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Visual Thinking Boosting Spanish Higher Education Students' Entrepreneurial Intentions

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Abstract

The need to boost entrepreneurship is necessary and universities play a crucial role in this respect. For this reason, this study, based on the Entrepreneurial Event Model (EEM), with the aim of boosting Entrepreneurial Intention (EI) amongst university students, examines the moderating effect that some methodologies and learning resources such as visual thinking have on EI in a sample of 333 university students from a Spanish university. The methodology employed is partial least squares-structural equation modelling. The results show how the employment of several visual thinking learning resources such as images, videos, and popplets moderates the relationships between the antecedents of the EEM and EI. While the use of popplets moderates the relationship between PD and PD with EI, the use of images moderates the relationship between PD and EI, and the use of videos moderates the relationship between PF and EI. Therefore, the use of visual thinking resources can help to increase EI amongst university students. To do this, universities, with the support of governments and public administrations, must promote a paradigm shift towards more visual learning methodologies.

Keywords Visual thinking · Entrepreneurial intentions · Popplet · Videos · Innovative education · Entrepreneurial Event Model

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Introduction

Economic growth, the creation of jobs and business innovation represent some of the main concerns facing society, governments, and public administrations. Therefore, entrepreneurship is given a key role, through which an individual is capable of driving innovation, increasing productivity, discovering new employment opportunities, revitalizing markets, and improving social welfare, culminating in economic development (Guerrero et al. 2008). As a result, entrepreneurs act as creative destruction agents, creating disequilibrium and changes in the economic system (Dutta et al. 2015).

Spain is one of the countries in the OECD with the highest unemployment rates, 14.1%. Within this situation, 32.6% of young people in Spain (between the ages of 15 and 24) are unemployed (OECD 2019), shifting the attention towards the entrepreneurial process (Hernández-Mogollón et al. 2018). This makes it necessary to find solutions that allow this percentage to be reduced, and entrepreneurial activity seems like a good option. This is because, apart from the fact that the enterprise itself would create indisputable added value, it could at the same time facilitate the creation of jobs, not only for the person who starts the entrepreneurial project but also for others who would find a job opportunity in the new enterprise (Hartono and Muzayanah 2020; ONTSI 2019). However, entrepreneurial initiative reaches 6.4% in Spain, which is very low if we compare it to the average of the most developed countries which is 10% or the EU28 average which is 7.7% (ONTSI 2019). Taking into account that our economic future partly depends on entrepreneurs (Vaicekauskaite and Valackiene 2018), it seems necessary to equip young Spaniards with entrepreneurial abilities. Therefore, it is necessary to understand the elements that determine the development of entrepreneurship.

Given that Entrepreneurial Intention (EI) represents the main antecedent to entrepreneurship, there is widespread interest in identifying the factors that stimulate EI (Gough 2019; Hernández-Mogollón et al. 2018), because a better understanding of the factors that influence attitudes towards entrepreneurship could lead to the successful development of these initiatives, especially for university students (Zampetakis 2008). As a result, universities become essential for strengthening entrepreneurial behaviors amongst students (Anderson and Jack 2008), to respond to the challenge of creating entrepreneurial environments that drive social and economic development (Zorrilla et al. 2020).

Although traditionally education systems have not promoted entrepreneurial skills or abilities (Hernández-Mogollón et al. 2018), with the aim of stimulating social and economic development through entrepreneurship, universities drive the implementation of innovative educational methodologies and learning resources (Zorrilla et al. 2020). This situation requires the study of the educational methodologies or resources that impact EI amongst students (Gough 2019), and specifically, those linked to visual thinking (Hayati and Umer 2018).

There has been less attention given to the relationship between these resources and EI, despite the European Commission (2011, 2) established that entrepreneurial competences can be better achieved through research and discovery that allow students to convert their ideas into actions. As a result, traditional methodologies and learning resources should be combined with others that are more innovative and promote the development of entrepreneurial ideas (Farhangmehr et al. 2016). Therefore, and in

response to studies from people such as Fayolle and Liñán (2014), the aim is to close the gap by studying how *visual thinking* moderates the predecessors to EI.

As a result, the objective of this study is to analyze the impact that the use of innovative methodologies and learning resources has on the relationship between the prior behaviors and EI. For the purpose of understanding the impact that specific methodologies and resources have on generating EI, this study aims to answer the following research question: Do the innovative methodologies and learning resources linked to visual thinking moderate the effect that perceived feasibility (PF) and perceived desirability (PD) have on EI? The importance of this study lies with the interest shown by society, governments, and public administrations in improving entrepreneurial activity, all of whom challenge universities to help them with this purpose.

