

The impact of the components of planned behavior on entrepreneurial intentions among university students in Puebla, Mexico

El impacto de los componentes del comportamiento planificado en las intenciones emprendedoras en estudiantes universitarios de Puebla, México

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Abstract

The objective of this paper is to obtain the impact of the components of the Theory of Planned Behavior on the entrepreneurial intention of university students. Using a sample of 336 students from a Technological University in the State of Puebla, México, we calculate four components of planned behavior that measure attitude, subjective and social norms, perceived behavioral control, and attraction to entrepreneurship. We apply four methodologies to obtain the impact of the treatment of obtaining high scores in the different components of the Theory of Planned Behavior on entrepreneurial intention, using the assumption for identification that individuals cannot control the intensity of the score they achieve. Our results show that perceived behavioral control is the most important element in predicting entrepreneurship intentions. Our results also identify the relative

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importance of the different components of perceived behavioral control. The results indicate the importance for the inclusion of independence and freedom to express new ideas in the education of university students in Puebla, Mexico to foster entrepreneurial intentions.

Información del artículo	Resumen
Received: 09 mayo 2021 Accepted: 15 marzo 2023	El objetivo de este artículo es obtener el impacto de los componentes de la Teoría del Comportamiento Planeado sobre la intención emprendedora de universitarios. Utilizando una muestra de 336 estudiantes de una Universidad Tecnológica en Puebla, México, se estiman cuatro componentes del comportamiento planeado que miden: la actitud, las normas sociales subjetivas, la percepción de control del comportamiento y la atracción por el emprendimiento. Se aplican cuatro metodologías para identificar el impacto de obtener un <i>score</i> alto sobre la intención de emprender, usando como supuesto de identificación que los individuos no pueden controlar la intensidad de su <i>score</i> . Los resultados muestran que la percepción de control del comportamiento es el elemento más importante para predecir las intenciones de emprender. Nuestros resultados también identifican la importancia relativa de los diferentes componentes de la percepción del control del comportamiento. Los resultados indican la importancia de la inclusión de independencia y libertad de expresar nuevas ideas en la educación de estudiantes universitarios de Puebla, México, para fortalecer las intenciones emprendedoras.
Clasificación JEL: J23, J24, C25, C26. Palabras clave: Teoría del Comportamiento Planeado, Intención Emprendedora, Percepción de Control del Comportamiento, Puebla.	

Introduction

The study of entrepreneurial intentions among university students has established the importance of the Theory of Planned Behavior (TPB) in predicting entrepreneurship for different countries and periods of time (Kolvereid, 1996,1996b; Tkachev and Kolvereid, 1999; Krueger et al., 2000; Audet, 2004; Fayolle and Gailly, 2015; Caro-González et al., 2017; Gorgievski et al., 2018). Similar studies have confirmed the importance of TPB to predict entrepreneurial intention among other populations different from university students, like adult populations (Schlaegel and Koenig, 2014; Kautonen et al., 2015) and minors (Osorio and Londoño, 2015).

The Theory of Planned Behavior stands out among theories developed to understand entrepreneurial intentions from the perspective of Social Psychology, which considers that the intention to carry out specific behaviors of different classes can be predicted through the antecedents of

such intentions, such as perceptions of the attractiveness or desirability of the behavior, that is, the attitude; family or social support for certain behavior, that is, social norms; and the feasibility to carry out the behavior, that is, perceived control (Ajzen, 1991).

The importance of studying entrepreneurial intentions among university students comes from the fact that becoming an entrepreneur is one of the options for career development for university students, especially among those graduating from engineering careers (OCDE, 2010). Moreover, various authors endorse the use of the university population to analyze the entrepreneurial population, since they are getting close to making a decision for their professional future, so the manifestations in terms of intentions are closer to their actual future behavior (Caro-González, 2017). Likewise, the use of the TPB seems adequate to study the factors that affect the entrepreneurial decisions of students since they emphasize the role of personal beliefs and attitudes, perceived social expectations, and self-efficacy concerns, as predictors of the intention to undertake (Davis et al. 2002).

The first contribution of this paper is the validation of the TPB on a sample of Mexican students, something that has already been done for the State of Yucatan (Flores-Novelo et al., 2020), Mexico but not for the State of Puebla, México. Our research also shows a study by Teran-Perez et al. (2021) which was carried out among university academics in Sinaloa, Mexico. Validating the importance of TPB in the Mexican population allows Mexican academic authorities to better design university programs aimed to foster entrepreneurship.

A common shortcoming in the current literature is that most studies present only correlations between indicators of the TPB and entrepreneurial intentions in studies of cross-sectional data that may be subject to different econometric shortcomings, with the notable exception of Favolle and Gailly (2015), that carry out a controlled experiment that identifies the causal effect of providing entrepreneurial education on the entrepreneurial intentions of university students. The different econometric challenges generate biased estimations, and consequently the need to verify the validity of the TPB in specific samples. The four econometric shortcomings of most of the current estimations are the following : i) selectivity which may arise from the selection of a sample of students, which may have different characteristics from the rest of the population; ii) the existence of omitted variables, to the extent that the models may not include all the observable factors that determine the

entrepreneurial intention; iii) unobserved heterogeneity, to the extent that unobserved factors determine the entrepreneurial intention, and iv) potential measurement error, to the extent that the entrepreneurial intention may not make a difference between entrepreneurs due to opportunity or due to necessity¹, or because of the use of Likert scales. The literature on entrepreneurial intention, in general, does not distinguish between necessity and the opportunity of entrepreneurs. The view is that students simply express their desire for entrepreneurship regardless of their potential financial constraints. Some papers have researched this topic by looking at self-employment activities carried out after graduation (Kolvereid, 1996; 1996b; Tchakev & Kolvereid, 1999), or by looking at longitudinal data (Audet, 2004, Kautonen et al., 2015).

