

Changing entrepreneurial intention and behaviour: A digital game-based learning environment dedicated to entrepreneurship education

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Abstract: This paper investigates in the research field of digital game-based learning (DGBL) attempting to shed light on the effect of a serious game (SG) for entrepreneurship education (EE). Based on 73 items an exploratory survey was conducted using the design and methodology proposed by prior studies. This research provides significant evidence that the use of a SG in a DGBL environment influences the entrepreneurial behaviour and intentions significantly comparing players and non players while the entrepreneurial attitudes towards entrepreneurship and towards EE are not significantly different between playing and not-playing survey participants. Data were statistically analyzed using multivariate regression analysis, Cronbach's Alpha, Exploratory Factor Analysis, and Mann-Whitney Tests. Accordingly, this research indicates that SGs can be an effective tool to be used in teaching individuals entrepreneurship combining a traditional-cum-digital approach. Although the use of games for educational purposes is still early stage, this work supports both researchers as well as lecturers from a pedagogical perspective to enhance their effectiveness.

Keywords: serious games; digital game-based learning; entrepreneurship education; entrepreneurial behaviour; entrepreneurial intention; entrepreneurial attitudes.

1. Introduction

Digital game-based learning (DGBL) is receiving increasing attention (Aleckson, 2009; Hwang and Wu, 2012; Leković, 2013). More and more, researchers and scholars have been recognizing the pedagogical value of gaming (Vogel, 1970; LoPiccolo, 2004; Savvas, 2007; Chaudhary, 2008; Brink, 2012;

Kuan-Cheng *et al.*, 2012). Although there is no coherent definition of DGBL (Prensky and Bryce, 2001; Gee, 2005; Chaudhary, 2008; van Rooij *et al.*, 2012), it takes the advantage of games explicitly designed for educational purposes with clear learning effects (Chaudhary, 2008). Marc Prensky (2001) with Deanne Bryce (2001) and Paul Gee (2005) are key contributors to the DGBL theory as a pedagogical tool.

The underlining roots of DGBL spin a long yarn. In the internationally well-known essay "Upon the Aesthetic Education of Man", Friedrich Schiller argues that play is a power of civilization, which supports humans to raise above their instincts to turn into open-minded members in communities. Narrowed by Schiller's concepts regarding beauty and freedom it is emphasised that human beings are only fully individuals when they play (Schiller, 1967; Martinson, 2005; Moggach, 2008; Schiller, 2012). However, it sets the basis for "Homo Ludens" created by Johan Huizinga (Huizinga, 1955; Huizinga, 1971), which has become an essential reading for those active in DGBL (Hjorth, 1999; Van Eck, 2006; Rodriguez, 2006; Bitzer *et al.*, 2007; Hofstede *et al.*, 2010; Hamari, 2013). Today, such persuasive games come into multiple play as a tool for business training (Richards, 2008), workforce training (Martin and Fetzer, 2014), soft skills training (Jabary, 2014), social science research (Wood *et al.*, 2014), health sector and cultural training (Zielke *et al.*, 2009; Orji *et al.*, 2014); or as computer simulation for training in the medical field (Bradley, 2006).

While previous authors have lamented that interactive gaming technology was not presenting its full potential in areas like education and training (LoPiccolo, 2005), however, much activity has happened recently to improve this situation (Oksanen and Hämäläinen, 2014; Lester *et al.*, 2014). A comprehensive construction for examining the interaction between a player or learner and game features with educational purposes is needed for a better understanding of its impacts. From a review of existing DGBL evaluation criteria, a tailored set of criteria were defined for a specially designed development, prototyping and evaluation dedicated to EE. Flow (Qin *et al.*, 2009; Wu *et al.*, 2013) perceived as behavioural control (Shinnar *et al.*, 2009) plays a central key element in such a DGBL narrative-central learning environment for education (Lester *et al.*, 2014). The criteria emphasize the need for the game to increase entrepreneurship literacy through applicability to management, actionable goals and feedback. Fortunately, the existing measurements of these fundamentals tend to advance continuously (Przybylski *et al.*, 2010), and lacking construct validity and reliability of measures (Pápay *et al.*, 2013) are improving constantly also (Kim and Kim, 2010). Although it is tempting to consider games as a method for promoting and teaching entrepreneurship, there is actually very little experience or proof this assumption.

The aim of this contribution is to enhance DGBL research based on validated and proven instruments in the area of games to measure all these various aspects of game plays with an educational character. We advance the literature on the efficacy of SG to promote and teach entrepreneurship (Neck and Greene, 2011). The recent promotion of DGBL in education presents convincing opportunities

and challenges for early childhood educators for today's so-called digital natives (Nolan and McBride, 2014). In this article a focus lies on EE using DGBL. Based upon previous analyses, what are the requirements for DGBL games for teaching entrepreneurship (Mayer et al., 2014), a research model is proposed that if the needed level of flow and recreation specialization is met, a SG will lead to entrepreneurial behaviour and intention. Accordingly, the research question for the study is: *Is a SG dedicated to EE influencing gamers entrepreneurial behaviour and intentions significantly different compared to non gamers?*

This article is organized as follows. It starts with a discussion of the theoretical underlying framework and examines prior investigations in associated fields to understand recent trends in research. Within this section EE with respect to the pilot project under research is addressed in detail. Scale development and empirical procedures are described in the subsequent methodology section, in which statistical results from a sample of 41 individuals, SG gamers and non gamers, are summarized. Finally, after discussing the results along with limitations and implications for both researchers and practitioners alike, the article ends with concluding remarks and suggestions for future research.