In order to respond to the proposed objective, we use Institutional Theory and the Entrepreneurial Event Model (EEM). Institutional theory looks at the influence that environmental factors have on the entrepreneurial function (Hernández-Mogollón et al. 2018). Furthermore, we use the (EEM) (Shapero and Sokol 1982) to establish the relationship between EI and the variables that precede it: perceived feasibility and perceived desirability. The methodology used to analyze the data is the partial least squares equations model.

This document is structured in the following manner: the following section presents a literature review that shows the theoretical framework based on previous studies to support the model and the hypotheses included in section three. The "Methodology" section details the methodology, summarizes the sample, and describes the measures that were used. The "Analysis and Results" section presents the results of our study, followed by the "Discussion" section which discusses the results. Finally, in the "Conclusions" section, we highlight the main contributions and implications, as well as the limitations and future areas to be studied.

Literature Review

Personality Traits and Development of Entrepreneurial Intentions

Shapero and Sokol's (1982) model, known as the Entrepreneurial Event Model, is widely accepted in the study of EI (Dutta et al. 2015). This model is specifically related to the area of entrepreneurship and has been developed in order to understand entrepreneurial behavior (Iakovleva and Kolvereid 2009; Krueger et al. 2000). The EEM is based on "defining what an entrepreneur is in distinction to other individuals" (Iakovleva and Kolvereid 2009, 68) and considers the creation of a business as an event that can be explained by the interaction between initiative, ability, management, relative autonomy, and risk (Guerrero et al. 2008; Iakovleva and Kolvereid 2009; Shapero and Sokol 1982; Zhang et al. 2014).

The EEM focuses on the way in which the cultural and social environment affects whether someone embarks on an entrepreneurial path (Shapero and Sokol 1982) and assumes that exogenous factors such as the perceived feasibility (PF) and perceived desirability (PD) influence the entrepreneurial process, and specifically EI (Krueger et al. 2000). This means that Shapero and Sokol (1982) consider that PF and PD are

predecessors of EI (Dutta et al. 2015; Fitzsimmons and Douglas 2011). PF along with PD are motivational components that transform the perceptions of internal and external control in EI (Schlaegel and Koenig 2014).

PD is defined as the attractiveness or inclination to start a business or become an entrepreneur, taking into account the intrapersonal and extrapersonal impacts (Dutta et al. 2015; Iakovleva and Kolvereid 2009; Schlaegel and Koenig 2014; Sánchez-Escobedo et al. 2011; Shapero and Sokol 1982; Zampetakis 2008). PD covers the components that reflect the level of attractiveness of the Theory of Planned Behavior (TPB): attitude towards the behavior and social norms (Sánchez-Escobedo et al. 2011). As individuals associate positive results with starting a business, it is more likely that they will have the intention of developing such behaviors (Shook and Bratianu 2010).

PF has been defined as the perception of how feasible it is to create a new business (Shapero and Sokol 1982); the extent to which the individual feels capable of starting a business (Zampetakis 2008). The PF would be represented by the desire to carry out a behavior in order to achieve an objective (Iakovleva and Kolvereid 2009; Krueger et al. 2000; Schlaegel and Koenig 2014). According to Krueger et al. (2000), Shapero's PF corresponds to the perceived behavioral control in TPB. PF is also known as business self-efficacy, which indicates that if an individual has a strong belief in themselves and their ability to successfully carry out entrepreneurial tasks (Dutta et al. 2015; Shook and Bratianu 2010).

Finally, there is the propensity to act. This refers to an individual's willingness to act, which will be influenced by events that occur. It is therefore the individual, through their PF and PD of that event, who decides whether to start a business or not (Dutta et al. 2015). Those factors that influence the PF and PD of starting a business will influence the strength of the EI. However, when we analyze the EI amongst university students, we should remember that students might not be worried about such factors as they might consider such a decision to be very remote (Guerrero et al. 2008; Peterman and Kennedy 2003; Zampetakis 2008).

