI models (Linan, 2004). Age is linked to experience, with older individuals more likely to have a higher degree of work experience. Experience itself has been shown to influence attitudes towards entrepreneurship (Shapero, 1985; Peterman and Kennedy, 2003), with estimates of between 50-90% of venture ideas being generated as a result of work experience (Hills et al., 1999). More specifically, previous entrepreneurial experience has been reported as an important factor in predicting the venture creation event (Rosefoss and Kolvereid, 2007), with suggestions that it is only through entrepreneurial experience that an individual can discover whether or not they have entrepreneurial talent (Storey, 2011).

Entrepreneurial education has been found to be an important influencer of the motivational factors within EI models, having an effect on career choice (Turker and Selcuk, 2009), the desirability and feasibility of business start-up (Linan, 2004) and having a relationship with EI itself (Souitaris et al., 2007; Pittaway and Cope, 2007; Joensuu et al., 2013). Soutaris et al., 2007 use a pre-test / post-test quasi-experimental design to explore the impact of a 5-month entrepreneurship programme in EI and find an increase in EI. Such findings are supported by Pittaway and Cope (2007) who conclude from a comprehensive review of the literature, that EE has a positive impact on students' intention to start a business.

Whilst rigorous empirical research on the longer term impact of EE on entrepreneurial activity is hard to find (Matlay and Carey, 2007) and more research is needed to establish how students' intentions translate into actual business start-ups (Nabi et al., 2010; BIS, 2013), the role of education in influencing entrepreneurial intent appears to be well established (Kolvereid and Isaksen 2006; Krueger et al., 2000; Linan et al., 2011). There have however been few studies conducted into the influence of specific types of intervention on entrepreneurial intent.

Although the potential pedagogical benefits of serious games as practical and easy to manage tools for experiential entrepreneurship learning are clear, their effect on entrepreneurial intentions is less well understood. Hence, using models of EI as a basis to test the impact of serious business games may provide a useful basis to inform curriculum design. As such, the objective of the paper is to explore the impact that a serious business game has upon EI, and to understanding the moderating effects of any situational and motivational factors. The following section outlines the framework conditions and experimental research design employed in the study.

3. Methodology

This paper adopts a pre-test / post-test quasi-experimental design (following Soutaris et al., 2007) to explore the impact of a serious business game on the entrepreneurial intent of a group of first year undergraduate students.

Figure 1 shows a representation of the model, highlighting situational and motivational factors affecting EI. This research takes an experimental approach where, with the exception of the serious game, situational factors are fixed before and after the exercise.

Fayolle et al., (2006) specify a number of variables that are important in comparing the design of EE programmes. As such the protocol for measuring EI within the context of EE is set out in Table 1. The institutional setting is a UK University and the target audience are Business and Management undergraduates undertaking an entrepreneurial awareness stage of education (Linan, 2004; QAA, 2013). Within this setting the objectives are pedagogic (e.g. developing a mind-set orientation) and the method is experiential rather than a traditional didactic approach.

TABLE 1 ABOUT HERE

The EI model (Linan et al., 2011) has been used in various empirical settings and may be regarded as relatively robust. This paper uses a modified version of Linan's model and Table 2 shows the key constructs of Entrepreneurial Intent (EI) used (Personal Attitude, Perceived Behavioural Control and Perceived Social Norms). It also shows the reliability (Cronbach Alpha) of the constructs used both pre and post-test.

TABLE 2 ABOUT HERE

Previous studies may have introduced bias by sampling from within populations already predisposed towards entrepreneurship (for example, MBA courses and entrepreneurship electives). To avoid selection-bias, 1st year students studying a non-elective core module across various business and management degree programmes within the same faculty and location were selected for the research. Whilst locational constraints may inhibit generalisability of findings, it enabled a consistent experience and control of the learning environment. The students were all participating in a common module of study, involving the use of an entrepreneurship serious game. The serious game in question was SimVenture™, a computer based platform through which students take on the management of a small company producing computers. Students were asked to fill in an online questionnaire immediately prior to their 1st session. They then ran a virtual start-up business in groups of 4-5 for 36 simulated months over a real world period of 3 weeks. At the beginning of every cycle, they were asked to submit various operational level decisions based on their determination of current performance. The overall goal was to improve the performance of the business. After the last cycle, the students completed the post game questionnaire. This resulted in 263 usable matched individual responses to both the pre and post-game questionnaire, with a control group of similar business students not using the game resulting in 48 matched pairs (from a population of 1,118, giving a response rate of 23%).

