

Psychological and emotional factors that influence the entrepreneurial attitude of university students from the Faculty of Engineering of a university

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The present study analyzed the psychological and emotional factors influencing the entrepreneurial attitude of students from the Faculty of Physical and Formal Sciences and Engineering at a private university in Arequipa. A total of 296 fourth- and fifth-year students were evaluated, with the results showing a majority of students in Industrial Engineering (40%) and a predominance of males (82%). A significant and direct relationship was found between these factors and entrepreneurial attitude, suggesting that higher levels of psychological and emotional factors are associated with a greater entrepreneurial attitude. The psychological and emotional factors were measured through levels of self-efficacy, self-confidence, achievement motivation, growth mindset, and conflict resolution skills. In contrast, the entrepreneurial attitude was measured through the number of ideas generated, innovation culture, and level of knowledge in entrepreneurship programs.

Keywords—entrepreneurial attitude, psychological and emotional factors, self-efficacy, self-confidence, entrepreneurship.

I. INTRODUCTION

Ref. [1] indicates that the Generation Z includes individuals born between the years 1997 and 2012. This generation is currently emerging as an influential force within the labor market and higher education. They are characterized by a unique profile that affects their perspective and practice of entrepreneurship. Additionally, they can quickly adapt to technological changes, a skill that could help them develop their innovative capacities [2]. In this context, it is important to highlight those soft skills such as motivation, self-efficacy, self-confidence, growth mindset, and conflict resolution skills are essential for entrepreneurial success, facilitating adaptability and innovation [3], [4]. For Generation Z, these competencies are vital for facing challenges and seizing opportunities in a highly challenging globalized environment.

For this reason, this research evaluates psychological factors and their impact on the entrepreneurial attitude of students from the Faculty of Physical and Formal Sciences and Engineering at a private university in Arequipa. An analysis was conducted on the dimensions of achievement motivation, self-efficacy, self-confidence, growth mindset, and conflict resolution skills, as well as their correlation with entrepreneurial attitude.

The results of this study contribute to a deeper understanding of the internal dynamics of Generation Z in the university context and provide valuable information to promote entrepreneurial attitude through programs that also strengthen soft skills, enabling young people to navigate complexities and face social challenges.

II. BACKGROUND

Ref. [5], Law No. 30220 promulgated by the Peruvian Government establishes the need for universities, as part of their educational mission, to promote the creation of micro and small enterprises (MSEs) owned by students, providing them with the necessary support, including advice and access to equipment and facilities according to each institution's regulations, to establish these businesses. Therefore, it is a legal requirement for universities to foster the creation of businesses. Additionally, in recent years, Peruvian universities have been increasing activities related to university social responsibility (USR), allowing students from various professional schools to apply their knowledge for the benefit of society [6].

Ref. [7] state that the capacity for innovation is a skill for developing new products and services, as well as new production methods, and even identifying new markets. Various authors agree on the need for coordinated efforts to achieve this innovation, which is not only the responsibility of businesses but also academia, which plays a crucial role in generating knowledge [8]. According to university law, academia is also responsible for promoting the creation of Mypes. Iglesia Sánchez et al. points out that the term "spin-off" refers to companies born within universities that transform research results and knowledge into products or technologies, leading to business development and enhancing the competitive edge of the productive economy [9].

Ref. [7] agree that the triple-helix alliance of university-business-government is crucial for developing innovations that address societal needs and environmental opportunities. In line with this, Iglesia Sánchez et al. confirm the role of academic institutions in their entrepreneurial university role [9].

To fulfill this role, universities need to develop entrepreneurial attitudes and competencies among their students [10]. As Sánchez García et al. indicates,

entrepreneurship education can be integrated as a horizontal approach throughout the study program, considering pedagogies such as problem-based learning, project-based methodologies, and cooperative teamwork, among others, to integrate social and economic development while ensuring a high standard of higher education [11]. In the field of engineering, Muñoz-La Rivera et al. emphasize that international accreditation bodies stress the importance of developing innovation and creativity among students [12].