Universities as Growth Agents

The theory of economic growth states that opportunities are endogenous (Acs et al. 2009), suggesting that investment in knowledge and human capital contributes to economic growth through an effect known as "spillover" (Hartono and Muzayanah 2020). As a result,, economic growth and technological progress are by far not only based on the efforts of large and incumbent firms but also SMEs and entrepreneurial ventures (Ghio et al. 2015) that serve as a conduit of knowledge spillovers (Audretsch and Keilbach 2008). The Knowledge Spillover Theory of Entrepreneurship (KSTE) incorporates the endogenous growth theory, knowledge spillovers, and entrepreneurship theory (Ghio et al. 2015).

The university environment plays a key role in helping individuals to start a business based on knowledge (Iglesias-Sánchez et al. 2012; Turker and Selçuk 2009), making universities agents of change through innovation and entrepreneurship (Barba-Sánchez and Atienza-Sahuquillo 2018). This means that universities transfer business "know-how" to their students, developing skills and competences that enable them to act in an increasingly complex world (Vaicekauskaite and Valackiene 2018), an important resource for driving economic development (Sudarwati 2018).

According to KSTE, knowledge created endogenously results in knowledge spillovers, which allow entrepreneurs to identify and exploit opportunities (Acs et al. 2009; Audretsch and Lehmann 2005; Shane and Venkataraman 2000). Low rates of return on R&D may be due to a lack of entrepreneurial skills. Hence, the ability to transform new knowledge into economic opportunities involves a set of skills, aptitudes, insights, and circumstances (Acs et al. 2009). The KSTE proposes that new knowledge and ideas created in one context but left uncommercialized—such as a research undertaken by a university—serve as the source of knowledge generating entrepreneurial opportunities (Audretsch and Lehmann 2005).

As a result, this confirms the positive and significant economic impact of teaching, research, and entrepreneurial activities (Guerrero et al. 2015). Therefore, universities play a crucial role in promoting "spillover" through research and human capital, provided by students who have been well educated (Audretsch and Lehmann 2005).

Teaching Methodologies and Resources and Entrepreneurial Intention Amongst University Students

Educational models should focus on continuous learning, innovation, and creation, making it necessary to drive an entrepreneurial culture within educational programs (Hernández-Mogollón et al. 2018). If the objective of education is to boost the number of entrepreneurs, it should not only focus on content but also on the learning method (Oyugi 2014). Furthermore, in order to activate entrepreneurial competences within the academic curriculum, universities adopt active methodologies that promote active, critical, and contextualized learning linked to real problems, situations, or professional experiences (Zorrilla et al. 2020). The use of innovative learning methodologies and resources arises from the need to adopt mechanisms and tools to support adequate academic development amongst students (Macías et al. 2018; Medrano et al. 2018). In fact, taking into account the current student body, the development and use of innovative methodologies and learning resources (Israr and Hashim 2017), as well as visual ones (Reyes and Manipol 2015), are essential. In addition, the role that professors play should not be forgotten, when it comes to finding active learning resources and methodologies which facilitate the development of specific skills and competences that are required for entrepreneurship (Anderson and Jack 2008; Sudarwati 2018).

Learning methodologies will be crucial so that students can acquire the tools, skills, and capabilities that promote the development of their EI (Anderson and Jack 2008; Farhangmehr et al. 2016; Israr and Hashim 2017; Oyugi 2014). This means that teaching methods are as important as the content if we want to influence EI. However, the effect of these learning methodologies and resources has not really been explored (Turunen 2018), specifically the effect they have on EI. Taking into account that the current generation of university students is a very visual generation with great visual skills (Lima et al. 2014), the use of more visual learning methods, understood as resources that allow you to analyze, organize, and represent ideas through visual tools, is increasingly being recommended (INTEF 2017; Reyes and Manipol 2015).

This line of thought is supported by authors such as Sudarwati (2018), who establishes the need to carry out more research in terms of the use of videos in entrepreneurial teaching. This is perhaps due to the fact that *visual thinking* (where videos are one of the resources used) is able to develop skills such as creativity and

innovation (Reyes and Manipol 2015; Sudarwati 2018), factors which the literature on entrepreneurship links to an increase in EI (Gielnik et al. 2012; Popescu et al. 2015; Zampetakis 2008). Creativity and *visual thinking* are very important characteristics amongst entrepreneurs, given that these can lead to new business opportunities that may not have been previously exploited (Anderson and Jack 2008; Mohedano-Suanes and Benítez 2018). Or because the use of some *visual thinking* methodologies facilitates the creation of mental maps (for example, through tools such as *Popplet*), one of the forms of visualization most commonly used by entrepreneurs for problem-solving and for generating ideas (Hayati and Umer 2018).