TABLE 3 ABOUT HERE

4. Analysis

Table 3 shows the results of pre and post-test regression models run to validate the expected relationships. Both models have good fit with strong explanatory power. In both models, Personal Attitude (PA) and Perceived Behavioural Control (PBC) have a strong positive relationship with Entrepreneurial Intent. Social Norm (SN) has no significant effect on Entrepreneurial Intent. According to Ajzen (1991), the relationships based on the Theory of Planned Behaviour are dependent on context, and several studies of EI have found SN to have no direct relationship with EI, instead having a moderating effect on PA and PBC.

Out of 263 cases, the median age is 19 (mean 19.42, standard deviation 3.8), with a similar educational profile (1st year of a business degree). 42.4% were female, 57.6% were male. 60.9% knew an entrepreneurial role model.

The serious game had a significant impact on the Entrepreneurial Intent of participants, with 95% significance in a paired sample t-test. 32.4% of participants showed an increase, 11.2% no change and 56.4% a decrease. In contrast, the control group showed no significant impact on EI over the same period.

A dependent variable was created, Direction of EI, encompassing increase or no change in direction (1) or decrease in direction (0). Of the situational factors, Gender and Role model have a significant effect on the direction of EI (see Table 4) with females more likely to see a decrease and males equally split between increase and decrease. Those with entrepreneurial role models are more likely to see a decrease in EI, whilst those without are more likely to see an increase. The experimental setting controls for Age and Education.

TABLE 4 ABOUT HERE

In order to control for the effects of cross correlation, a logistic regression model was applied to the data to test the likelihood of an increase or decrease in Entrepreneurial Intent as a function of the serious game. The model predicts the log odds of an increase or decrease in EI. Table 5 describes the model, including the log odds and standard errors. With an available sample of 263, missing data resulted in 27 missing cases, an 11% reduction in sample size. This provided sufficient power for analysis.

TABLE 5 ABOUT HERE

For all models, educational level is controlled by the experimental setting. Age has minor variation around the median of 19 years and is included for consistency. Interactions showed no significant effects and have been omitted for parsimony. Model 1 introduces the situational variables, which according to Nagelkerke's R^2, a measure of variance adjusted for sample size explained by the model, explains 6.4% of variance. Model 2 introduces the motivational variables, explaining 4.1% of variance. Model 3 uses both situational and motivational variables, explaining 8.0% of variance. Clearly other predictor variables exist which are not captured in the model of Entrepreneurial Intent.

Model 3 is a good predictor of decrease in EI, with 82.1% of decreases correctly identified. However, it is not a good predictor of increase in EI, with only 30.7% of increases correctly classified within the sample. Nevertheless, the Hosmer and Lemeshow test of significance indicates that the factors presented can be accepted as valid for the purposes of this analysis which was to identify the relationship of key variables whilst controlling for their effect upon

each other. As a result of this analysis, the characteristics which are particularly important in discriminating between the groups have been highlighted.

The baseline levels of pre-game motivational factors identified in the model of EI have no significant effect on the direction of EI as a result of the game. Of the situational factors, Gender and Role Model are significant across both models. Female participants that can identify an entrepreneurial Role Model are more likely to experience a decrease in EI as a result of playing the serious game.

5. Discussion

Using an experimental approach, this study examined the impact of a serious game on EI, whilst controlling for other effects. As a result of the gaming intervention, an overall decrease in EI was measured.

For the majority of the students, this was their first meaningful engagement with entrepreneurial behaviour. Within this intervention, motivational factors (personal attitudes, perceived behavioural control and social networks) exerted no significant change on EI. The impact of the gaming intervention upon EI was moderated only through the situational factors, role model and gender.

Social learning theory (Bandura 1997) suggests that the presence of an entrepreneurial individual within the family or social group may exert an impact on EI. Parental (Scherer et al., 1989), peer group (Van Auken et al., 2006) and popular media (Henderson and Robertston 2000) role models have been found to influence personal attitudes, self-efficacy and social norms (Krueger et al., 2000).