According to reference [11] young people need a change in mindset, viewing entrepreneurship not just as self-employment but as a way to enhance their individual and societal development. Therefore, Muñoz-La Rivera et al. consider that innovation training is key for future professionals. The authors emphasize aligning training with the challenges posed by Industry 4.0 and the Sustainable Development Goals (SDGs) [12].

In the engineering field, Mancero Arias notes that training should incorporate activities that foster critical thinking and the continuous development of innovative skills, contributing to the development of new products and services that address social problems in the national context. Therefore, the author adds that training programs should be flexible and adapt to the industrial environment and needs, promoting the development of high technology with an innovative and scientific approach [13].

It is important to mention that in engineering, teaching methodologies should include approaches like those mentioned by Cornejo-Paredes et al., who in their research presented the implementation of a mobile application that integrates challenge-based learning and personalized chatbots, encouraging university students to foster innovation [10]. Additionally, university innovation departments offer training programs or hackathons to strengthen research, entrepreneurship, and university social responsibility, applying comprehensive learning methodologies that satisfy over 74% of participants [8], [6].

This research analyzes the psychological factors influencing the attitude of engineering students at a university in Arequipa, Peru, noting that university entrepreneurs have the tools to increase productivity levels, as most university ventures are innovative with a technological base.

III. METHODOLOGY

Studies on personality have shown that certain psychological factors can motivate people to become entrepreneurs. This approach has attempted to create a descriptive profile of the entrepreneur to identify those with the potential to start businesses. According to Lanzas Duque et al., based on the theory of entrepreneurial personality traits, individuals who exhibit high internal control, a strong need for achievement, the ability to take risks, and a high tolerance for ambiguity are more

likely to successfully undertake entrepreneurial ventures [14]. The authors add that this analysis examines how these particular traits can influence the inclination toward entrepreneurship, providing a theoretical framework to identify and support potential entrepreneurs [14].

Similarly, according to Guzmán-Pérez, Torres-Flórez, and Hernández-Gracia, the psychological perspective suggests that certain personal traits and attributes determine whether some people become entrepreneurs. Additionally, it considers that personal values influence entrepreneurial behavior. This approach is linked to two orientations: the theory of personality traits and the process-oriented theory. The first theory emphasizes that the personal characteristics of entrepreneurs affect both the type of business they create and how they manage it. The second theory focuses on describing the actions, activities, and functions related to entrepreneurship, concentrating on opportunity identification and business development [15].

The objective of this research is to deepen the understanding of the psychological and emotional factors that influence the entrepreneurial attitude of fourth- and fifth-year students at a private university in Arequipa. A structured survey was used as a data collection technique, and a questionnaire consisting of 19 questions was used as the instrument.

Statistical techniques were employed to analyze the correlation between variables. According to reference [16], this approach allows for identifying significant trends and associations in the collected data, facilitating the understanding of how psychological and emotional factors affect entrepreneurial attitude and ensuring the objectivity of the results obtained.

The study population consisted of 1,265 university students, from which a representative sample of 296 fourth- and fifth-year students from the Faculty of Physical and Formal Sciences and Engineering was selected. The inclusion criteria considered students with active enrollment, with a 95% confidence level and a 5% margin of error.

The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS) software. The statistical analysis allowed for exploring aspects of the data and identifying significant patterns and relationships between both variables.

To develop the instrument to be applied, various studies on entrepreneurial attitude were used as a basis, as well as studies analyzing the psychological and emotional factors influencing the development of this attitude. In Reference [14], [15] and [17] present the reviewed studies which contributed to the design of the applied instrument.

Reference [17], examines several dimensions to better understand the entrepreneurial attitude of university students. These dimensions include sociodemographic characteristics, universal values, academic training, and personality traits. The

IV. RESULTS AND DISCUSSION

latter include agreeableness, need for achievement, risk propensity, extroversion, tolerance for ambiguity, internal control, and neuroticism.