Research Model and Hypothesis

The Entrepreneurial Event Model

EI is defined as "self-acknowledged conviction by a person that they intend to set up a new business venture and consciously plan to do so at some point in the future" (Thompson 2009, 676). EI is considered as the predecessor to the act of starting a business (Zhang et al. 2014). This study uses EEM as its theoretical framework, as it is one of the most widely used models for analyzing EI (Popescu et al. 2015). By using this model, we establish that PF and PD are the principal factors that determine EI (Dutta et al. 2015; Fitzsimmons and Douglas 2011; Guerrero et al. 2008; Shook and Bratianu 2010; Yi 2018) and that PF influences PD (Schlaegel and Koenig 2014). Furthermore, the relationship between PF and PD is established, in terms of generating EI, although occasionally a negative relationship is established between both variables (Fitzsimmons and Douglas 2011). In addition to this, it is important to note that the main antecedent of EI, in terms of explained variation, is PD (Dutta et al. 2015; Guerrero et al. 2008; Shook and Bratianu 2010). This situation could arise in the period before university, as students might not be concerned about the PF of starting a business given that such an event feels so remote. They might be more concerned about the direction their studies and experience are taking so that they are prepared for their professional careers, and they might be affected by PD (Peterman and Kennedy 2003). Although we are not the first to examine these relationships, we establish the following hypotheses so that we can be certain about the effectiveness of our model. Therefore, taking into account the EEM and results from previous studies, we propose that:

$H1_a$: PD determines EI in a direct and positive manner.
$H1_b$: PF determines EI in a direct and positive manner.
$H1_{c:}$ PF determines PD in a direct and positive manner.

Visual Thinking and Its Effect on Perceived Desirability and Feasibility

The moderator effect of the innovative educational learning methodologies and resources on the relationships between the prior variables and EI has not received widespread coverage in the academic literature, despite these methodologies and

resources being able to change individuals' behavior and EI (Israr and Hashim 2017). In fact, a greater number of studies are required in the literature that analyze the influence these innovative methodologies and educational resources have on EI (Fayolle and Liñán 2014; Gough 2019) and that specifically focus on the role of *visual thinking* (Hayati and Umer 2018).

Participation in educational programs linked to entrepreneurship significantly affects PF and PD (Peterman and Kennedy 2003; Yi 2018). Images can help to develop cerebral abilities such as spatial intelligence; that is, improved development of the brain's right hemisphere (Kellet 2006). Therefore, the use of images can lead to a greater PF for two reasons. Firstly, because the intuitive side of the brain is developed more than the rational side (Castellano et al. 2014). Secondly, because it creates greater intuition because the development of this spatial intelligence can help someone to have a broader understanding of their environment and consequently be able to make decisions (Kickul et al. 2010). Furthermore, the use of images can affect behaviors and the PD (Castellano et al. 2014) as they facilitate intuitive thinking enabling the development of new and unfamiliar ideas (Feinstein and Kiner 2011; Gielnik et al. 2012). The use of visual resources also inspires creativity and develops new entrepreneurs through the existing link between creativity and PD, as PD mediates the effect of creativity on EI (Kellet 2006; Zampetakis 2008). Similarly, images can influence attitudes and therefore facilitate the development of EI. In fact, images help to demonstrate an entrepreneurial spirit in a more interactive and reflective manner, helping to change students' perceptions in relation to entrepreneurship (Ellborg 2018). Taking all of the above into account, we establish that:

$H2_a$: The use of images moderates the relationship between PD and EI.
$H2_b$: The use of images moderates the relationship between PF and EI.

The use of audio-visual resources such as videos is able to create more experiential environments which are critical for the promotion of an entrepreneurial spirit amongst individuals (Comeche and Pascual 2014). With regard to videos, it is expected that the use of these moderates the relationship between the PF and EI. On the one hand, because based on their content they can "generate innovative, creative and high-entrepreneurial skill students" (Sudarwati 2018, 1), characteristics linked to greater EI (Popescu et al. 2015). Having these characteristics can motivate and inspire students (Reyes and Manipol 2015) to carry out entrepreneurial activity, but also help them to feel more prepared (Sudarwati 2018) increasing their EIs. Similarly, they can provide students with knowledge and resources that make starting a business feel more feasible to them; the use of entrepreneurial role models in videos can influence the PF and EI (Turunen 2018). This means that it is crucial to employ resources such as videos to build environments that support the development of characteristics such as creativity that can boost PF and EI. In contrast, we do not believe that videos can affect the PD in the same way, as this requires time in order to happen (Turunen 2018). Taking all of the above into account, we can establish:

H_{2c}: The use of videos does not moderate the relationship between PD and EI.
H_{2d}: The use of videos moderates the relationship between PF and EI.