2. Theoretical framework and hypotheses

Digital game-based learning

Games are defined as a rules-based, conflict-driven quantifiable and unambiguous challenge that allows positive or negative outcomes (Hainley and Henderson, 2006; Haurie *et al.*, 2012; Mariais *et al.*, 2012). In general games contain well-defined rules and constrained fields of play that are complicated and rely on the ability to detect and exploit complexity. The key to SGs is prioritizing entertainment over pedagogy (Grimes, 2005; Sawyer, 2007; de Freitas and Ketelhut, 2014; Konert, 2014).

Despite a lack of agreement regarding a precise definition of the phenomenon of DGBL (Prensky and Bryce, 2001; Gee, 2005; Chaudhary, 2008; van Rooij *et al.*, 2012), drawing on the literatures of studies, the recent encouragement in this research field with a focus on education presents convincing opportunities and challenges for lecturers who request for adequate support teaching today's so-called digital natives (Bennett *et al.*, 2008; Lei, 2009; Margaryan *et al.*, 2011). Recent research studies have concluded that for the new generation DGBL is more engaging and effective in the learning process than traditional education (Adcock, 2008; Chih-Hung *et al.*, 2013; Iacovides *et al.*, 2014). Although the pedagogical worth of gaming technology has often been viewed with cynicism by educators who did not grow up in the digital age (Prensky, 2003; Neville and Shelton, 2010; Nolan and McBride, 2014), it is of utmost importance to meet the changing demands of the new generation and adopt educational strategies that are creative and innovative (Chaudhary, 2008; Kim *et al.*, 2009; Hwang and Wu, 2012).

DGBL environments, an interactive and engaging phenomenon, hold significant promise for enormously complex education fields such as specific disciplines including science, technology, engineering and mathematics (Leung *et al.*, 2013; Leung *et al.*, 2013; Lester *et al.*, 2014; Wood *et al.*, 2014). Furthermore, advances in communication and information technology have considerably increased opportunities for the public to participate in government activities (Kelley and Johnston, 2012). Many tools focus exclusively on Massively Multiplayer Online Role Playing Games (MMORPGs) (Yao-Chung, 2006; Charlton and Danforth, 2007; Kim and Kim, 2010; Kong *et al.*, 2012).

Experience-based instructional methods such as simulations and DGBL impacted teaching concepts substantially in the past, that provides a pervasive groundwork across many fields (Ruben, 1999; Qing *et al.*, 2013; Kapp, 2014). Despite a long tradition, there are still many unanswered questions regarding the instructional use of educational games (Leemkuil and De Jong, 2012). Results indicate that both multimodality and interactivity contribute to educational outcomes (Ritterfeld *et al.*, 2009). From the infrastructure aspect, communication and cooperative learning are supported by new technologies (Chen and Huang, 2012). The input/output subsystem is vital within computer architecture because it determines how the computer interacts with its environment to take into account different styles of teaching, ranging from purely theoretical to completely practical (Larrazza-Mendiluze *et al.*, 2013). Assessing the performance in previous studies, interactive learning objects enhance motivation and interest in learning (Wen-Hao David *et al.*, 2010; Chen and Huang, 2012; Kuan-Cheng *et al.*, 2012). An important issue of educational games is the support that learners need in a game to enhance their learning by providing alerts, game-like features, hints for appropriate actions to take in the game or Radio Frequency Identification (RFID) (Chandra and Yin Leng, 2009; Leemkuil and De Jong, 2012; Chen and Huang, 2012). The DGBL design exploits the capabilities of technology to address users' needs and preferences. Beside increasing usability and learnability, the concept of DGBL requires active participation of players. Well designed games in a risk-free setting create ideal learning environments where a player works towards a goal, chooses their actions and the experience the result of their selected actions (Brink, 2012).

Despite the general consensus that excessive abuse of gaming can lead to a variety of physical and psychological problems (Parker *et al.*, 2008; van Rooij *et al.*, 2012), previous adventure learning environment are dedicated to increase interest in and awareness of information technology, safety awareness or ethical issues among individuals using inquiry-based learning (Carron *et al.*, 2008; Bloom, 2009; Rursch *et al.*, 2010; Adams, 2010).

Past research investigating the decision-making process and examining the cognitive nature of the decisions on which the behavioural responses were based shows that between-environment differences were obtained the outcome of the learning process showed evidence of behavioural learning among the participants (Ruben, 1999). Social SG support the knowledge exchange in the learning process (Konert, 2014).

As a result of a profound curiosity in gaming of students, parents, educators and administrators, the gaming industry has also started booming with expected growth of the SGs and gamification market (Chaudhary, 2008; Martin and Fetzer, 2014).

