Flow and business simulation games: a typology of students

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Abstract

In the context of management training business simulation games are increasingly emerging as pedagogical tools for motivating and engaging players actively in the learning experience. Business simulation games provide opportunities for students to enter the flow state. However, few studies have applied flow theory in this specific context. Using data from a two-wave longitudinal study with a sample of 430 students who played a business simulation game, this research draws on the four-channel model of flow to identify subgroups of students based on their levels of skill and challenge and to analyse the evolution of their optimal experience of flow. In addition, it explores whether students in flow achieve higher learning outcomes; in particular, students' perceived learning, satisfaction and skills development.

Keywords: business simulation games; flow; learning; cluster analysis

1. Introduction

Business simulation games are virtual representations of real commercial situations that allow students to manage companies in risk-free environments (Pando-García et al., 2016) and enable instructors to provide a bridge between theory and practice (Loon et al., 2015). By simulating market trends, business simulation games provide an overall view of corporate strategic functions and allow students to address educational contents in interactive and enjoyable ways.

One of the most important aspects to consider when games are used for learning purposes is the game-playing experience of the players (Hou & Li, 2014). In this sense, the concept of flow is commonly used to describe the psychological state of the players. Flow is a state of optimal experience where concentration is so intense that nothing else seems to matter, time becomes distorted, and self-consciousness disappears (Csikszentmihalyi, 1975). As a result, the activities that produce such experiences are characterised as pleasant and intrinsically rewarding. Flow occurs when challenges and skills are high and in balance (Csikszentmihalyi & Csikszentmihalyi, 1988). By contrast, three additional states of mind are identified when challenge and skill are not in balance, or both fall below a critical threshold: boredom, apathy and anxiety.

Previous research in game-based learning contexts has acknowledged that experiencing flow is important for students (Hamari et al., 2016; Kiili et al., 2014). However, although business simulation games provide opportunities for students to enter the flow state, only a few studies have applied flow theory in this specific context (see Kiili et al., 2014 and Buil et al., 2018, for exceptions). To bridge this gap, this research draws on the four-channel model of flow (Csikszentmihalyi, 1990) to classify subgroups of students based on their levels of skill and the level of challenge they face while playing business simulation games. Unlike previous cross-sectional research, this two-wave longitudinal study examines students' states of mind at two measurement points to analyse the evolution of the optimal experience of flow among students. In addition, it explores whether students in flow states achieve better learning outcomes than those not in flow state; in particular, students' perceived learning, satisfaction and skills development are examined.

2. Theoretical framework and hypotheses development

2.1. Flow theory

Flow theory has its origin in Csikszentmihalyi's desire to understand enjoyment. Csikszentmihalyi (1975) explored why some people were willing to invest great amounts of time and effort in undertaking activities that provide no external reward. He found that this group of people felt rewarded by executing actions per se, experiencing high enjoyment and fulfilment from the activity in itself. Those activities were characterised to be intrinsically motivating, and the optimal experience derived from performing them was labelled 'flow' (Csikszentmihalyi, 1975). The flow construct was described as a *'crucial component of enjoyment'* (Csikszentmihalyi, 1975, 11), and the flow experience was defined as *'the holistic sensation that people feel when they act with total involvement'* (Csikszentmihalyi, 1975, 36). Most flow measuring instruments include the challenge-skill dimension, which has been claimed to be the most important flow antecedent (Csikszentmihalyi, 1990). The original flow model specified that it occurred when there was an equal match between challenge and skills (i.e., both equally high and equally low) (Csikszentmihalyi, 1975). Suboptimal scenarios arose where situations where too challenging, which led to anxiety, or insufficiently challenging, which led to boredom. Later empirical formulations proposed that, for flow to occur, both challenges and skills had to be high, and in balance, leading to the four-channel model of flow (Csikszentmihalyi & Csikszentmihalyi, 1988). According to this model, the opposite pole of flow is apathy, in which both challenges and skills are equally low. Drawing on the four-channel model of flow, we propose:

Hypothesis 1: Four subgroups of students' states of mind can be identified based on their skill levels and the challenge they face while playing a business simulation game: boredom (low scores in challenge and high scores in skill); anxiety (low scores in skill and high scores in challenge); apathy (low scores in skill and challenge); and flow (high scores in skill and challenge).