Finally, the use of *visual thinking* using tools such as *Popplet* enables mind maps and brainstorms to be created. These two tools support the development of inductive (divergent) and deductive (convergent) thinking, which is why students subjected to these tools are able to generate a greater number of new and original ideas, thanks to intuitive thinking, developing the creativity that is required in order to start a business (Popescu et al. 2015; Zampetakis 2008). Technical and logical skills linked to deductive thinking can also provide solutions to problems and help to identify opportunities (Karimi et al. 2016), so an equilibrium between both forms of thinking is necessary in order to start a business (Fiet 2001) as this will give individuals the confidence to act in specific environments (Oyugi 2014). These types of tools strengthen the interaction between individuals and the exchange of ideas, which in turn leads to innovation, the discovery of opportunities, and creativity. This can improve the PF (Abaho et al. 2015; Padilla-Angulo et al. 2019) and PD (Zampetakis 2008), because as a result of the exchange of multiple ideas, resources, and knowledge through interaction, the individuals can consider a specific action to be more desirable or feasible. The use of active and practical methodologies, such as popplets, can increase self-efficacy and intention, in our case the PF and EI (Piperopoulos and Dimov 2015). We must also consider how those who seek to develop their creativity will have a greater desire to express it through entrepreneurship (Popescu et al. 2015). Taking all of the above into account, we propose the following hypotheses:

H_{2e}: The use of popplet moderates the relationship between PD and EI.
H_{2f}: The use of popplet moderates the relationship between PF and EI.

Methodology

Constructs and Variables

The items included in the questionnaire were taken from validated scales using a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree): EI (Liñán et al. 2011); PD and PF (Shapero and Sokol 1982; Shook and Bratianu 2010). The reason for doing this is because, while Liñán et al. (2011) use a 1/7 scale, Shook and Bratianu 2010 use a 1/5 scale. In order to unify the questionnaire, a 1/7 scale was chosen because it allows for the collection of more precise information. We have used several variables as *moderating variables*, (see Fig. 1). To evaluate these variables, we have used questions such as the following: "Answer sincerely to what extent your teachers use the following methodologies and learning resources from 1 (Never) to 7 (Many times): (a) Visual thinking 1: Images to visualize examples; (b) Visual thinking 2: videos to visualize examples; (c) Visual thinking 3: Popplet.

Data and Sample

The collection of data took place during the last week of January and the first week of February 2020, through an online questionnaire limited to one response per first-year university student. Student samples have been used frequently in EI (Krueger et al. 2000; Liñán et al. 2011), and this requires studies to be carried out based on students in

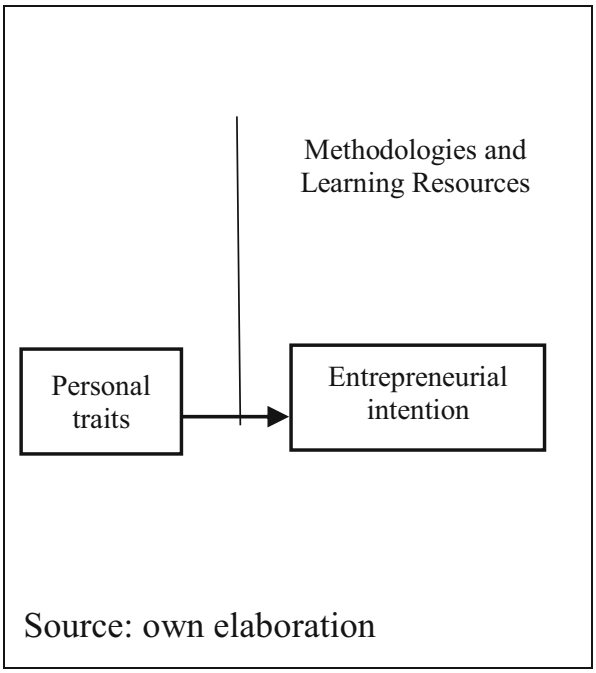

Fig. 1 Conceptual model

the first year of university. The final sample consisted of 333 Spanish students (Table 1 statistical analysis). The proposed model was tested using partial least squares (SmartPLS 3.2.7.)