Cross-sectional research shows that role models have a generally positive effect on EI. However, this research shows that the dynamic effect of EE for those with role models was negative. Those with role models have a significantly higher baseline EI (4.73 *cf.* 4.08) and are more likely to see a decrease in EI as a result of the serious business game. Role models may lead to high and unrealistic expectations of an individual's ability which the game helps them to reassess. This may be explained by entrepreneurial talent or identity conflict theory.

Previous studies have shown that broad programmes of EE have resulted in higher levels of change in EI for females compared to males (Joensuu et al., 2013; Zhang et al., 2013). However, broadly based programmes will contain many interventions which may have different effects. The impact of this specific and controlled intervention utilising a serious game was a higher likelihood of a decrease in EI for females. This corresponds with industry evidence where, after an initial entrepreneurial experience, women are less likely to be involved in repeat entrepreneurial behaviour (Kolvereid and Bullvag 1993; Westhead and Wright 1998) and also ties into research on business simulations by Aucher and Kriz (2013) which raises the possibility that this may be an impact of the technology employed. Motivational factors, such as perceived behavioural control / self-efficacy do not account for the difference and whilst female participants started with a marginally lower perceived behavioural control (4.29 *cf.* 4.33) this was not statistically significant. Applying Kolb's experiential learning theory (1984), males have been observed to prefer an *abstract conceptualisation* mode of learning compared to females (Severiens and ten Dam, 1994). This might suggest that males are more likely to make linkages between the *concrete experience* gained in the serious game and previous experience, nevertheless there is no significant relationship between a gender and employment experience interaction to support this.

Observations of female involvement with serious games show lower levels of engagement. Female participants have been reported as being less competitive (Garber and Clopton, 2004), more anxious and less target driven than male participants (Towler et al., 2009).

At a broader level, whether a decrease in EI is regarded as a positive or negative result depends upon the purpose of the educational intervention. Considered from the perspective of a new venture creation outcome, such a decrease implies that serious gaming is not an appropriate tool for the stimulation of start-up as it will have the effect of turning students away from an entrepreneurial career path. Considered from the alternative perspective, an appropriate outcome for entrepreneurship education is to develop enterprising people. Whilst these may go on to set up a business, this is not necessarily the case. Within this perspective, serious gaming is a useful tool in grounding the students in the operational realities of an entrepreneurial career. During such an initial intervention with students, a decrease in EI may be simply regarded as the students' process of internal calibration, where they dispel preconceived notions and set the foundations for future learning. As such it may be viewed as a personal development tool for identifying areas for future capability needs, enabling students to plan learning or training activities which may enhance their readiness for entrepreneurial action. Hence serious games have continuing relevance and an important role to play in the field of entrepreneurship education.

6. Conclusion

No significant robust research appears to have been conducted exploring the impact of serious games on EI. In order to initiate a rigorous approach to mapping the impact of the serious game on EI, this paper focused on its impact on first year Business and Management undergraduates

during their first EE engagement. Other impacts were controlled for. It found that serious gaming as an initial EE intervention decreased EI. Used at this early stage, gaming helps to give a realistic version of what entrepreneurship is about, dispelling preconceptions, grounding expectations and providing a firm basis for the next steps in student learning.

Although, more traditional entrepreneurial programmes do a job of raising the profile and desirability of the entrepreneurial career, the operational authenticity of a serious business game effectively recreates some of the uncertainty and complexity of entrepreneurship and its routine reality or "everydayness" (Steyaert and Katz, 2004).

The serious game used in this research appears to play a role in helping students reflect on what starting a business really entails. A student's interest in entrepreneurship prior to the gaming activity may have been piqued by the glamour of famous role models and the cache of 'entre-tainment' (Swail et al., 2013). As a result of playing the serious game they are, perhaps for the first time, considering the entrepreneurial life-world, enabled by their perceptions of authenticity. This allows them to make a considered choice in terms of their future occupation. In this sense, it is perhaps because serious games are such an authentic and powerful learning tool that they have a negative impact on entrepreneurial intentions for many students. To gloss over the reality of entrepreneurship to meet an economic impact agenda aligned to raising levels of EI may be considered a disservice to students by the educator community. Therefore, serious games play an important role in ensuring a grounded and value-free approach to educating future entrepreneurs.