In this paper we also have cross sectional data, and the questionnaire does not distinguish between necessity and entrepreneurial opportunity, however, the second contribution of this paper is the use of four methodologies that estimate the causal effect of the TPB on the entrepreneurial intention, taking care of the four different shortcomings mentioned earlier. This is the first paper to obtain causal effects using a sample from Mexico. Determining the causal effect of TPB on entrepreneurial intentions is important because it allows for the identification of strategies that can cause a higher entrepreneurship intention. The identification of the causal effect of the TPB is achieved by exploiting the fact that individuals only answer the questions of the questionnaires that are linked to the TPB, without knowing the relative intensity of the index of TPB that they will score. Consequently, we focus in using whether an individual obtains high scores in the TPB index to identify the impact of TPB on entrepreneurial intentions, using four different methodologies for such purpose: i) the Augmented Inverse-Probability Weighting (AIPW) (Cattaneo, 2010), ii) the Inverse Probability Weighted Regression Adjustment (IPWRA) (Cattaneo, 2010), iii) the Propensity Score Matching (PSM) estimator (Khandker, Koolwal and Samad, 2010), and iv) the Nearest Neighbor Matching (NNM) (Khandker, Koolwal and Samad, 2010). Our results show that each of the components of the TPB: attitude, social norms, perceived control behavior and the attraction to make business are all statistically significant and positively related to entrepreneurial intentions.

¹ According to Gutiérrez and Rodríguez (2016), necessity entrepreneurs are determined by individual, socio economic and attitudinal characteristics, as well as by structural factors. Korpysa (2010) points out that among unemployment and economic crisis are important determinants of necessity entrepreneurship.

Our methodology allows us to generate a third contribution, which is the identification of the control of perceived behavior as the component that affects the entrepreneurial intentions the most. We further investigate the components of controlled perceived behavior, to identify their relative strengths. Our results show that what generates the highest impact on entrepreneurial intentions is the following question, is running a business easy? This result may imply that the question may be an indicator for the unobserved ability of individuals. Our results also show that education should foster creativity and thought independence since the other two elements that are also linked to the control of perceived behavior signal out the importance of independence and creativity for entrepreneurs.

A fourth contribution of the paper is the validation of the causal effect of each of the components of the TPB in a sample of university students in Mexico, which shows that the education of entrepreneurship among university students needs to be comprehensive because it must foster each of the elements of the TPB to increase entrepreneurial intentions.

The rest of the paper is organized as follows: the first section briefly reviews the literature on the factors that predict entrepreneurial intention, as well as the relation between entrepreneurial intention and the TPB; the second shows the methodology including the questionnaire, the linear models, and the treatment models used to identify the impact of TPB on entrepreneurial intention; the third presents the results of descriptive statistics and the different linear and treatment models; the fourth section concludes the paper.

1. Literature review

It should be noted that most of the authors who analyze the determinants of entrepreneurial intention², interchangeably use self-employment or entrepreneurship (Blanchflower and Oswald, 1998) to denote the spirit of business creation, two concepts that have changed over time, since the 20th century some scholars argued that self-employment was a government strategy to keep those who did not participate in regular business engaged in activities beneficial to society; while today governments promote the culture of entrepreneurship as a mechanism to

² Entrepreneurship intention can be defined as a state of mind that directs the individual's attention and actions towards situations of self-employment as opposed to situations of salaried employees (Fayolle & Gailly, 2015).

create employment and competitiveness, while seeking to increase income to improve welfare and governance (Valencia, 2012).

For years, studies on the determinants of entrepreneurship were aimed at identifying the characteristics of people who create companies, that is, the entrepreneurial profile, whether individual or situational³, to forecast entrepreneurial activity; but given the small explanatory power of these, various theories have arisen within social psychology, which focus in studying entrepreneurial intention, seen as a way to search for opportunities, giving rise to behavioral models, aimed to predict entrepreneurial intention, conceived as planned behavior (Ajzen, 1991; Krueger, *et al* 2000).

Studies focused on the profile of the entrepreneur consider the existence of specific personality traits of entrepreneurs, which could be psychological or socio-demographic. Some of them are mentioned below. For an account of these studies on the profile of the determinants of the entrepreneurial intention of students, you can consult (Ubierna Gómez, 2015).

1.1 Factors explaining entrepreneurial intention

Table 1 shows eleven studies carried out between 1961 and 2007 about the different determinants of entrepreneurial intentions, focusing on psychological traits and socio demographic characteristics.

Among the studies on psychological traits, eight of those studies highlight the need for achievement as one of the main characteristics of entrepreneurs, defining it as the continuous need that the person experiences to achieve a goal that has been set and for whose results, they feel responsible. On the contrary, Box et al. (1993) determine that there is no relevant relationship between the need for achievement and the creation and results of the company. Likewise, six of those studies mention the internal locus of control or the perception of an individual about the causes of events in his life, which in this case it means that his business performance is controlled by his own action, as an important predictor of entrepreneurial intention. Six of those studies consider the propensity to take risks, which means adopting risky tasks or assignments and having a greater tendency to take risks, as a fundamental characteristic of entrepreneurs. Three of the studies point to tolerance, to ambiguity and uncertainty, which refer to the ability and comfort to make

³ Individual variables refer to demographic characteristics or personality traits, while situational variables refer to employment status or emotional cues (Krueger et al. 2000).

decisions with ambiguous and incomplete information regarding among others, markets, cash flows, competitors, as another important characteristic of entrepreneurs. Three of those studies signal out the preference for innovation, which refers to the ability to innovate or introduce new products or production methods, to open new markets, or new sources of supply, or to reorganize industries, as a variable of crucial importance in entrepreneurship. Furthermore, the desire for independence, which refers to the love for autonomy or the desire to be the boss of oneself, is mentioned by three studies as a key attraction that offers self-employment, which in some ways help to explain why individuals remain to be self-employed despite earning less than salaried employees.

Fernández and Junquera (2001) highlight opportunity orientation, commitment, and personal security⁴, while Rauch and Frese (2007) point out the proactive personality, general self-efficacy and stress tolerance, as important predictors of entrepreneurship.