Analysis and Results

We start the analysis of the model by studying the reliability of the indicators. As shown in Table 1, two indicators of PF and EI had to be removed. The remaining

Table 1 Analysis of the measurement model (I)

Indicator	Loadings	Cronbach's alpha	rho_A	Composite reliability	Average variance extracted (AVE)
PD1	0.974	0.955	0.957	0.955	0.877
PD2	0.908				
PD3	0.927				
PF1	1.000	1.000	1.000	1.000	1.000
EI2	0.821	0.909	0.910	0.909	0.715
EI3	0.855				
EI4	0.889				
EI6	0.814				

variables have a loading greater than 0.707 for their corresponding constructs, with the minimum value being 0.814.

In terms of the reliability of the constructs, they all meet the strict criteria for Cronbach's alpha (0.8/0.9), as well as the Dijkstra-Henseler (rho_A) indicator and composite reliability (0.7). In addition, the models also represent convergent validity as they exceed the threshold required for AVE (0.5) (Table 1).

The table above (Table 2) shows that the models exceed the criteria for establishing discriminant validity. In all cases, the models meet the Fornell and Lacker and HTMT criteria, including the confidence intervals.

Analysis of the Structural Model

Firstly, the possible collinearity of the models is rejected based on the VIF value (Table 3). In addition, the R^2 exceeds the required values (PD = 0.619; EI = 0.777) in all cases. Based on the value of the path for the relationship between the constructs, as well as the correlation between these, we can establish the relevance of the predecessors for determining the explained variation of EI. Therefore, PD explains 0.695 (90%) and PF 0.082 (10%).

All of the relationships that were considered in the structural model are significant. This is the case for the direct relationships: PD on EI (t-stat. = 15.184, p value = 0.000); PF on PD (t-stat. = 25.638, p value = 0.000); PF on EI (t-stat. = 1.972, p value = 0.049), both for the p value as well as the confidence intervals (Table 4). Furthermore, the indirect relationships between PF → PD → EI (t-stat. = 13.428, p value = 0.000) are also significant.

Analysis of the Moderation

Interaction effect was used to analyze the moderator role of different teaching resources and methodologies linked to *Visual Thinking*. Thus, the images moderate the relationship between PD → EI (t-statistic = 2.046; p value = 0.041), although they do not moderate the other relationships included in the model. When the use of videos is analyzed, we find that these moderate the relationship between PF-EI (t-statistic = 1.946; p value = 0.052). The use of Popplet moderates the relationship with the two predecessors to EI, PD (t-statistic = 2.163; p value = 0.031), and PF (t-statistic = 2.490, p value = 0.013) (Table 5).

Table 2 Discriminant validity

Fornell and Lacker (F&L)				HTMT			
F&L	PD	EI	PF	Relationship	Original sample	2.5%	97.5%
PD	0.937	-	-	EI → PD	0.879	0.841	0.908
EI	0.879	0.846	-	PF → PD	0.787	0.723	0.840
PF	0.787	0.734	1.000	PF → EI	0.734	0.664	0.794

Table 3 Analysis of the structural model F2 and VIF (F2/VIF)

F^2	PD	EI	PF
PD	-	1.066/2.627	-
EI	-	-	-
PF	1.627/1.000	0.021/2.627	-

Discussion

In this study, we have analyzed the impact that specific resources and methodologies have on the variables that make up the EEM in the first year of university. Therefore, we have started by validating the role that PF and PD have as determining factors of EI (Dutta et al. 2015; Fitzsimmons and Douglas 2011; Guerrero et al. 2008; Shook and Bratianu 2010; Yi 2018), with H_{1a} and H_{1b} being accepted. In our case, both variables play a significant role, in contrast with other studies that indicate that their role is less important as students consider the act of starting a business as something very remote (Guerrero et al. 2008; Peterman and Kennedy 2003; Zampetakis 2008). It is important to remember that the students in the sample are all first-year students, which is why the result is more relevant. Furthermore, the PF is connected to the PD in a significant way, accepting H_{1c} in line with previous studies (Schlaegel and Koenig 2014). The positive relationship between both variables is confirmed, both in terms of the direct relationship as well as the indirect impact that PF has on EI, through PD. Furthermore, based on the literature (Dutta et al. 2015; Guerrero et al. 2008; Shook and Bratianu 2010), PD represents the main antecedent to EI, explaining its behavior in 90% of cases.