2.2. States of mind and learning outcomes

Flow theory has been widely associated with learning (Shernoff & Csikszentmihalyi, 2009). Previous studies have reported flow as a strong predictor of students' learning in different contexts, such online learning (e.g., Esteban-Millat et al., 2014) and game-based learning (Hamari et al., 2016). In addition, flow has been found to influence the development of various skills (Buil et al., 2018; Klein et al., 2010), which is of particular importance in the specific context of business simulation games, and student satisfaction (Joo et al., 2011, 2013; Klein et al., 2010; Lee & Choi, 2013). On the other hand, boredom has been associated with lower levels of self-esteem, and pessimism about the future (Hunter & Csikszentmihalyi, 2003), and has been reported as detrimental to students' motivation (Pekrun et al., 2002). Similarly, apathy has been negatively related to affect, concentration, contentment and motivation (Konradt et al., 2003). Finally, anxiety has been associated with decreased levels of motivation (Jain & Sidhu, 2013) and learning performance (Chou, 2001) and higher levels of cognitive load (Hwang et al., 2013). Therefore, we propose:

Hypothesis 2: Students in flow will show higher levels of (a) perceived learning, (b) satisfaction, and (c) skills development than those who are not in flow.

3. Methodology

The empirical study was carried out with a sample of 430 final-year business students who played a business simulation game in a semester-long marketing course. The data were collected from the same course over three academic years, from 2016 to 2019. The players were asked to answer a self-administered questionnaire at two measurement points: at the beginning of the simulation competition (T1) and at the end of the competition (T2).

To measure the constructs included in the study, well-established scales taken from previous literature were adapted to ensure that the items fitted the context. 7-point Likert-type scale items were used, ranging from 1 (strongly disagree) to 7 (strongly agree). First, to classify the students, their perceptions about their skills (Cronbach's α T1= 0.77; α T2= 0.80) and the challenge (α T1= 0.84; α T2= 0.88) presented in the game were measured at T1 and T2, following Novak et al. (2000). Secondly, to examine whether students in flow achieve better learning outcomes, perceived learning, satisfaction and skills development were measured at T2. Perceived learning (α T2= 0.90) was adapted from Tiwari et al. (2014). Satisfaction with the business simulation game (α T2= 0.92) was measured following Kettanurak et al. (2001). To measure skills development (α T2= 0.87), we included various skills which have been highlighted in previous studies as the most important in business simulation games.

4. Analysis of results

4.1. Cluster analysis: results

Two cluster analyses were used to classify the respondents based on their levels of skill and challenge at T1 and T2. SPSS 20 was employed. In the first cluster analysis (see Table 1) a single composite measure for each construct (i.e., skill and challenge at T1) was calculated to form the clustering variables. A two-step approach was employed. First, Ward's hierarchical cluster analysis method, using squared Euclidean distance, was used to determine the number of groups. Three-, four- and five-cluster solutions were explored. In addition, the authors examined the dendrograms and the distances at which each cluster was formed, profiled each cluster and used practical judgments and theoretical foundations (Hair et al., 2006). These indicators suggested that the four-cluster solution was the most appropriate. Thereafter, a K-means clustering analysis was performed for the four-cluster solution. The initial centroids of the four clusters were used as the starting centres for the analysis. This solution provided the greatest contrast between the groups (Hair et al., 2006). Finally, discriminant analysis supported the appropriateness of the four-cluster solution.

Table 1. Clusters, ANOVA and Post-Hoc Analyses (T1)

	Cluster 1 *Boredom*	Cluster 2 *Flow*	Cluster 3 *Anxiety*	Cluster 4 *Apathy*	F-value	Post-hoc test
Skill	4.65	4.84	3.33	3.25	269.41**	1-2, 1-3, 1-4, 2-3, 2-4
Challenge	4.30	5.74	5.25	3.56	297.92**	1-2, 1-3, 1-4, 2-3, 2-4, 3-4
No. cases	108	115	115	92		
%	25.1	26.7	26.7	21.4		

Note: **p<0.05

In the second cluster analysis (see Table 2), again a single composite measure for each construct (i.e., skill and challenge at T2) was calculated to form the clustering variables. Ward's hierarchical cluster analysis method was used to determine the number of groups. The four-cluster solution was the most appropriate. This estimate was prespecified in a K-means cluster analysis. This solution provided the greatest contrast between the groups (Hair et al., 2006). Discriminant analysis also supported the appropriateness of the four-cluster solution.