Serious games

As an application of game technologies with serious elements today the universal use of games for purposes beyond entertainment is jointly referred to as SG (Sawyer, 2007; Deterding *et al.*, 2011; Wortley, 2013). SG are being applied to problems in a wide array of areas including healthcare, science, and of course training and education (Alsever and Sacks, 2005; Sawyer, 2007; Barnes *et al.*, 2009; Lester *et al.*, 2013; Vaz de Carvalho *et al.*, 2014; Orji *et al.*, 2014). Taylor *et al.* (2012) argue a shift to a player-centered approach will increase the transfer of knowledge. In addition, Orji *et al.* (2014) employed persuasive games for health to motivate behaviour. Using SGs in energy research a set of criteria for evaluation of SGs which are intended as effective methods of engaging energy users and lowering consumption (Wood *et al.*, 2014). Drawing from cross-cultural and communication studies, Witte (2014) tested SG aimed at rewarding cooperation, communication, and cultural empathy linking to business learning objectives enhances accountability, action, and cultural awareness. In particular from an entrepreneurial perspective, designed strategy games provide insight into how and why a company should position itself in relation to its competition to analyze a situation, create and implement an action plan to learn about the quality of decisions (Chisholm, 2007; Dibbell, 2011). Overall, the SG community has much to offer in this discipline (Crookall, 2010).

Comparing two different game approaches in staff training Vaz de Carvalho *et al.* (2014) show that both a simulation game based on a realistic manufacturing platform and a digital SG encourage motivation and knowledge acquisition to achieve more effective learning results. For the development of SG, it is necessary to articulate the specific features for effective learning. With respect to the trade-off between costs and quality, previous research suggests that cinematics are not worth the immense development investment (Procci *et al.*, 2014). The Sherry Ortner's model of SG draws attention to the purposes and intentions. Power is central to the approach (Jakimow, 2012). Finally, the selected game has to suit to the targeted output (Jong *et al.*, 2013), which leads to the next section, drawing the attention to EE.

Entrepreneurship education

Because of the vital nature of entrepreneurship and the multifaceted impact of EE, this complex discipline has been source for discussions (e.g., Gorman and Hanlon, 1997; Katz, 2003; Peterman and Kennedy, 2003; Kuratko, 2003; 2005; Fayolle *et al.*, 2006; Pittaway and Cope, 2007; Souitaris *et al.*, 2007; Albornoz, 2008; Rasmussen, 2011; Lorz *et al.*, 2013). Based on these assertions developing

more able entrepreneurs can play a critical role in economic growth and employment (e.g., Schumpeter, 1934; Gorman and Hanlon, 1997; Shane and Venkataraman, 2000; Peterman and Kennedy, 2003; Katz, 2008; Pittaway and Cope, 2007). EE must be encouraged to change individuals' attitude towards a career as entrepreneur (EC, 2013). In line with this development, EE is becoming more essential across different education systems (Kozlinska, 2011; Shane and Venkataraman, 2000), even only few scholars have focused on EE (Peterman and Kennedy, 2003; Fayolle et al., 2006; Souitaris et al., 2007).

A large amount of entrepreneurs argue that entrepreneurship cannot be learnt only acquired in practice (Nab et al., 2010; Gstraunthaler and Hendry, 2011), it is believed that entrepreneurship starts young, and that it should be cultivated early (Kourilsky and Walstad, 2002). It has been discussed whether EE actually have a positive impact on actual entrepreneurial actions (Pittaway and Cope, 2007; von Graevenitz et al., 2010; Lautenschläger and Haase, 2011).

The preferred methods for teaching entrepreneurship have been targeted towards the experiential and authentic learning styles (Nab et al., 2010), largely in the following forms of case studies from past, present or future (Van der Sijde et al., 2008); simulated business, largely separated from the real world (Hindle, 2002) or incubators where applying personalities and competencies within a low-investment experienced and real business to set up and manage a company in the real world (von Graevenitz et al., 2010). Additional support is seen by experienced, senior entrepreneurs who provide practical advice or SG as a form of experiential learning (Hindle, 2002; Panoutsopoulos et al., 2011).

In this context, we focus on SGs to promote and teach entrepreneurship (Neck and Greene, 2011). At least since the 1990s SG have been a commonly applied didactic method for teaching entrepreneurship (Katz and Gundry, 1994). The role of SGs as a tool for entrepreneurial business skills is increasing. It is stated that, games such as World of Warcraft have been implemented by firms to improve strategy skills in business (Richards, 2008). Several SGs focusing on EE have appeared. Examples include Hot Shot Business, TopSim and the Enterprise game. For this research a new prototype was launched as well based on Laumer et al. idea (2012) that a SG can be used as self-assessment tool to gain a realistic idea of the job.