With regard to the moderation hypotheses that were proposed, we observe that the use of visual resources such as images moderates the relationship between PD and EI (Table 6). This can be due to how these stimulate students' creativity, which in turn influences the development of new and innovative ideas (Gielnik et al. 2012), thus accepting H_{2a}. However, it does not moderate the relationship between PF and EI, and H_{2b} is therefore not accepted. The fact that the effect of PF on EI is not moderated means that we cannot confirm whether there is an impact on intuitive thinking, which is linked to both types of perceptions.

Table 4 Relationship between constructs

	Path	Standard deviation	*t*-statistic	*p* value	2.5%	97.5%
PD → EI	0.791	0.052	15.184***	0.000	0.683	0.888
PF→ PD	0.787	0.031	25.638***	0.000	0.719	0.840
PF → EI	0.111	0.056	1.972*	0.049	0.006	0.226
PF → PD → EI	0.623	0.046	13.428***	0.000	0.535	0.718

*p, 0.05; **p, 0.01; ***p, 0.001 based on Student's t-distribution with a tail (499), t (0.05; 499) = 1.6479; t (0.01; 499) = 2.3338; t (0.001; 499) = 3.1066

Table 5 Analysis of the moderator effects

		Original sample	Standard deviation	*t*-statistic	*p* value	Confidence interval	
						2.5%	97.5%
Images	PD → EI	0.074	0.036	2.046*	0.041	0,001	0,142
	PF → EI	0.063	0.036	1.778	0.076	−0.010	0.128
Videos	PD → EI	0.041	0.035	1.175	0.240	−0.029	0.107
	PF → EI	0.068	0.035	1.946*	0.052	0.002	0.136
Popplet	PD → EI	0.080	0.037	2.163*	0.031	0.010	0.153
	PF → EI	0.089	0.036	2.490*	0.013	0.019	0.158

As assumed based on Turunen (2018), the use of videos requires time for the effects on the PD to show, meaning that it does not moderate the relationship between PD and EI, and we can accept H_{2c}. However, the use of videos enables students to feel better equipped for their entrepreneurial adventure, affecting the relationship between PF and EI (Turunen 2018) meaning we can accept H_{2d}. As a result, we can assume that the use of videos as an innovative teaching resource inspires students so that they feel more prepared and consider the option of starting a business to be more feasible (Reyes and Manipol 2015; Turunen 2018).

In the case of using *popplet* as a *visual thinking* tool, we can assume that it provides equilibrium between the different types of thinking that lead to entrepreneurship (Fiet 2001; Karimi et al. 2016), and improves both types of perceptions (Padilla-Angulo et al. 2019; Zampetakis 2008), moderating the relationship between PD and EI as well as PF and EI. We can therefore accept H_{2e} and H_{2f}. This is why we can assume that the use of innovative educational methodologies and tools condition the impact that PD and PF have on EI, and universities must respond and become agents of change (Barba-Sánchez and Atienza-Sahuquillo 2018). As a result, this study has confirmed how the resources and methodologies used can modify individuals' perceptions and EI (Israr and Hashim 2017).

Table 6 Summary of hypotheses

Hypothesis	Result
H_{1a}	Supported
H_{1b}	Supported
H_{1c}	Supported
H_{2a}	Supported
H_{2b}	Not supported
H_{2c}	Supported
H_{2d}	Supported
H_{2e}	Supported
H_{2f}	Supported