Additionally, in the research "Entrepreneurial Attitude in University Administration Students: Case Pachuca, Mexico" by Guzmán-Pérez, Torres-Flórez, and Hernández-Gracia, the sociodemographic and entrepreneurial characteristics of university students were analyzed using a quantitative, descriptive, and cross-sectional approach with the Personality Questionnaire (CEP). It was found that more than half of the students plan to start a business after graduating, with goal setting being their most prominent entrepreneurial trait, while quality self-demand and risk-taking propensity were less evident [15]. The evaluated dimensions include age, gender, cultural background, parents' occupation, educational level, professional experience, and entrepreneurship training, as well as goal setting, quality self-demand, and risk-taking [15].

The reference [14] focuses on the profile of technology-based entrepreneurs, highlighting various dimensions from a psychological perspective. Entrepreneurial competencies include the intuition of benefits and costs, high achievement motivation, positive self-assessment, leadership skills, and perceived control with risk-taking. Additionally, the authors point out that attitude factors, based on the profile of the European entrepreneur, include work and management style, high achievement motivation, self-efficacy, leadership skills, and perceived control with risk-taking. Work and management style are influenced by attitudes and values, reflecting self-efficacy and leadership skills [14].

Understanding the psychological profile of technology-based entrepreneurs is essential for designing training and support programs that promote these competencies and attitudes. Psychological characteristics such as achievement motivation, self-efficacy, and internal locus of control are determinants of entrepreneurial success, influencing individuals' ability to innovate, lead, and persevere in the business environment. Based on the review of these studies, the following dimensions were defined in the instrument: level of self-efficacy, level of self-confidence, degree of achievement motivation, level of growth mindset, and conflict resolution skills, all to measure the variable psychological and emotional factors. Additionally, the level of ideas generated, level of innovation culture, and level of knowledge in entrepreneurship programs were considered to measure the variable entrepreneurial attitude.

To validate the instrument, Cronbach's alpha coefficient was calculated to measure content consistency. A value of 0.923 was obtained, demonstrating that the instrument is reliable.

Upon conducting the research, the obtained information was analyzed as detailed below:

A. General Data

The research was conducted at a private university in Arequipa, specifically in the Faculty of Physical and Formal Sciences and Engineering, encompassing various professional schools. The study included fourth- and fifth-year students, those nearing graduation.

In the fourth year, it was identified that the professional schools with the highest number of students were Industrial Engineering and Mining Engineering, with 40% and 16%, respectively.

TABLE I
DISTRIBUTION BY PROFESSIONAL SCHOOL FOURTH YEAR

Professional School	Frequency fourth year	Percentage
Mining Engineering	23	16%
Systems Engineering	22	15%
Electronic Engineering	5	4%
Industrial Engineering	57	40%
Mechanical Engineering	18	13%
Mechanical-Electronic Engineering	5	4%
Mechatronics Engineering	13	9%
Total	142	100%

In the fifth year, the professional schools with the highest number of enrolled students are Industrial Engineering with 40% and Systems Engineering with 14% (see Table II).

TABLE II
DISTRIBUTION BY PROFESSIONAL SCHOOL FIFTH YEAR

Professional School	Frequency fifth year	Percentage
Mining Engineering	19	12%
Systems Engineering	21	14%
Electronic Engineering	8	5%
Industrial Engineering	61	40%
Mechanical Engineering	17	11%
Mechanical-Electronic Engineering	9	6%
Mechatronics Engineering	18	12%
Total	154	100%

Figure 1 presents the percentage distribution of students between the fourth and fifth years of engineering professional

schools at a university in Arequipa, represented by 48% and 52%, respectively. This almost balanced parity suggests that both fourth- and fifth-year students are significantly represented, which is important for a comprehensive analysis of the psychological factors influencing their entrepreneurial attitude. Including both cohorts allows for a more complete and diversified view of attitudes and perceptions towards entrepreneurship within this academic group.