Game effects on entrepreneurial attitudes

A number of investigations found a positive impact of EE taking attitudes toward entrepreneurship into account which influence behaviour (e.g. Peterman and Kennedy, 2003; Dickson, 2004; Krueger, 2007; Brännback et al., 2007; Cheung, 2008; Petridou and Glaveli, 2008; Dickson et al., 2008; Oosterbeek et al., 2010; von Graevenitz et al., 2010). There appears to be a causal link between education towards awareness and individuals' entrepreneurial attitudes. Accordingly, EE influences attitudes and perceptions (Walter and Dohse, 2012; Fretschner and Weber, 2013). Based on prior studies that bring to light differences in attitudes and outcomes among individuals who were and were not

participating EE (Duval-Couetil, Reed-Rhoads, and Haghghi 2012; Fayolle and Gailly, 2015), we assume that a SG dedicated to EE support individuals changing their attitudes towards both entrepreneurship and EE. Based on this, we assume and examine following proposition that:

Hypothesis 1: Taking attitudes towards EE into consideration there is no significant difference between the players and non players' of SGs dedicated to EE.

Hypothesis 2: Taking attitudes towards entrepreneurship into consideration there is no significant difference between the players and non players' of SGs dedicated to EE.

Game effects on entrepreneurial intentions

Intentions have proved to be a well-built predictor of planned behaviours in entrepreneurship research (Kolvereid, 1996; Krueger et al., 2000). An increasing body of literature is arguing that intentions play a central role in the decision to start a business (Liñán and Chen, 2009). Despite methodological limitations (Peterman and Kennedy, 2003) the majority of studies that analyze the impact of EE on behaviours and intentions report positive results (e.g., Hansemark, 1998; Liao and Gartner, 2007; Wilson et al., 2007; Krueger, 2007; Souitaris et al., 2007; Oosterbeek et al., 2010; von Graevenitz et al., 2010; Sánchez, 2013; Lorz et al., 2013; Bae et al., 2014). Only few studies reported that EE shows a negative effect on entrepreneurial intention (Oosterbeek et al., 2010; von Graevenitz et al., 2010). Based on previous studies, which found a significant correlation between EE and intentions, we assume that a SG support individuals changing their entrepreneurial intentions. Thus, we propose that:

Hypothesis 3: Taking entrepreneurial intention into consideration there is no significant difference between the players and non players' of SG dedicated to EE.

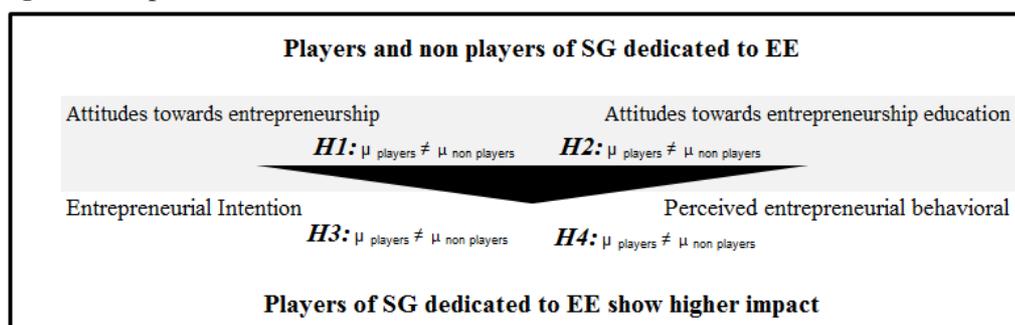
In order to evaluate the outcomes of EE, the present work follows Fayolle et al, (2006) and Souitaris et al. (2007) that the essential factor is the individual intention to perform a given behaviour. Accordingly, our attempt follows that motivation, perceptions and attitudes or independent antecedents predict intention toward the behaviour (Kolvereid, 1996). As a final point, intentions appear to be the immediate antecedent of behaviour (Krueger et al., 2000; Souitaris et al., 2007). Accordingly, intentions appear to be a powerful predictor of planned person behaviour, especially when actions are rare and complicated to examine (Krueger Jr et al., 2000). Entrepreneurship represents such an example of planned and intentional behaviour (Krueger and Brazeal, 1994). In addition, an enormous body of literature is arguing that intentions play a crucial role in the decision to start a new venture (Liñán and Chen, 2009). As a consequence, entrepreneurial intention have been discussed in entrepreneurship research intensively (Krueger and Carsrud, 1993; Kolvereid, 1996), where intention is the unswerving

antecedent of behaviour. The efficacy and ability to predict entrepreneurial intentions has been confirmed by number of entrepreneurial studies (e.g. Kolvereid, 1996; Engle et al., 2010; Autio et al., 2013; Fayolle and Gailly, 2013; Fayolle and Gailly, 2015).

Furthermore, intentions are determined by attitudes (Ajzen, 1991; Kolvereid, 1996; Segal et al., 2005; Souitaris et al., 2007; Gibson et al., 2014). In order to assess the effect of a SG in a DGBL environment for EE, the present study follows these studies in which the central factor is the individual intention to perform a behaviour. As a result, three independent antecedents to predict intention are highlighted. First of all, attitudes toward the behaviour, which appears to be the degree to which the individual wants to become an entrepreneur (Autio, 2005; Kolvereid, 1996). The second key element are the subjective norms, which involve the perceived social pressure from family, friends or other important parties in relation to start or do not start a new business (Ajzen, 1991). Finally, the third one represents the perceived behavioural control, which is the perceived level of difficulty concerning becoming an entrepreneur. Several researchers in EE have used and confirmed this theory regarding the impact of attitude, subjective norm, and perceived behavioural control on intentions (e.g. Kolvereid, 1996; Krueger Jr et al., 2000; Kennedy and Drennan, 2001; Fayolle et al., 2006; Tegtmeier, 2006; Müller, 2008; Swaim et al., 2014; Koe et al., 2014). Based on this line of argumentation, we propose the following:

Hypothesis 4: Taking entrepreneurial behaviour into consideration there is no significant difference in the expected and observed result between the players and non players' of SG dedicated to EE.