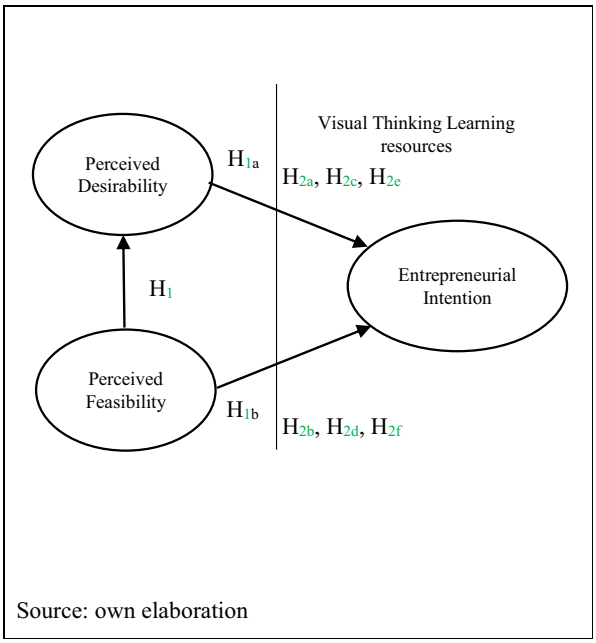

Fig. 2 Contrasting model

Conclusions

This study has been carried out in order to fill the gap of studying how *visual thinking* moderates the predecessors to EI. Therefore, the objective of the study is to analyze the impact that the use of innovative methodologies and learning resources has on the relationship between the preceding behaviors and EI. This raises the question of whether the innovative methodologies and learning resources linked to visual thinking moderate the effect that perceived feasibility (PF) and perceived desirability (PD) have on EI (Fig. 2). To understand this, we examined whether innovative learning methodologies and resources related to *visual thinking*, such as images, videos, and the use of *popplet*, could moderate the relationship between PF and PD. The study was carried out in a Spanish university with 333 first-year students.

The results show how innovative learning methodologies and resources such as *visual thinking*, through the use of images, videos, and *popplet*, do moderate the relationship between the predecessors to Shapero and Sokol's model (PF and PD), as well as EI. More precisely, while popplets moderate the relationship between PD and PD with EI, images moderate the relationship between PD and EI, and videos moderate the relationship between PF and EI.

This is because these resources are able to not only develop intuitive thinking, which is linked to improved creativity, but also deductive thinking, which is linked to more logical and technical thinking that supports the identification of opportunities and problem solving. We can deduce that the development of both types of thinking is essential for carrying out entrepreneurial activity and these *visual thinking* tools facilitate it, helping individuals to perceive the entrepreneurial process as something more feasible and desirable.

Limitations

Despite our efforts, there are some limitations to this study. Firstly, the sample used includes one group of students from a Spanish university, all in the same academic year. It would be interesting to extend the sample to other universities. Secondly, the sample could be extended to other academic years to establish whether the moderations change between first-year students and final-year students, as a result of their perceptions changing.

Contributions

In the present day, universities are filled with students who have personal traits that differentiate them from previous generations. Furthermore, if they want to play the role of agents of transformation, as is required of them, they should seek to strengthen their students' EI. In order to achieve these aspects, universities can use tools linked to *visual thinking*. Amongst these tools, this study has focused on the following, which are linked to innovative learning methodologies and resources: (1) the use of images as teaching resources; (2) the use of videos; (3) the use of popplet.

We should remember that, in addition to helping with the development of EI amongst students, the use of such teaching resources brings benefits such as the motivation and increased satisfaction they provide the students. This is particularly relevant, as is the case in this study, during the early years of study, as students become accustomed to using them during their education prior to university.

If the purpose of the universities is to act as agents that transfer knowledge to their surroundings, so that in addition to fulfilling their basic objectives, they can help to support economic growth in the areas in which they operate, this study can help with the strategy of implementing resources and methodologies that are adapted to the profile of their student body. Therefore, the use of popplets and images is recommended amongst first year students, as they moderate the relationship between PD and EI, promoting the development of EI. At the start of their studies, the students might consider the start of their entrepreneurial adventure to be too far in the future. As they reach the end of their studies, the use of videos can help to reinforce the impact that PF has on EI. This is why, simply, supporting the development of each subject using the teaching resources explained in this study, can help to improve students' EI. The use of such resources, therefore, should also be accompanied by the use of more active teaching methodologies, which act as a catalyst for the aforementioned impact.

Therefore, if we combine the knowledge that has been acquired, with the competencies and skills—such as those that already exist but have not been applied in the market, in line with the KSTE approach—universities can become local development agents. These plans are particularly relevant for economies based on SMEs, as is the case in Spain.

Limitations and Future Research

As the main limitation of the work, the sample is made up of first-year students, making it interesting to extend the study to later courses. It would be interesting to analyze the effect of a greater number of innovative teaching resources, as well as include

additional variables in the number. Similarly, we could analyze whether adapting the resources to the entrepreneurial field strengthens their effects.

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