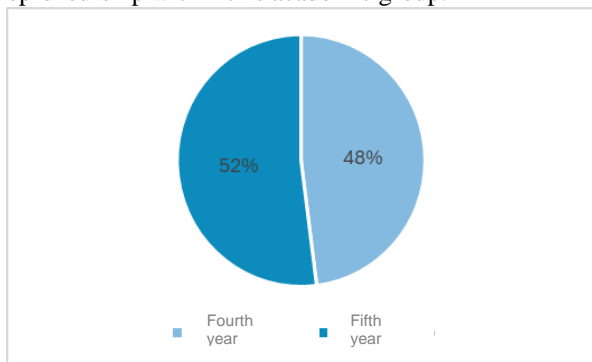


Fig.1 Year of study of the surveyed sample

82% of the students are male, while 18% are female (see Table III). This distribution shows a marked predominance of male students in the engineering professional schools, with an approximate ratio of 4 to 1 compared to female students. This gender imbalance reflects a generally observed trend in engineering faculties, where historically, there has been higher male participation.

TABLE III
GENDER

Gender	Frequency	Percentage
<i>Masculine</i>	243	82%
<i>Feminine</i>	53	18%
<i>Total</i>	296	100%

B. Analysis by Levels

To simplify and categorize the data, an analysis was conducted based on three levels, considering the following:

- Low: Includes responses with values 1 and 2 on the Likert scale ("Strongly Disagree" and "Disagree").
- Medium: Includes the response with a value of 3 on the Likert scale ("Neutral").
- High: Includes responses with values 4 and 5 on the Likert scale ("Agree" and "Strongly Agree").

Therefore, in the levels table of the study variable "Psychological and Emotional Factors," the following is considered:

- Low (1 and 2): Reflects that participants have a negative or low perception of psychological and emotional factors.
- Medium (3): Reveals that participants have a neutral perception of psychological and emotional factors.
- High (4 and 5): Indicates that participants have a positive or high perception of psychological and emotional factors.

In this sense, the analysis presents the results obtained through tables, considering the proposed levels that allow measuring the psychological and emotional factors influencing the entrepreneurial attitude of university students.

For the variable psychological and emotional factors, the following dimensions are considered: level of achievement motivation, level of self-efficacy, level of self-confidence, level of growth mindset, and conflict resolution skills. Regarding the variable entrepreneurial attitude, the dimensions considered are level of ideas generated, level of innovation culture, and level of knowledge in entrepreneurship programs.

The results reveal that the majority of students have a high achievement motivation (74%), a moderate proportion is at a medium level (23%), while a small percentage has low motivation (3%). This distribution suggests a predominance of students with a strong achievement motivation, which is a positive indicator for their academic and professional development.

TABLE IV
ACHIEVEMENT MOTIVATION LEVEL

Levels	Frequency	Percentage
Low	9	3%
Medium	68	23%
High	219	74%
Total	296	100%

Table V shows that 72% of students from the Faculty of Engineering have high self-efficacy, 24% have moderate self-efficacy, and only 4% have low self-efficacy. This distribution suggests that a large portion of students positively perceive their ability to perform tasks and achieve goals, which is a favorable indicator for their academic performance and personal and professional development.

TABLE V
SELF-EFFICACY LEVEL

Levels	Frequency	Percentage
Low	12	4%
Medium	71	24%
High	213	72%
Total	296	100%

The results indicate that 68% of students exhibit high levels of self-confidence. This is encouraging as it shows that a large proportion of participants feel secure in their abilities and decisions, a crucial factor for success in the entrepreneurial field as it enables them to face challenges and opportunities with greater assurance and determination. Additionally, 26% have a medium or moderate level of self-confidence perception, and 6% have low self-confidence (see Table VI).