Table 2. Clusters, ANOVA and Post-Hoc Analyses (T2)

	Cluster 1 *Boredom*	Cluster 2 *Flow*	Cluster 3 *Anxiety*	Cluster 4 *Apathy*	F-value	Post-hoc test
Skill	5.48	5.69	4.48	3.63	236.91**	1-2, 1-3, 1-4, 2-3, 2-4, 3-4
Challenge	4.02	5.92	5.12	3.36	380.53**	1-2, 1-3, 1-4, 2-3, 2-4, 3-4
No. cases	90	145	143	52		
%	20.9	33.7	33.3	12.1		

Note: **p<0.05

Based on the respondents' average ratings of skills and challenge, the four clusters obtained at T1 and T2 were labelled as 'boredom', 'flow', 'anxiety' and 'apathy', in accordance with the four-channel model of flow. An analysis of variance (ANOVA) was conducted to test for differences among the four clusters at T1 and T2.

The results revealed that students in the boredom state (cluster 1) reported at T1 a medium level of skills ($M_{Skill\ T1} = 4.65$) and a low level of game challenge ($M_{Challenge\ T1} = 4.30$). At T2, students in the boredom state reported higher levels of skills ($M_{Skill\ T2} = 5.48$) due to their experience of playing the game, although the game challenge was even lower ($M_{Challenge\ T2} = 4.02$). Students in the flow state (cluster 2), in contrast, showed the highest levels of skills and game challenge in the class, both at the beginning ($M_{Skill\ T1} = 4.84$; $M_{Challenge\ T1} = 5.74$) and at the end of the simulation ($M_{Skill\ T2} = 5.69$; $M_{Challenge\ T2} = 5.92$). In contrast to the boredom state, students in the anxiety state (cluster 3) reported at T1 a low level of skills ($M_{Skill\ T1} = 3.33$) and a high level of game challenge ($M_{Challenge\ T1} = 5.25$). Although at T2 their skills levels had increased as a consequence of playing the game ($M_{Skill\ T2} = 4.48$), they were still perceived as too low to face the challenges of the game ($M_{Challenge\ T2} = 5.12$). Finally, students in the apathy state (cluster 4) reported the lowest level of skills and game challenge in the class, both at the beginning ($M_{Skill\ T1} = 3.25$; $M_{Challenge\ T1} = 3.56$) and at the end of the simulation ($M_{Skill\ T2} = 3.63$; $M_{Challenge\ T2} = 3.36$). Hence, hypothesis 1 is supported. The results also revealed that, overall, the tendency was for the students to perceive that their skills were higher after taking part in the business simulation game, and that the game challenge became lower as a consequence of playing it.

Despite the similarities among the clusters at T1 and T2, not all students were classified into the same subgroups at both measurement points. Table 3 presents the percentage of students classified into a given subgroup at T2, based on their classification at T1.

Table 3. Distribution of cluster membership at T2 on the basis of cluster membership at T1

		Cluster membership (T2)			
		Cluster 1 *Boredom*	Cluster 2 *Flow*	Cluster 3 *Anxiety*	Cluster 4 *Apathy*
Cluster membership (T1)	Cluster 1 *Boredom*	35.2%	29.6%	24.1%	11.1%
	Cluster 2 *Flow*	15.7%	53%	27%	4.3%
	Cluster 3 *Anxiety*	9.6%	30.4%	50.4%	9.6%
	Cluster 4 *Apathy*	25%	18.5%	30.4%	26.1%

4.2. The effect of flow on learning outcomes: results

To examine whether students in flow achieved higher levels of learning outcomes than those not in flow, we conducted three ANOVAs, one for each dependent variable: students' perceived learning, satisfaction and skills development (see Table 4).