Within the context of the gaming intervention studied, the research finds that motivational factors do not have an impact on changing levels of EI. Instead, the situational factors, role model and gender are important. Role models are understood as important within EE and prior

to the gaming, students with role models reported higher levels of EI. However, the dynamic effect of the serious business game shows that these same students are the ones most likely to experience a decrease in EI as a result of playing the game. Whilst role models might attract students to engage in EE in the first place, they appear to be counter-productive and promote a false sense of ability and identity. Gender also has an impact, with females likely to see a higher decrease in EI. The reasons behind this are unclear, but various factors relating to differences in learning style and to the appeal of serious games are amongst those that can be inferred from previous studies.

In terms of limitations, evidence suggests that impact on EI may vary by sector (Carey and Matlay, 2010) and the serious game used in this research is set in the context of a manufacturing business. Results might therefore vary if using a game oriented within the service industry. Additionally, the research sample was limited to students within a geographically bound institution[1]; different results might be gained in a different area with different students.

A fuller appreciation of the impact of serious games in a variety of contexts will assist game designers in creating games that better align with the learning objectives sought by the educational community ensuring that they are positioned clearly in the educational rather than edutainment domain. Future research should therefore explore the impacts of a range of serious games across different educational disciplines and contexts. For instance, changing the 'treatment' by introducing different entrepreneurship games to determine differences, or keeping the treatment and changing the learning environment. This would enable game designers to test the game fidelity and effectiveness. This would also enable enterprise educators to make

[1] Research was conducted at Plymouth University, based in the South West of England.

informed choices regarding the suitability and utility of serious games to meet intended learning outcomes.

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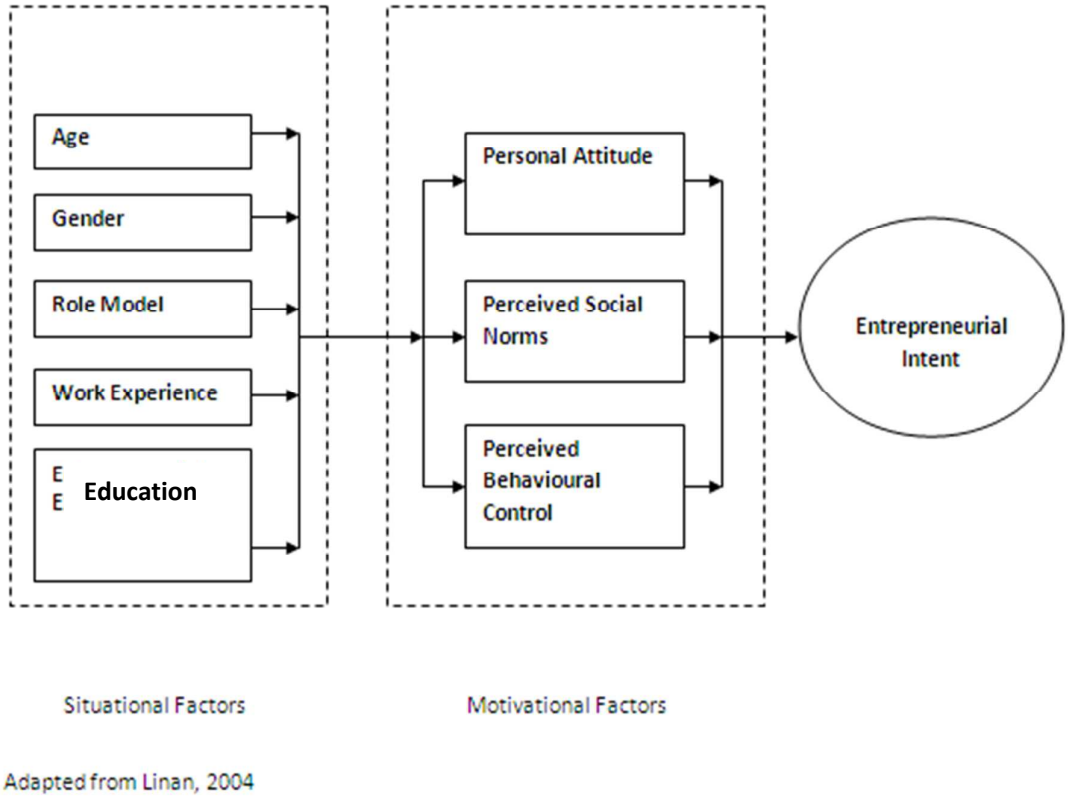
Figure 1 Model of Entrepreneurial Intent