TABLE VI
SELF-CONFIDENCE LEVEL

Levels	Frequency	Percentage
Low	18	6%
Medium	76	26%
High	202	68%
Total	296	100%

Table VII records that 84% of students have a high growth mindset. This means that students learn to adapt and overcome challenges, a fundamental aspect for success in entrepreneurship and professional life.

TABLE VII
GROWTH MINDSET LEVEL

Levels	Frequency	Percentage
Low	7	2%
Medium	40	14%
High	249	84%
Total	296	100%

72% of students have a high conflict resolution capacity, while 24% have a medium capacity, indicating that they may need more tools and strategies to effectively handle disagreements. Finally, 4% face significant difficulties in resolving conflicts (see Table VIII).

TABLE VIII
CONFLICT RESOLUTION CAPACITY LEVEL

Levels	Frequency	Percentage
Low	12	4%
Medium	72	24%
High	212	72%
Total	296	100%

On the other hand, the indicators degree of ideas generated, culture of innovation, and level of knowledge in entrepreneurship programs are used to measure the variable entrepreneurial attitude. Regarding the degree of ideas generated, Table IX shows that 65% have a high degree of idea generation. This is a positive and essential indicator of innovation and success in entrepreneurship. Similarly, 30% have a moderate level of idea generation, while 5% of the sample have a low capacity to generate ideas, limiting their ability to innovate and be creative.

TABLE IX
DEGREE OF IDEA GENERATION LEVEL

Levels	Frequency	Percentage
Low	16	5%
Medium	88	30%
High	192	65%
Total	296	100%

Furthermore, 42% of students possess a high culture of innovation, indicating a more balanced distribution in this category. This group is likely to adopt new ideas and methods, while 41% exhibit a medium level, suggesting that although students are open to innovation, they do not actively seek it. Finally, 17% report a low level of innovation culture, which could limit their ability to innovate (see Table X).

TABLE X
INNOVATION CULTURE LEVEL

Levels	Frequency	Percentage
Low	51	17%
Medium	120	41%
High	125	42%
Total	296	100%

Table XI reveals that 36% of participants have low knowledge in entrepreneurship programs. This group could be at a disadvantage when it comes to leveraging available resources and opportunities for entrepreneurs. 39% have a high level of knowledge in entrepreneurship programs, while 25% of participants have a moderate level of knowledge.

TABLE XI
KNOWLEDGE IN ENTREPRENEURSHIP PROGRAMS LEVEL

Levels	Frequency	Percentage
Low	106	36%
Medium	74	25%
High	116	39%
Total	296	100%

C. Normality Analysis

To understand the following section, abbreviations for the study variables are used: Psychological and Emotional Factors (PEF) and Entrepreneurial Attitude (EA).

The study comprises 296 observations; therefore, the Kolmogorov-Smirnov normality test is employed. Table XII shows a significance value (Sig.) of 0.000, which is less than 0.05. This indicates that both variables, PEF and EA, do not follow a normal distribution according to the applied test.

TABLE XII
NORMALITY TEST

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
PEF	,092	296	,000
EA	,091	296	,000

To complement the test, the distribution of the observations is graphically presented to validate the presence of normality. As seen in Figure 2, the variable "Psychological and Emotional Factors" does not perfectly follow a normal distribution. The deviations at the extremes suggest that there are more extreme values (heavier tails) than would be expected in a normal distribution. This pattern may indicate the presence of skewness or outliers in the data.

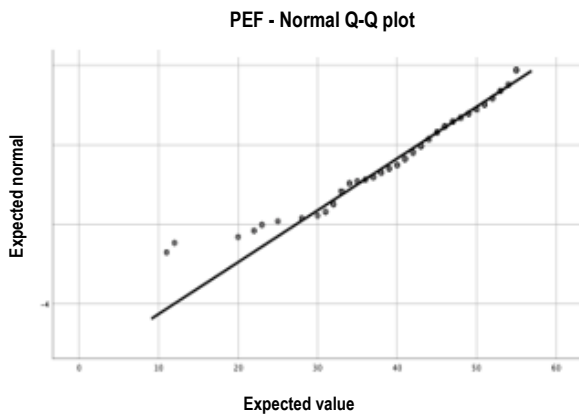


Fig.2. Normality graph: Psychological Emotional Factors

For the EA variable, the graph suggests that the distribution deviates from normality, especially at the extreme values. This deviation justifies the use of non-parametric statistical methods, such as Spearman's coefficient, to analyze the EA data.