Table 1
Literature review of factors related to entrepreneurial intentions

Factor	Related to	References	Relation with entrepreneurial intention
Need of achievement	Psychological traits	McClelland (1961), Shaver and Scott (1991), Amit et al. (1993), Stewart et al. (1998), Fernández and Junquera (2001), Rauch and Frese (2007), Parker (2004), Koh (1996)	Positive relation
Need of achievement	Psychological traits	Box et al. (1993)	No relation
Internal locus of control	Psychological traits	Shaver and Scott (1991), Amit et al. (1993), Fernández and Junquera (2001), Rauch and Frese (2007), Parker (2004), Koh (1996)	Positive relation
Propensity to take risks	Psychological traits	Amit et al. (1993), Koh (1996), Stewart et al. (1998), Fernández and Junquera	Positive relation

⁴ Opportunity orientation implies that the entrepreneur actively seeks new opportunities through his perceptions about the market, and not by pre-established rules. Commitment implies total dedication to work, both on weekdays and holidays. Personal security refers to the fact that unemployment for a long period of time, or the threat of it, can stimulate many people to start their own business, considering it safer than the situation prior to its creation (Fernández and Junquera, 2001).

Tolerance to ambiguity and uncertainty	Psychological traits	(2001), Parker (2004), Rauch and Frese (2007) Amit et al. (1993), Koh (1996), Fernández and Junquera (2001)	Positive relation
Preference for innovation	Psychological traits	Koh (1996), Stewart et al. (1998), Rauch and Frese (2007)	Positive relation
Desire for independence	Psychological traits	Taylor (1996), Fernández and Junquera (2001), Parker (2004)	Positive
Orientation to opportunities, commitment, and personal security	Psychological traits	Fernández and Junquera (2001)	Positive
Proactive personality, general self-efficacy, and stress tolerance	Psychological traits	Rauch and Frese (2007)	Positive
Age, education, family and social environment, social blockage, and social position	Socio demographic characteristics	Fernández and Junquera (2001)	Positive
Entrepreneurial education	Socio demographic characteristics	Peterman and Kennedy (2003)	Positive
Previous technological experience	Socio demographic characteristics	Majid et al. (2011)	Positive

Source: Own elaboration with information from mentioned studies

Among the studies on socio demographic characteristics, Fernández and Junquera (2001) indicate age, education, family and social environment, social blockage, and social position⁵ as the more important determinants of entrepreneurship intentions. Peterman and Kennedy (2003) study the influence of entrepreneurial education on the intention to undertake and found using experimental design that after completing the entrepreneurship program, participants report significantly high perceptions of desirability and feasibility of entrepreneurship and that the degree of change in their perceptions is related to the success in the business education program. Majid et al. (2011) found that in Malaysia's case, the influence of a previous technological experience in the creation of technology-based companies and that the impact on entrepreneurial intention can also come from the following: a better recognition of

5 The family and social environment implies that many company founders come from families in which one of its members is already an entrepreneur or businessman/woman, who in turn provides them with social encouragement and support. The social blockade is related to the dissatisfaction of managers and workers in their previous jobs, so they create their own companies, as a second chance. Social position means that some people need to show others that they mean something, that they cannot be ignored, that they have a compelling need to be heard and recognized, and even to be considered heroes (Fernández and Junquera, 2001).

business opportunities, knowledge of the market and the productive activities achieved in professional activities, rather than just human resources that the company has.

1.2 Entrepreneurial intention and the TPB

For authors like Gartner (1988), research on the entrepreneur should focus not on who the entrepreneur is, that is, on personality traits and characteristics, but on what the entrepreneur does, that is, on the behaviors or activities involved in the creation of organizations, the latter being the behavioral approach, which in his opinion is the most appropriate to explain the phenomenon of entrepreneurship; although they recognize that the analysis of personality and demographic traits is not opposite to, but complementary to the study of attitudinal characteristics based on intentions.

For its part, according to Ajzen (1991), intentions are the best predictor of planned behavior, especially when that behavior is rare or difficult to observe. In this line, according to Sánchez et al. (2005), the entrepreneurial intention is the key to understanding the entrepreneurial phenomenon and can be seen as the first step or behavior in the entrepreneurial process, while it is difficult to imagine the creation of a business simply as a response to a stimulus and not as a planned decision, the study of the antecedents and determinants of these intentions is especially relevant to understand the process of business creation.

The TPB was designed to explain human behavior, when it is rare or difficult to observe, through the analysis of a person's intention to carry out that specific behavior, such as the recognition of a business opportunity, and has been extended to very diverse sectors such as sports, health, road safety and university education, although it seems particularly suitable for studying factors that influence students' decisions (Davis et al. 2002), by emphasizing beliefs and personal attitudes.

This theory identifies three main attitudinal antecedents of intention, of which two reflect the desirability of perceived behavior performance: personal attitudes toward behavioral outcomes and perceived social norms; while the third, control of perceived behavior, reflects the perception that behavior is personally controllable. Control of perceived behavior reflects the perceived feasibility of performing the behavior and

is thus related to perceptions of situational competencies or self-efficacy (Krueger et al. 2000).

Applied to entrepreneurial intention, the TPB suggests that university students' entrepreneurial intentions, together with control of perceived behavior, predict the probability that a student will start a business and that entrepreneurial intentions, in turn, are determined by attitudes towards starting a business, by perceived social pressure to start a business or subjective norm, and by perceptions of control over this behavior. These determinants are briefly explained below.

Attitude towards behavior. It refers to the subject's attitude towards a given behavior (Audet, 2004); that is, to the degree to which an individual has a favorable or unfavorable assessment of the behavior in question, in this case of carrying out an entrepreneurial action, and which reflects the beliefs and opinions that the individual has about such behavior (Osorio and Londoño, 2015; Krueger et al. 2000).