Figure 1 Proposed research model



The overall research framework, the hypotheses and the suggested directions of the effects are summarized in Figure 1. The objectives include the development and empirically testing of this model toward DGBL for EE.

3. Methodology

Participants and procedure

The total random sample (n = 41; 36,6 % female) was divided into two groups. Those who had already played educational games were categorized as gamers (SG with n = 12), and those who had already played SG dedicated to EE were categorized as EE gamers (EE SG with n = 23). As shown in Table 1 educators, teachers, researchers, students or individual in training, advisors, and finally entrepreneur serve as the population for this empirical study. The empirical data was gathered through a random sample in Austria in March 2015.

Table 1 Survey participants

	Gender		player of SG		player of EE SG		
	male	female	no	yes	no	yes	
Expert groups							
Educator, teacher or researcher	6	5	7	4	8	3	11
Student or in training	4	2	6	0	4	2	6
Advisor	7	7	9	5	5	9	14
Entrepreneur	9	1	7	3	1	9	10
Respondents	26	15	29	12	18	23	41

Measurement

Based on a systematic review of the techniques in DGBL any study needs to rely on a suitable design for representing causality. Performing such an impact study a theoretical foundation with respect to validity and reliability procedures, adequate sample size, and structured sampling procedures were considered. A quasi-experiment with a control group design was conducted in this study. The study used a quantitative method including a structured online questionnaire. In order to obtain reliable prevalence data, it is important to use validated measurement tools and items from previous studies which are outlined in the Appendix. Primary data collection through items based on the existing literature critically assessing the impact of EE (Duval-Couetil, 2013) builds the basis for the construct. All items had five response categories, ranging from strongly disagree (1) to strongly agree (5) measured by the use of a five-point Likert scale.

4. Results

Data analysis, reliability and validity tests

We applied multivariate regression analysis, Cronbach's Alpha, Exploratory Factor Analysis, and Mann-Whitney Tests using SPSS to test the hypotheses (Jin *et al.*, 2006; Coakes and Steed, 2009). First of all, reliability mirrors the steadiness of the measuring instrument (Letz and Gerr, 1995). There are numerous methods to ascertain reliability that take account of split-halves method, test-retest method, internal consistency method, and equivalent forms. Internal consistency methods are espoused in this research. Cronbach's alpha is widely used for internal consistency (Cronbach, 1951). All of the Cronbach's alpha values for the constructs developed were higher than 0.75. While according to Nunnally (1978) a value that equals or above 0.70 is measured to show strong internal consistency, Hair *et al.* (1995) considers an alpha value equal or above of 0.60 significant. As indicated in Table 2 as well as a performed item-total statistics, the p values are all significant. As shown Cronbach's alpha value of the 73 items in the instrument is 0,951. Consequently, all items in the instrument are taken without being changed. These results indicate that the reliability of this research is adequate.

Table 2 Reliability Statistics - Cronbach's Alpha

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,951	,947	73

In the next research step, validity is concerned with the success of measuring. Content validity, construct validity, and criterion-referenced validity are three different approaches concerning validity (Haertel, 1985; Murphy and Davidshofer, 1988; Fraenkel and Wallen, 1993). In this research effort construct validity and content validity are applied. Carmines & Zeller (1990) argue that validity of a questionnaire's structure is the extent to which the instrument measures the conception it is supposed to measure. For this investigation statistical validity analysis are applied for content validity. Based on Hair *et al.* (1995) the content validity of an instrument examines the adequate explanation of the conceptual field to cover. The correlation between an item and the whole items are examined. Table 3 outlines a Pearson Correlation with the transformed computed variables of each group. The correlation between the items subjective norms, behaviour and entrepreneurship intention with enjoyment, curiosity and skills are not significant correlated. Eliminating these question groups, the construct validity of the instrument is proven. All other correlations are significant which indicates that the items measure the concept. These outcomes indicate that the content validity of the appliance is acceptable.

Table 3 Questionnaire: Pearson Correlation Analysis – Reliability and Validity

Sig. (2-tailed)	Indicators _of_Flow	Attitudes_ of_E	Attitudes_ of_EE	Person- ality	Norms	Behaviour	E_ Intentions
	1						
		1					
			1				
				1			
					1		
						1	
							1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Exploratory Factor Analysis

A performed Exploratory Factor Analysis (EFA) confirms the structural quality of the questionnaire for this study. First of all, using Kaiser-Meyer-Olkin (Dziuban and Shirkey, 1974) the items or questions are examined regarding enough common information. Next, with respect to extract factors an eigenvalue of not less than 1 is implemented (Parlett, 1980). The extracted model represents an adequate structure examined by following elements. (i) The determinant of the correlation matrix of the correlating question groups in Table 4 is 0,014 which is greater than the necessary value of 0,00001. (ii) The communalities of all variables are not less than 0.5. (iii) The model explains the total variance well.¹ (iv) The factor loadings of an item in the rotated component matrix is less than 0.45 for all factors. (v) Each two factors extracted should not be correlated, as interpreted by the component score covariance matrix (Hair et al., 1995; Lattin et al., 2003; Smith et al., 2007). Based on Hair et al. (1995) and single-item factors or items with factor loadings less than 0.5 on all factors or greater than 0.5 on two or more factors were eliminated if the criteria were not fulfilled. As shown in Table 5 for all items, an EFA is suitable because Kaiser-Meyer-Olkin was more than 0.5, in fact above 0.8 which is great according to Kaiser (1974).