The results indicate a significant difference in perceptions of learning between students in flow ($M_{PL\,flow} = 5.91$) and students in boredom ($M_{PL\,boredom} = 5.23$), anxiety ($M_{PL\,anxiety} = 5.33$), and apathy ($M_{PL\,apathy} = 4.78$) ($F = 27.46$; $p < 0.05$). Similarly, a significant difference in satisfaction was found between students in flow ($M_{SAT\,flow} = 6.27$) and students in boredom ($M_{SAT\,boredom} = 5.61$), anxiety ($M_{SAT\,anxiety} = 5.83$), and apathy ($M_{SAT\,apathy} = 4.84$) ($F = 33.98$; $p < 0.05$). The results also showed a significant difference in skills development between students in states of flow ($M_{SD\,flow} = 6.06$), boredom ($M_{SD\,boredom} = 5.29$), anxiety ($M_{SD\,anxiety} = 5.59$), and apathy ($M_{SD\,apathy} = 4.80$) ($F = 39.18$; $p < 0.05$). Therefore, hypothesis 2 is supported. In addition, the results confirmed that students in apathy show significantly lower levels of satisfaction and skills development that those who are in flow, boredom or anxiety. Finally, there is no difference in terms of learning outcomes between students in boredom and students in anxiety.

Table 4. Learning outcomes across the four clusters (T2)

	Cluster 1 *Boredom*	Cluster 2 *Flow*	Cluster 3 *Anxiety*	Cluster 4 *Apathy*	F-value	Post-hoc test
Perceived learning	5.23	5.91	5.33	4.78	27.46^{**}	1-2, 2-3, 2-4, 3-4
Satisfaction	5.61	6.27	5.83	4.84	33.98^{**}	1-2, 1-4, 2-3, 2-4, 3-4
Skills development	5.29	6.06	5.59	4.80	39.18^{**}	1-2, 1-4, 2-3, 2-4, 3-4

Note: **p<0.05

5. Conclusions

This study presents two main theoretical contributions. First, while previous research into game-based learning has acknowledged the importance of flow for students (Hamari et al., 2016; Kiili et al., 2014), few studies have analysed flow in the context of business simulation games (e.g., Kiili et al., 2014 and Buil et al., 2018). Therefore, this research advances existing knowledge by applying the four-channel model of flow

(Csikszentmihalyi, 1990) to identify subgroups of students based on their levels of skill and challenge while playing a business simulation game and by exploring how the different states of mind associated with the four-channel model of flow relate to positive learning outcomes. Second, previous research analysing flow in this specific context has relied on cross-sectional data (e.g., Buil et al., 2018). Therefore, this study contributes to the literature by examining students' states of mind at two measurement points to analyse the evolution of the optimal flow experience.

This study also provides practical suggestions for designing learning activities using business simulation games. First, instructors are encouraged to monitor the activities by measuring the students' perceptions of their skills and the challenges they face at different points of the simulation. Our findings have shown that, although many students stay in the same clusters during the simulation, others change from one to another. Therefore, taking into account that it takes a comparatively short time to measure the skills and challenges used in this study, it would be worthwhile to monitor students' states of mind at different points and, based on those results, implement solutions to prevent students from suffering boredom, anxiety and apathy, and to encourage flow. Second, as shown in this study, in order to experience flow in game playing, students need to perceive that they are being challenged and that their skills are high enough to face the challenge. Thus, instructors should provide students with a constantly evolving challenge; for example, the algorithm could be programmed so that unexpected events take place during the simulation (e.g., strikes, inflation, etc.), which would make it more challenging. This might reduce the possibility of students becoming bored or apathetic. In addition, instructors might provide students with explanations in class about the functioning of the simulation game and materials (e.g., PowerPoint slides and users' manuals) that would give the students the necessary skills and knowledge to play the game better. Finally, this study has demonstrated that experiencing flow while playing a business simulation game is crucial to reach the highest levels of perceived learning, satisfaction and skills development. Therefore, instructors should encourage this state of mind by favouring its determinants. As proposed by Csikszentmihalyi (1990), as well as ensuring there is a balance between individuals' skills and the challenge presented during the activity, establishing clear goals and providing immediate feedback on performance is essential for helping individuals reach a state of flow. Thus, students need to know how well they are performing during the business simulation game and how the activity is proceeding. One way to do this might be to design the game so that it provides students with relevant information, such as competitors' prices and sales, product cost per unit, etc., so that they can progressively reorient their strategies.

This study has limitations. First, this study describes flow in terms of students' skills and perceived challenge. It would be interesting for future studies to use conceptualisations of flow proposed by other authors. A second limitation is the use of retrospective and self-reported measures of flow. In addition, as the questionnaire was answered anonymously, we could not link students' responses to objective measures of learning, such as their grades. Therefore, another avenue for future research could include other measures of learning performance, such as application tests, memory retention or transfer learning.

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