Subjective norms. It refers to the subject's perception of the opinions of others concerning the proposed behavior (Audet, 2004); that is, the perceived social pressure to carry out or not a certain behavior and refers to the degree to which the behavior to be carried out complies with the wishes of those important individuals in the individual's life, for example, the expectations of family, with regards to becoming an entrepreneur or not. (Osorio and Londoño, 2015; Krueger et al. 2000).

Perception of behavior control. This refers to the subject's perception of his own control over behavior (Audet, 2004); that is, to the perceived ease or difficulty of performing a certain behavior, and it is the perception that the individual has of their ability to carry out a specific behavior (Osorio and Londoño, 2015), which is closely related to the concept of self-efficacy, since both refer to the specific perceptual factors for the achievement of a certain behavior or behavioral objective. The questions related to this regularly refer to their perceived ability to carry out any type of entrepreneurial action and are limited to activities that involve work, reward, risk, new ways of doing and other aspects aligned with the project/company concept (Osorio and Londoño, 2015).

There are many studies that have been carried out to look at the relation between the Theory of Planned Behavior (TPB) and entrepreneurial intentions or activities. In this paper, we explore eighteen studies. Three studies show that the elements of the TPB are linked positively with the choice of self-employment. Fifteen studies found a positive relation

between TPB and entrepreneurial intentions. Seven studies have investigated the components of TPB or the relation between those components and other theories. Nine studies have concluded that Perceived Behavioral Control is the most important component explaining entrepreneurial intentions.

Table 2
Literature review of studies applying the Theory of Planned Behavior on Entrepreneurial Intentions

Author	Method	TPB applied on	Country	Result
Kolvereid (1996)	Correlations	354 Graduated business majors	Norway	PBC is the most important element related to self-employment status. Attitudes are also related to self-employment status. No effect found for SN.
Kolvereid (1996b)	Correlations using probit model	128 Business students	Norway	TPB explains choice of self-employment status. PBC is the most important component.
Tkachev and Kolvereid (1999)	Correlations using linear probability model	512 University students	Russia	TPB explains choice of self-employment status. PBC is the most important component. TPB explains entrepreneurial intention.
Krueger et al. (2000)	Correlations using linear regression model	97 Business students	USA	PBC is the most important component. The entrepreneurial event model has a higher R ² than the TPB model.
Audet (2004)	Correlations using linear regression	107 Business undergraduate students	Canada	TPB and entrepreneurial short-term intentions are linked positively. This relation varies over time. TPB is linked positively to entrepreneurial intentions and is linked to the diversity in educational background.
Wu and Wu (2008)	Structural equation modelling	150 University students	China	PBC is the second most important determinant of intentions. PBC is determined mainly by the career of the students.

Schlaegel and Koenig (2014)	Structural equation modelling	Meta study (114 thousand individuals, 123 samples)	USA, Arab nations, United Kingdom, Finland, Uganda, Canada, Barbados, Germany, Bangladesh, France, Spain, Italy, Austria, Botswana, South Africa, Germany, Turkey, Russia, Australia, Norway, Belgium, Malaysia, Pakistan, Romania, Nigeria, Kenya, Thailand, Iran, The Netherlands, Singapore, Taiwan, China, Ukraine	TPB explains entrepreneurial intention. PBC is the main factor predicting intentions. It is also the main determinant of perceived desirability and feasibility
Fayolle and Gailly (2015)	Controlled experiment	Adults	France	TPB is positively related to business intentions if previous experience is not had, while it reduces business intention if previous experience exists TPB explains startup intentions and behaviors. Subjective norms are the most important component. PBC is the third most important and is also linked to behavior. Previous experience is positively related to entrepreneurial intention. Attitude is the most important component. PBC is the second most important.
Kautonen et al. (2015)	Structural equation modelling	969 adults	Austria and Finland	TPB explains entrepreneurial intentions when business training is missing. The attitudes component is the most important. The second most important component is PBC. Theory of human values mediates its relationship with intention through TPB components. Attitudes is the most important component. PBC is the third most important. TPB linked positively to entrepreneurial intention, less so in Spain
Osorio and Londoño (2015)	Structural Equation Modelling	643 students from 10 th and 11 th grade	Colombia	Self-determination theory shapes entrepreneurial intentions via its attitudinal antecedents. PBC is the second most important factor.
Caro-González et al. (2017)	Structural Equation Modelling	235 Communication students	Spain	
Gorgievski et al. (2018)	Structural Equation Modelling	823 University students	Spain, Netherlands, Germany, Poland	
Al-Jubari, Hassan and Liñan (2019)	Structural Equation Modelling	438 University students	Malaysia	

Diez-Farhat and Guevara (2019)	Structural Equation Modelling	603 University students	Ecuador	Proactivity and self-efficiency are linked positively to entrepreneurial intentions. PBC is the most important component. Attitude is the second most important, and SN is the third most important. Attitude towards entrepreneurship is the most important component of TPB explaining entrepreneurial intentions. PBC is the second most important. TPB elements are important predictors of entrepreneurial intentions as well as entrepreneurial situational factors and entrepreneurial implementation intention. PBC is the most important component. TPB is positively linked to entrepreneurial intentions. PBC is the second most important component.
Flores-Novelo (2020)	Linear correlations	277 University students	Yucatan, Mexico	
Teran-Perez et al. (2021)	Structural Equation Modelling	173 University academics	Sinaloa, Mexico	
Lihua, D. (2022)	Structural Equation Modelling	838 University students	China	
Rueda Barrios et al. (2022)	Linear regression models	4214 University students	Colombia	

Source: Own elaboration with cited sources

In total, twelve of the studies were done with university students from different careers like business, communications, and other careers; one study was done with adults; another study was done with alumni from business school, another study was done with university academics, another study was done with high school students, while one was a meta study done using 123 samples.