¹ Tables related to Item-Total Statistics, Communalities and Total Variance Explained are provided by the Author if further details are needed.

Table 4 Correlation Matrix

a Determinant = ,014		Indicator_ Flow	Attitudes_ of_E	Attitudes_ of_EE	Personal- ity	Norms	Behaviour	Intentions
Correlation	Indicators_Flow	1,000						
	Attitudes_of_E	,655	1,000					
	Attitudes_of_EE	,569	,503	1,000				
	Personality	,714	,671	,610	1,000			
	Norms	,434	,435	,413	,398	1,000		
	Behaviour	,589	,781	,635	,634	,433	1,000	
	Intentions	,389	,657	,171	,386	,449	,572	1,000
Sig. (1-tailed)	Indicators_Flow							
	Attitudes_of_E	,000						
	Attitudes_of_EE	,000	,000					
	Personality	,000	,000	,000				
	Norms	,002	,002	,004	,005			
	Behaviour	,000	,000	,000	,000	,002		
	Intentions	,006	,000	,142	,006	,002	,000	

Table 5 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,835
Bartlett's Test of Sphericity	Approx. Chi-Square	156,425
	df	21
	Sig.	,000

To cope with non-response bias a study report was offered. As single informants are applied, common-method bias might occur. To response to this problem the suggestions of Podsakoff et al. (2003) by means of a Harman's single-factor test were followed. As a result, the reliability of the construct is determined to be sufficient. The tendency to invest in a SG for EE uses a concept consisting of 73 items measured on a 5-point Likert rating scale ranging from 1 (strongly disagree) to 5 (strongly agree). Divided into subscales, and presented in Table 6 the questionnaire includes indicators of flow towards a narrative approach (five items; Cronbach's $\alpha = .876$), attitude towards entrepreneurship (eleven items; Cronbach's $\alpha = .696$), attitudes towards EE (six items; Cronbach's $\alpha = .656$), proactive personality (five items; Cronbach's $\alpha = .866$), subjective norm (three items; Cronbach's $\alpha = .870$), perceived behavioural control (thirteen items; Cronbach's $\alpha = .883$), and entrepreneurial intentions (seven items; Cronbach's $\alpha = .953$).

Table 6 Reliability Statistics Cronbach's Alpha

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Indicators of flow	,876	,874	5
Attitudes towards entrepreneurship	,696	,715	11
Attitudes towards EE	,656	,667	6
Proactive personality	,866	,868	5
Subjective norm	,870	,871	3
Perceived behavioural control	,883	,884	13
Entrepreneurial intentions	,953	,953	7
All items	,951	,947	73

While a series of different regression models were used to describe the relationship between players and non players, for testing the hypothesis in this study we conducted Mann-Whitney Tests between player and non players summarized in Table 7.

Table 7 Test Statistics Mann-Whitney Test between player/non players

	<i>H1</i> <i>Attitudes_E</i>	<i>H2</i> <i>Attitudes_EE</i>	<i>H3</i> <i>Behaviour</i>	<i>H4</i> <i>E_Intentions</i>
Mann-Whitney U	146,000	161,500	123,000	130,000
Wilcoxon W	317,000	332,500	294,000	301,000
Z	-1,607	-1,202	-2,210	-2,026
Asymp. Sig. (2-tailed)	,108	,229	,027	,043

a Grouping Variable: V85 - players and non players of SG for EE

Based on recommendations in prior studies related to small samples and similar research in this field (Chen and Luo, 2004; Vidal-Salazar *et al.*, 2012; Leković, 2013; Aziz and Ayvaz, 2014), Mann-Whitney Tests were applied to achieve more precise and more powerful estimations. As indicated in Table 7 hypothesis 3 and hypothesis 4 are rejected. There is a significant difference between players and non players of SG dedicated to EE when it comes to entrepreneurial behaviour and intentions. While there is no evidence for a significant difference between players' and non players' attitudes towards entrepreneurship and EE, significant differences between the between players' and non players' entrepreneurial behaviour and entrepreneurial intention confirms that SG dedicated to EE appears to be a valuable pedagogical method for additional entrepreneurial training.

5. Discussion and Conclusion

SG demand educators to apply new pedagogical approaches. However, current toolkits for developing effective SG for EE in an efficient way requires a specific approach and innovative set. We used a novel instrument designed to measure 73 items of DGBL for EE based on literature of both disciplines. The findings of this research show that SG dedicated to EE can be an effective tool to be used in teaching entrepreneurship resulting in a significant difference between players and non players enhancing education. While this research has shown that DGBL can contribute significantly in EE in a combined traditional-cum-digital approach, there are still questions pending because of following limitations.