Adapted from Linan, 2004

Table 1 Protocol used for Measuring EI within EEP

Factor name	**Factor**
Institutional setting	A University based in the South West of England.
Audience	Business and Management undergraduates, with a median age of 19 and predominately British
Type	Entrepreneurial awareness education
Objectives	Economic / **Pedagogic** / Social
Teaching approach and methods	**Experiential** / Didactic

Protocol based on a common framework proposed by Fayolle et al (2006)

Table 2 Model of Entrepreneurial Intent Scale Reliability

Scale	**Question**	**Cronbach Alpha**
Entrepreneurial Intent (EI)	I am ready to do anything to be an entrepreneur	Pre test .827
	I will make every effort to start and run my own business	Post test .839
	I have no doubt I will start my own business	
	I am determined to create a business venture in the future	
	My professional goal is to be an entrepreneur	
	I have a very high intention of starting a business	
Personal Attitude (PA)	A career as an entrepreneur is attractive to me	Pre test .808
	If I had the opportunity and resources, I would love to start a business	Post test .804
	Amongst various career options, I would rather be an entrepreneur	
	Being an entrepreneur would give me great satisfaction	
	Being an entrepreneur implies more advantages than disadvantages to me	
Perceived Behavioural	Starting a firm and keeping it viable would be easy for me	Pre test .730
	I completely believe I would be able to start a business	Post test .717

Control (PBC)	I am able to manage the start-up process of a new business	
	If I tried to start a business, I would have a high chance of being successful	
	It would be very easy for me to develop a business idea	
	I know all about the practical details needed to start a business	
Perceived Social Norms (PSN)	My friends would approve of my decision to start a business	Pre test .868
	My immediate family would approve of my decision to start a business	Post test .874
	My colleagues would approve of my decision to start a business	
	My team mates would approve of my decision to start a business	

Table 3 EI Model Validation – Pre and Post Test Regression

	Pre-simulation model		*Post-simulation model*	
Variable	*Observed Coef.*	*Std. Err.*	*Observed Coef.*	*Std. Err.*
Constant	-.834***	.243	-.788***	.237
Personal Attitude	**.**656***	.049	**.**636***	.050
Perceived Behavioural Control	**.**328***	.058	**.**375***	.065
Perceived Social Norm	.096*	.047	.042	.049
R Sqr	.682		.699	
Adj. R-Sqr	.678		.686	
Durbin-Watson	1.728		2.001	

*** .001, ** .05, * .1 significance

Table 4 Independent Variables Relationship with Entrepreneurial Intent

Direction of EI		Increase / Stable	Decrease
Chi-Square		*%*	*%*
Gender**	Male	49.3%	50.7%
	Female	35.0%	65.0%
Role Model**	Yes	36.8%	63.2%
	No	52.6%	47.4%
ANOVA		*Mean*	*Mean*
Baseline PA*		5.0648	5.2971
Baseline PBC**		4.1540	4.4104
Baseline PSN**		4.8245	5.1889

*p < .1 **p < .05, *** p < .001

Table 5 Logistic Regression Predicting Increase or Decrease in Entrepreneurial Intent

	Model 1		**Model 2**		**Model 3**	
	Log odds	Standard error	Log odds	Standard error	Log odds	Standard error
Situational Factors						
Education	-	-	-	-	-	-
Age	1.001	.034	-	-	.994	.034
Gender	1.911**	.278	-	-	1.920**	.284
Role Model	.562**	.276	-	-	.616*	.291
Work Experience	.508	.700	-	-	.545	.714
Baseline Motivational Factors						
Personal Attitude	-	-	.986	.154	.995	.161
Perceived Behavioural Control	-	-	.793	.184	.832	.192
Perceived Social Norms	-	-	.854	.146	.921	.153

Constant	.720	.720	5.033 **	.785	2.711	1.146
Nagelkerke R^2	R^2 =.064		R^2 =.041		R^2 =.080	
-2 Log-likelihood	311.728		317.635		303.913	
Sample size N = 263	237		237		233	

*p < .1 **p < .05, *** p < .001

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