From the point of view of empirical methods, linear correlation was used in two studies, linear probability and regression models have been used in three studies, probit models have been used in two analysis, structural equation modelling has been used in ten studies, while one controlled experiment was used in one of the studies. In all the cases the questionnaire on TPB was applied on students, regardless of their exposition to entrepreneurial education, which was only provided in the study of Fayolle and Gailly (2015).

Seven of the studies were done in European samples, three studies were done in Asian samples, two studies have been done in North America, five

studies have been done in Latin American countries. Two studies have been done in Mexico, for the states of Sinaloa and Yucatan.

2. Methodology

The questionnaire⁶ was applied in 2019 and the sample selected for convenience included 336 out of a total of 448 students from the ninth semester of the undergraduate degree, of which 334 responded to the questionnaire face to face. The participants were students from a Technological University in the metropolitan area of Puebla, Mexico, who were all enrolled in university programs from the following degrees: 99 from Business Administration; 90 from Industrial Processes; 64 from Information Technologies; 44 from Mechanics; 30 from Business Development; 4 from Food Technology; 2 from Design and Industrial Production; and 1 from Mechatronics.

Puebla City is the fourth largest metropolitan area of Mexico with 3.2 million inhabitants (INEGI, 2022). The municipality of Puebla has a low level of marginalization, within the top decile of lowest levels of marginalization in Mexico, however, the State of Puebla has the 7th largest level of marginalization in Mexico (CONAPO, 2020), which implies that the state has a large level of inequality. Consequently, if university students can get jobs or develop business within the metropolitan area, they might be successful, while outside the metropolitan area there are lower probabilities to find jobs or to form successful business. An important aspect of the metropolitan area of Puebla is that it is strongly related to the automotive and auto part industries of Mexico, which generates a strong metropolitan economic dynamic.⁷

The questionnaire was designed with the purpose of showing the relation that the TPB has on the entrepreneurial intention, for which items were included aimed at evaluating the theoretical constructs of such theory, that is, attitude, subjective social norms, and perceived control of behavior, about setting up a business. In addition, items about the students' psychological and sociodemographic characteristics were included. According to literature (Fishbein & Ajzen, 2010), all questions related to TPB are answered using Likert scales⁸. Different studies have

⁶ The specific questions are available from the authors upon request.

⁷ The automotive sector of Mexico is among the top 10 in the world production of automobiles. In 2021, the automotive sector generated 130 billion US dollars in exports to the rest of the world. (INEGI, 2021)

⁸ Note that the use of Liker Scales could also generate measurement error in the equations estimated. However, this measurement error is taken care using the four methodologies applied in this paper.

confirmed in different samples the validity of using Likert scales for TPB and its convenience in forming components for multivariate analysis and applying multivariate analysis (Carter and Van Auken, 2006; Espiritu et al., 2012). Principal components analysis (PCA) is implemented to generate the first three estimated components. A linear combination of these components is constructed to generate an index of planned behavior (IPB). Each of these three components correspond to the three theoretical constructs of the TPB, attitude (AT), subjective social norms (SSN) and control of perceived behavior (CPB) (Carter and Van Auken, 2006; Espiritu et al., 2012). In this paper, we explore if there is statistical evidence of the existence of a fourth component.

The empirical model implemented proposes that there exists a linear relation between the reported probability of starting a business (y_i), which we call entrepreneurial intention, and the index of planned behavior (IPB), as well as of a set of additional controls, as follows:

$$y_i = \beta_0 + \beta_1 IPB_i + \beta_2 X_i + u_i \quad (1)$$

The vector of exogenous components includes age of the student, sex of the student, a dummy that takes the value of 1 if the individual studies engineering, and a variable that takes the value of 1 if the students' father ever owned a business. This last variable is included because in the literature it has been identified that the labor market status of the father influences the future career paths of individuals (Cornelissen, Jirjahn and Tsersvadze, 2008).⁹

On a second model, each of the Z_j components of the IPB are included in the equation to explore if entrepreneurial intention has a similar relation with each one of the components, as follows:

$$y_i = \beta_0 + \beta_1 Z_{ij} + \beta_2 X_i + u_i \text{ for } j=1 \text{ to } 4 \quad (2)$$

A third specification, includes the four components of the IPB simultaneously, which could help identify the partial correlation of each one of the components with entrepreneurial intention:

$$y_i = \beta_0 + \sum_j \beta_{1j} Z_{ij} + \beta_2 X_i + u_i \quad (3)$$

⁹ The possibility of using whether the mother ever owned a business was considered but it is not feasible since it was not asked in the questionnaire.

Note, however, that none of these equations can be said to identify an impact since the IPB or any of the components may have some of the four econometric challenges explained before: i) selectivity, ii) omitted variables, iii) unobserved heterogeneity, and iv) measurement error. Because we do not have a controlled experiment in the Technical University of Puebla, we use the following identification strategy. The identification starts from the fact that the individuals were asked a set of 21 questions, and that they could not possibly know if they would end up scoring high or low in the distribution of the IPB or in any of the estimated components. So, we partition the data in terms of the median of the estimated IPB or any of the four components. If the individuals score above the median, they are classified as high IPB individuals, and if they score below the median, they are classified as low IPB individuals. This relative position of the individuals is considered as our exogenous variable.¹⁰

Once we have built this classification, we apply four different methodologies to estimate the impact of scoring high in the IPB index. The first methodology is called Augmented Inverse-Probability Weighting (AIPW) which consists in estimating two equations, one for the outcome variable and a second one for the treatment variable, where estimations are corrected, using inverse probability weighting, due to the fact that observations are only observed in one of the potential outcomes. The estimator also includes a correction term in the outcome equations in case that the treatment model is mis-specified (Cattaneo, 2010). The second methodology is called Inverse Probability Weighted Regression Adjustment (IPWRA), which consists in using weighted regression coefficients to compute averages of treatment level predicted outcomes, where the weights are the estimated inverse probability of treatment. This estimator uses a model to predict treatment and then a second to predict outcomes. The estimator has been shown to have the double robust property, which implies that only one of the two models needs to be correctly specified (Cattaneo, 2010). The third methodology is called the Propensity Score Matching (PSM) estimator. PSM uses an average of the outcomes of similar subjects who get the other treatment level to impute the missing potential outcome for each subject (Khandker, Koolwal and Samad, 2010). The similarity between subjects is estimated using the estimated treatment probability, called propensity scores. The fourth methodology is called the Nearest Neighbor Matching (NNM) estimator. NNM also uses an average of the outcomes of similar subjects who get the other treatment level to impute the missing potential

¹⁰ Notice that using this relative position measure, reduces the potential bias that may come from having measurement error that could be brought by using Likert scales.

outcomes for each subject, measuring similarity based on a weighted function of the covariates for each observation (Khandker, Koolwal and Samad, 2010).