Limitation

The academic literature is still less unanimous. While a number of researchers concede that particular forms of EE are associated with sizable positive effects (Peterman and Kennedy, 2003; Sternberg and Wennekers, 2005; Van Stel et al., 2005; Fayolle et al., 2006; Acs and Szerb, 2007; Souitaris et al., 2007), other scholars discover indication that the effects are negative (Oosterbeek et al., 2010). Limitations of this study are principally related to the analysis of the items. Characteristics and results should be examined more profoundly with respect for further statistical analyses based on a structural equation models. Further extra effort is needed to separate intertwined factors (e.g. gender, age, expert group, indicators of enjoyment, indicators of flow, indicators of curiosity, indicators of challenge and skills, attitude towards entrepreneurship, proactive personality, subjective norm, perceived behavioural control, and entrepreneurial intentions), their directions and effects, and dependences. However, these results contribute to the current state of research regarding the use of SGs for EE stating that playing results in significant transformation in entrepreneurial behaviour and intentions. However, there remains essential work to be done to convert insights about entrepreneurial experience, entrepreneurial teaching techniques, applied tools and entrepreneurial learning into practice especially with a focus on DGBL which leads to the next section, further research.

Implications

The findings obtained in this study lead us to advise that the educational centres and managerial institutions which organise workshops and programmes dedicated to entrepreneurship should seeking to reinforce the innovative concept of DGBL with SG to enhance the effectiveness with a combined traditional-cum-digital approach. SG dedicated to EE can be an effective tool to be used in teaching entrepreneurship enhancing entrepreneurial motivation as well as increasing practical knowledge related to starting a business from the scratch. In awareness of these findings, some policy-makers declare the sensitization of possible founders, including appropriate EE, a primary goal of innovation

policies (EC, 2013) which also highlights the absolute necessity to enhance research in this discipline that leads directly to the next subsection of this paper.

Further research

As advised for future research by Fang et al. (2010) we continue to investigate additional factors that contribute to DGBL with a focus on entrepreneurship. Furthermore, refining the instrument by adding and revising items is needed to be empirically tested again. Next, numerous scholars provide support that women have lower entrepreneurial intentions than men (Scherer et al., 1989; Chen et al., 1998; Kourilsky and Walstad, 1998; Hao et al., 2005). Consequently, the impacts of SG dedicated to EE may differ between women and men. However, there are no universally accepted gender differences for the EE intentions relationship (Chowdhury, 2005). Accordingly, given the possibility that SGs have a pedagogical bias towards different education levels and gender these effects appear to be still poorly understood. Therefore, in future studies gender differences and educational level should be taken into account.

Appendix

Items

- G1: What is your gender? (male, female)
 G2: What is your age? (<20; 20-30; 31-40, 40<)
 G3: What is your profession? (Entrepreneur/Advisor, Educator/ Teacher/ Researcher, Student or in training)
 G4: What is your area of expertise?
 G5: Have you ever played a serious game explicitly designed with educational purposes?
 G6: Have you ever played a serious game dedicated to entrepreneurship?
 G7: Have you ever participated in any form of entrepreneurship education?

Indicators of Enjoyment (based on Fang *et al.*, 2010)

- IE1: I will feel unhappy when playing a serious game in a farm setting dedicated to entrepreneurship.
 IE2: I will feel worried when playing a serious game in a farm setting dedicated to entrepreneurship.
 IE3: I will feel happy when playing a serious game in a farm setting dedicated to entrepreneurship.
 IE4: I will feel exhausted when playing a serious game in a farm setting dedicated to entrepreneurship.
 IE5: I will feel miserable when playing a serious game in a farm setting dedicated to entrepreneurship.
 IE6: Playing a serious game in a farm setting dedicated to entrepreneurship will make me more intelligent.
 IE7: The activities in a serious game in a farm setting dedicated to entrepreneurship are respectable.
 IE8: The activities in a serious game in a farm setting dedicated to entrepreneurship are decent.

Indicators of Flow (based on Wu *et al.*, 2013)

- IF1: Playing a serious game in a farm setting dedicated to entrepreneurship will be interesting.
 IF2: Playing a serious game in a farm setting dedicated to entrepreneurship will be fun.
 IF3: I will feel curious while playing a serious game in a farm setting dedicated to entrepreneurship.
 IF4: I will be in control of a serious game in a farm setting dedicated to entrepreneurship.
 IF5: I will be entirely absorbed in playing a serious game in a farm setting dedicated to entrepreneurship.

Indicators of Curiosity (based on Qin *et al.*, 2009)

IC1: I want to know the rest of the storyline in the course of playing a serious game in a farm setting.

IC2: A serious game in a farm setting dedicated to entrepreneurship sounds interesting.

IC3: I will feel successful when I overcome the obstacles, tasks or opponents in the farm game.

IC4: I will explore actively the farm game.

IC5: I will like to concentrate on the story of a serious game in a farm setting dedicated to entrepreneurship.