3. Results

3.1 Principal components analysis

A Kaiser, Mayer-Olkin (KMO) analysis was estimated with the 21 questions that measure the TPB, and a value of .875 was obtained, which indicates the adequacy of the 21 questions to perform PCA. The PCA uses an orthogonal rotation to extract three or four components, since the first three factors explain 42% of the variation, while the first four factors explain 52% of the variation.¹¹

The 21 questions about the theoretical constructs of the TPB were evaluated with a Likert scale¹², which are described below:

Attitude: Questions about attitudes, which implied the idea of committing to starting your own business in the next 12 months, were evaluated using the following six questions: "Starting my own business seems attractive to me", "I can detect a good opportunity long before others", "Starting my own company would probably be the best way to take advantage of my education", "I excel at identifying opportunities ", "I trust that I will be successful if I start my own business "and " I personally consider that the entrepreneurial spirit is a very desirable career alternative for people with my education ". In the PCA, all these six items had high scores in the attitude factor (0.60 to 0.73) and much lower numbers in the other three factors (-0.24 to 0.45).

Subjective norms: Respondents were asked to evaluate to what degree they believe that close friends and family or those who are considered important think that they should establish their own business, through eight items, five capturing the attitudes of the university towards to start their own business: "At my university, people are actively encouraged to follow their own ideas", "At my university, you can meet a lot of people with good ideas for a new business", "Entrepreneurship courses at my

¹¹ The results from the PCA are available from the authors upon request. They are not shown here for lack of space.

¹²The response options contemplated in these questions of the questionnaire were: 1, totally disagree, 2 moderately disagree, 3 slightly disagree, 4 neutral, 5 slightly agree, 6 moderately agree and 7 totally agree.

university prepare people well for an entrepreneurial career ", "At my university there is a supporting infrastructure that works well to support the start-up of new companies" and " I know many people at my university who have successfully started their own business", another that captured the attitudes of his friends regarding his entrepreneurial intention: "My family and friends support me to start my own business." The following are two more comments to measure the motivation of the survey with regards to the opinion of those important to him: "I like to face and overcome obstacles to my ideas" and "I have the skills and abilities to succeed as an entrepreneur." In the PCA, these eight items had high loads in the subjective norm factor (0.38 to 0.80) and low loads in the remaining factors (-0.08 to 0.43).

Control of perceived behavior. Three items evaluated the perceived control over starting their own business, one of which evaluated the ease of doing business activities "It would be easy for me to start my own business" and two capture the control that the respondent felt they would have over such behavior "Entrepreneurship cannot be taught" and "I love challenging the status quo." In the PCA, these three items had high loads in the perceived behavior control factor (0.51 to 0.74) and low loads in the remaining factors (-0.50 to 0.24).

Additionally, the following four statements were included to evaluate the personal attraction of the entrepreneurial activity: "nothing is more exciting than seeing how my ideas become reality", "I prefer to start a new company than to be the manager of an existing one", "it is more beneficial for society to have large companies than small companies", "in business, it is preferable to be an entrepreneur rather than a great employee of the company". In the PCA, these four items had high loads in the attraction of the entrepreneurial activity factor (0.44 to 0.67) and low loads in the remaining factors (-0.09 to 0.36).

3.2 Principal components analysis

Table 3 shows the average values for the entire sample, as well as for the first two subsamples, where we split the data set according to the score in the IPB. In terms of the entrepreneurial intention, on average, the sample reveals that it has a 40% expected probability of starting a business. The sample with a high score in IPB, shows a 44.2% expected probability of starting a business, while those scoring a low IPB have a 36.3% expected probability of starting a business.

On average, the sample gets an IPB of 21.4, scoring an average of 6 in attitude, a score of 4.8 in Subjective Social Norms, an average of 5.7 in Control of Perceived Behavior, and an average of 4.9 in the fourth component. As expected, the sample with a high IPB has on average higher scores for each of the IPB components.

Table 3 also shows that the sample age on average is 20 years old, and that the sample that scores the lower IPB is relatively younger, although the difference is not statistically significant.¹³ Table 2 reveals that the sample is quite similar on sex, average career and in terms of socioeconomic background, at least with respect to whether their father owned a business. This balance found in the covariates chosen for the empirical analysis, guarantees that the different random matching estimators would work better.

Table 3
Average values (standard deviations in brackets)

	All sample	High IPB	Low IPB
Entrepreneurial Intention	40.3 [25.5]	44.2 [26.1]	36.3 [24.1]
IPB	21.4 [3.6]	24.2 [1.7]	18.6 [2.6]
Attitude	6.0 [1.1]	6.7 [0.6]	5.2 [1.0]
Subjective Soc.Norms	4.8 [0.8]	5.5 [0.5]	4.2 [0.6]
Perc. Beh. Control	5.7 [1.0]	6.4 [0.5]	4.9 [0.8]
Component 4	4.9 [0.9]	5.6 [0.5]	4.3 [0.6]
Age	19.8 [1.7]	19.9 [1.8]	19.6 [1.4]
Male	0.5 [0.5]	0.5 [0.5]	0.5 [0.5]
Engineer	0.7 [0.5]	0.7 [0.5]	0.7 [0.5]
Father Ever Business	0.9	0.9	0.9

¹³ This finding is not surprising since most of the respondents belong to the same ninth semester.

	[0.3]	[0.4]	[0.3]
N	336	169	167

Source: Own calculations based on survey data

3.3 Linear models

Table 4 presents the results from the linear models. Only the variables linked to the IPB, or its components are statistically significant. The first column shows that a unitary increase in the IPB generates an increase of 1.44 points of expected probability. The second column shows that the component of attitude has a higher correlation with the expected probability of starting a business, since a one-point increase in this component increases 3.19 points the expected probability. The third column reveals that the component subjective social norms, has also a higher correlation, since a one-point increase in this score generates an increase of 6.4 points of expected probability. The fourth column reveals that a one-point increase in the component control of perceived behavior, increases by 4.60 points the expected probability. Column 5 reveals that a one-point increase in the fourth component increases 6.8 points the expected probability. Consequently, the partial correlation of the index and each component of the index increases entrepreneurial intentions.

Column 6 reveals that the partial correlations of each component do not preserve the same sign nor the same magnitude. For example, the first component is not statistically significant, while factor 3 now becomes negative. Factors 2 and 4 continue to be statistically significant but with magnitudes completely different from the ones shown in the other columns. This behavior may show the existence of unobserved components that may bias our estimation, and consequently reveal the need for other estimation techniques, which will be shown in our next section.

Table 4
Results for linear models for entrepreneurial intention

	(1)	(2)	(3)	(4)	(5)	(6)
Age	1.67 (1.50)	2.12 (1.51)	1.38 (1.51)	1.85 (1.50)	1.31 (1.50)	1.89 (1.50)
Male	1.24 (2.89)	1.62 (2.92)	0.93 (2.89)	1.51 (2.90)	0.87 (2.87)	1.24 (2.88)
Father ever bus.	7.48 (4.26)	7.40 (4.32)	8.00 (4.24)	7.35 (4.28)	8.20 (4.22)	7.99 (4.20)
Engineer	3.38 (3.20)	2.87 (3.23)	3.52 (3.19)	3.23 (3.21)	3.56 (3.18)	3.10 (3.14)

IPB	1.44***					
	(0.38)					
Attitude		3.19*				15.78
		(1.24)				(11.04)
Sub. Soc. Norm.			6.44***			-68.12***
			(1.62)			(20.12)
Control of Perc. Behavior				4.60***		-11.06
				(1.34)		(15.12)
Attraction for Buss.					6.75***	70.58***
					(1.57)	(19.72)
Constant	-2.72	8.69	-2.92	1.91	-5.10	-22.08
	(9.27)	(8.64)	(8.97)	(8.81)	(8.92)	(12.18)
R squared	0.05	0.03	0.05	0.04	0.06	0.08
N	336	336	336	336	336	336

***1% significance level, ** 5% significance level, *10% significance level

Source: Own calculations based on survey data

3.4 Treatment models

Table 5 presents the results of the treatment models once we use as exogenous or treatment variable the obtention of a high score in the IPB or in any of its four components. Column 1, shows that individuals with high estimated IPB, have between 7.24 points or 8.42 points additional of entrepreneurial intention. Of the four components of the IPB, the component that has the highest impact is that of Control of Perceived Behavior, which increases the expected probability to start a business in 10.1 or 11.42 points. The component that has the lowest impact is that of Attraction for Business, which increases the expected probability to start a business in 7.62 or 9.44 points.

These results imply that once we use a variable that is less subject to unobserved heterogeneity, we obtained a higher coefficient with less variation, which implies that there is evidence that the linear models presented in subsection 3.3 suffer from the existence of unobserved heterogeneity. Moreover, the variations observed between the different estimations carried out in subsection 3.4 to obtain the impact of the IPB, also show that using methods that control for the probability of obtaining a high IPB are needed to completely control for unobserved heterogeneity.

Now, our estimations also have implications for the design of careers at technical universities in the State of Puebla, since the two components more important, attitude and control of perceived behavior, have high loads with questions that are linked to perceptions about behavior and

not with questions that link students with their career. Does it mean that education in technical universities should aim to strengthen attitudes and the perceptions of students rather than on providing additional technical skills? Or is it the case that attitudes and perceptions are built thanks to the technical skills acquired? Further research is required to understand how the factors identified in this study could be strengthened using education. In the following section, we present a first step in this direction, analyzing the three questions that have their highest load with the component Control of Perceived Behavior.

Table 5
Estimation of the impact of High IPB or its components, N=336

	High IPB	High Attitude	High Subjective Soc. Norm.	High CPB	Attraction for Buss.
Linear	7.42*** [2.75]	8.8*** [2.74]	8.3*** [2.75]	10.3*** [2.72]	7.62*** [3.31]
AIPW	7.45*** [2.74]	8.76*** [2.70]	8.36*** [2.76]	10.31*** [2.72]	8.41*** [3.00]
IPWRA	7.45*** [2.74]	8.76*** [2.70]	8.26*** [2.76]	10.31*** [2.72]	8.38*** [2.99]
NNM	7.24*** [2.70]	8.39*** [2.70]	8.27*** [2.72]	10.1*** [2.68]	9.44*** [3.31]
PSM	8.42*** [2.73]	9.58*** [2.64]	9.11*** [2.70]	11.42*** [2.72]	8.25*** [3.06]

***1% significance level

Source: Own calculations based on survey data

3.5 Identifying the relative importance of Control of Perceived Behavior

In this subsection we study the three answered questions that have their highest load with the component CPB. Because a seven-point Likert scale was used to measure those questions, here we define new variables that take the value of one for all the answers that give the Likert values of 5, 6 and 7, and zero otherwise.

The first variable is identified as “it is easy to make business”, the second variable is identified as “entrepreneurship can’t be taught” and the third variable is called “love challenging status quo”.