IC6: The story in a serious game in a farm setting dedicated to entrepreneurship should quickly grab my attention at the beginning.

Indicators of challenge and skills (based on Qin *et al.*, 2009)

ICS1: Parts of the story should be formed by me in the course of playing the serious game in a farm setting dedicated to entrepreneurship.

ICS2: I will like tasks or conflicts, which are difficult in a serious game story.

ICS3: Some tasks or conflicts in the serious game story should be stimulating and suspenseful.

Attitude towards entrepreneurship

AE1: In business, it is preferable to be an entrepreneur, rather than a large firm employee. (Carayannis *et al.*, 2003)

AE2: It is more beneficial to society to have large enterprises than small firms. (Carayannis, Evans, & Hanson, 2003)

AE3: I would rather found a new company than be the manager of an existing one. (Lüthje & Franke, 2003)

AE4: Starting my own business sounds attractive to me. (Krueger *et al.*, 2000)

AE5: I personally consider entrepreneurship to be a highly desirable career alternative for people with my professional and education background. (Autio *et al.*, 2001)

AE6: Overall, I consider an entrepreneurship career. (Francis *et al.*, 2004)

AE7: A career as an entrepreneur is totally unattractive to me. (Linan and Chen, 2009)

AE8: If I had the opportunity and resources, I would love to start a business. (Linan and Chen, 2009)

AE9: Amongst various options, I would rather be anything but an entrepreneur. (Linan and Chen, 2009)

AE10: Being an entrepreneur would give me great satisfaction. (Linan and Chen, 2009)

AE11: Being an entrepreneur implies more advantages than disadvantages to me. (Linan and Chen, 2009)

Attitude towards entrepreneurship education (Autio *et al.*, 2001)

AEE1: I know many people who have successfully started up their own business.

AEE2: In my environment, people are actively encouraged to pursue their own ideas.

AEE3: In my environment, you get to meet lots of people with good ideas for a new business.

AEE4: Entrepreneurship education prepares people well for an entrepreneurial career.

AEE5: In my environment there is a well functioning support infrastructure to support the start-up of new firms.

AEE6: Entrepreneurship cannot be taught.

Proactive personality (Kickul and Gundry, 2002)

PP1: I enjoy facing and overcoming obstacles to my ideas.

PP2: Nothing is more exciting than seeing my ideas turn into reality.

PP3: I excel at identifying opportunities.

PP4: I love to challenge the status quo.

PP5: I can spot a good opportunity long before others can.

Subjective norm

SN1: My family and friends support me to start my own business. (Krueger et al., 2000)

SN2: If I became an entrepreneur, my family would consider it to be. (Autio et al., 2001)

SN3: If I became an entrepreneur, my close friends would consider it to be. (Autio et al., 2001)

Perceived behavioral control

PBC1: I am confident that I would succeed if I started my own business. (Autio *et al.*, 2001)

PBC2: It would be easy for me to start my own business. (Autio *et al.*, 2001)

PBC3: To start my own firm would probably be the best way for me to take advantage of my education. (Autio *et al.*, 2001)

PBC4: I have the skills and capabilities required to succeed as an entrepreneur. (Autio *et al.*, 2001)

PBC5: I have ever thought about starting a business. (Shinnar *et al.*, 2009)

PBC6: I am interested in an entrepreneurial serious game in a farm setting. (Shinnar *et al.*, 2009)

PBC7: Starting a firm and keeping it viable would be easy for me. (Liñán and Chen, 2009; Kolvereid, 1996)

PBC8: I believe I would be completely unable to start a business. (Linan and Chen, 2009 and Kolvereid, 1996)

PBC9: I am able to control the creation process of a new business. (Linan and Chen, 2009 and Kolvereid, 1996)

PBC10: If I tried to start a business, I would have a high chance of being. (Linan and Chen, 2009 and Kolvereid, 1996)

PBC11: I know all about the practical details needed to start a business. (Linan and Chen, 2009 and Kolvereid, 1996)

PBC12: The number of events outside my control which could prevent me from starting a new business are very few. (Linan and Chen, 2009 and Kolvereid, 1996)

PBC13: For me, developing a business idea would be easy. (Linan and Chen, 2009 and Kolvereid, 1996)

Entrepreneurial Intentions

EI1: Are you currently self-employed? (Lüthje and Franke, 2003)

EI2: Do you plan to be self-employed in the foreseeable future ? (Lüthje & Franke, 2003)

EI3: Estimate the probability (0-100%) you will start your own business in the next 5 years? (Krueger *et al.*, 2000)

EI4: I'm ready to make anything to be an entrepreneur. (Liñán and Chen, 2009)

EI5: My professional goal is becoming an entrepreneur. (Liñán and Chen, 2009)

EI6: I will make every effort to start and run my own business. (Liñán and Chen, 2009)

EI7: I'm determined to create a firm in the future. (Liñán and Chen, 2009)

EI8: I have very seriously thought in starting a business. (Liñán and Chen, 2009)

EI9: I've got the firm intention to start a firm someday. (Liñán and Chen, 2009)

EI10: I'm going to start my own business within one years. (Kolvereid, 1996; Armitage and Conner, 2001)

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