Table 6 presents the results of applying the five methodologies discussed in subsection 3.4 to these three variables. The variable that generates the

highest increase in the entrepreneurial intention is the first one. Individuals that answered in agreement with the statement “it is easy to make business” have between 9.9 and 10.8 more probability points than the rest of individuals. This result implies that individuals that perceive that opening a business is an easy thing to do, declare a higher entrepreneurial intention. However, with the information at hand we do not know why these individuals have such perception. The result, then implies the need to further research why students at this technical university have such perceptions, and if the objective is to stimulate the entrepreneurial intention, then find ways to strengthen this perception.

Table 6
Control of Perceived Behavior, N=336

	It is Easy to make Business	Entrepreneurship can't be taught	Love challenging status quo
Linear	9.92*** [3.27]	7.74*** [2.98]	7.27** [3.02]
AIPW	9.95*** [3.25]	7.58*** [2.96]	7.11** [3.02]
IPWRA	9.93*** [3.25]	7.58*** [2.95]	7.11** [3.02]
NNM	10.83*** [3.20]	7*** [2.99]	7.05** [3.20]
PSM	9.45*** [3.34]	9*** [3.10]	7.1** [3.11]

***1% significance level

Source: Own calculations based on survey data

3.6 Discussion

The general result obtained about the positive effect of TPB on the entrepreneurial intention confirms the results that have been obtained with university students in Norway (Kolvereid, 1996b), Russia (Tkachev and Kolvereid, 1999), USA (Krueger et al., 2000), Canada (Audet, 2004), China (Wu and Wu, 2008; Lihua, 2022), France (Fayolle and Gailly, 2015), Spain (Caro-González et al., 2017), Spain, the Netherlands, Germany and Poland (Gorgievski et al., 2018), Malaysia (Al-Jubari, Hassan and Liñan, 2019), Ecuador (Diez-Farhat and Guevara, 2019), Mexico (Flores-Novelo et al., 2020) and Colombia (Rueda-Barrios et al., 2022). This result also coincides with results for the adult population of Austria and Finland

(Kautonen et al., 2015), students from 10th and 11th grade in Colombia (Osorio and Londoño, 2015), and for academic workers in Mexico (Teran-Perez et al. (2021). It also coincides with results found in a meta-analysis carried out by Schlaegel and Koenig (2014) for 123 samples and a population of 114,007 people from different countries.

Our finding that the component of control of perceived behavior is the most important coincides with the work of Kolvereid (1996, 1996b); Tchakev and Kolvereid (1999); Krueger et al. (2020); Schlaegel and Koenig (2014); Flores-Novelo et al. (2020) and Lihua (2022), which mention the control of perceived behavior as the most important component explaining entrepreneurial intentions.

Our finding about the relative importance of the three answered questions consisting of the control of perceived behavior is a new result, since previous studies only looked at the importance of the component and did not explore the different elements that compose it. One of those questions relates to the perception that being an entrepreneur is an easy task, which we interpret as important evidence of the unobserved ability in determining who can become an entrepreneur. The other two answers express the perception about the ideas that entrepreneurship can't be taught and that they love to challenge the status quo. We interpret these results as indicators that independence, freedom, and creativity need to be foster in the training of potential entrepreneurs, since they reveal the perception that entrepreneurship involves abilities hard to be learned and that could be new and challenging to the status quo.

Our finding about the importance of social norms coincides with results of Kolvereid (1996b); Tchakev and Kolvereid (1999); Schlaegel and Koenig (2014); Kautonen et al. (2015); Osorio and Londoño (2015); Gorgievski et al. (2018); Al-Jubari et al. (2019); Flores-Novelo et al. (2020); Lihua (2022); and Rueda Barrios et al. (2022).

Our finding about the importance of attitudes coincides with those of Kolvereid (1996, 1996b); Tchakev and Kolvereid (1999); Krueger et al. (2000); Wu and Wu (2008); Schlaegel and Koenig (2014); Kautonen et al. (2015); Osorio and Londoño (2015); Caro-González et al. (2017); Gorgievski et al. (2018); Al-Jubari et al. (2019); Flores-Novelo et al. (2020); Teran-Perez et al. (2021); Lihua (2022); and Rueda Barrios et al. (2022).

Our finding about the importance of business attraction is new since it has not been previously reported in literature.

Finally, the importance of the different components of the TPB also signals out that education for entrepreneurs needs to be comprehensive, since, according to TPB, should foster the different elements that are important for predicting entrepreneurial intentions.

Conclusions

The contributions of our study are the following: (1) it validates the positive impact of TPB on entrepreneurial intentions in a set of Mexican university students; (2) it identifies the control of perceived behavior as the component that affects the most entrepreneurial intentions; (3) our study identifies the importance for independence and freedom to be creative, as well as for the unobserved ability in explaining entrepreneurial intentions; and (4) our study signals the importance for a comprehensive approach to teach entrepreneurship given the different elements needed to foster entrepreneurial intentions.

The implications of these results for educators in entrepreneurship are challenging since it involves the elaboration of programs that will help students express their creativity, in environments that will respect their freedom and their challenges to the status quo.

Our results also imply the need for interdisciplinary and multidisciplinary education for entrepreneurs, since all the elements of the TPB, the social norms, the attitudes, and the perceived behavioral control were found as important determinants of entrepreneurial intentions, and they involve not only entrepreneurial knowledge but also fostering certain attitudes, social norms, and behaviors expressed by potential entrepreneurs.

Furthermore, these results also need to be taken with discretion considering that they were obtained in a public technical university that operates in a dynamic metropolitan area of Mexico, which may condition our results. Another limitation of our study is its cross-section nature that did not allowed us to look at actual entrepreneurial behavior, as well as to the nature of time between TPB and entrepreneurial intention.

Our recommendation for individuals attempting to apply these results would then be to apply a TPB questionnaire like we have done, apply our suggested causal techniques and obtain specific results for the contexts being studied, which would help determine the factors that need to be strengthened to generate greater entrepreneurial intention.

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