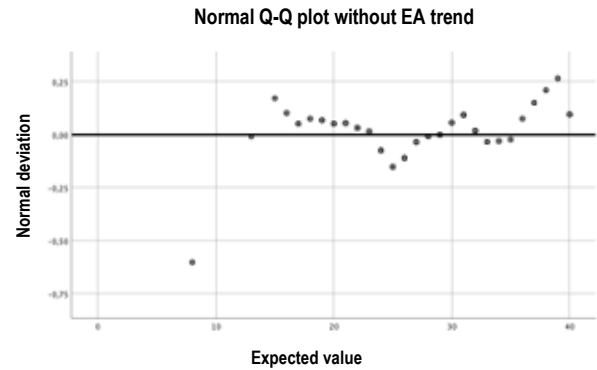


Fig.3. Normality graph: Entrepreneurial attitude

D. Correlations

Given that the normality assumptions are not met, Spearman's Correlation is used to measure the strength and direction of the relationship between two variables, without considering the normality assumption. Additionally, Spearman's correlation is less sensitive to outliers.

In Table XIII, the correlation values are presented. Since the significance level is less than 0.05, it is confirmed that there is a significant relationship between the variables "Psychological and Emotional Factors" and "Entrepreneurial Attitude." This relationship is direct, meaning that higher Psychological and Emotional Factors correspond to a higher Entrepreneurial Attitude. The correlation was moderately positive at 0.437.

TABLE XIII
CORRELATION PSYCHOLOGICAL AND EMOTIONAL FACTORS AND ENTREPRENEURIAL ATTITUDE

		PEF	EA
PEF	Spearman's correlation	1	0,437
	Sig.(2-tailed)		,000
	N	296	296
EA	Spearman's correlation	0,437	1
	Sig.(2-tailed)	,000	
	N	296	296

The research results align with Jaya Pineda et al., who consider that there is indeed a relationship between emotional skills and entrepreneurship, with these not being independent attributes but necessary together to strongly explain the act of entrepreneurship [18]. Moreover, Gamero and Ostos identify key factors such as prior knowledge, entrepreneurial alertness to identify business opportunities, self-efficacy, and creativity [19].

V. CONCLUSIONS

The Reference [20] confirm that a higher perception of control and self-efficacy is related to an individual's intention to undertake. Additionally, research by Ruedas Sampedro et al. considers the student's perception of their self-efficacy to develop entrepreneurial behavior relevant; that is, how they perceive their skills and abilities to develop a business. Their results affirm that those who perceive themselves with greater capacities and skills have a firmer intention to develop an entrepreneurial project [21]. Given this, the importance of incorporating training programs in the university curricular design to develop the necessary skills and capabilities for creating businesses is evident.

The reference [22] argue that it is important to transform ideas into businesses, requiring tools to move from the idea to implementation and overcome each stage of the process, requiring discipline to manage entrepreneurship.

Risk-taking is another factor that influences the intention to undertake, as noted by Valencia Arias et al., since the entrepreneur operates in an uncertain environment but is enthusiastic about facing the unknown due to having more self-confidence [20].

Additionally, Rueda Sampedro et al. note that students' intention also relates to their beliefs about entrepreneurship, with a greater propensity to undertake if they have positive beliefs and perceive fewer drawbacks [21].

For reference [22] it is also fundamental to have the ability to persuade, resolve conflicts, have self-confidence, initiative, negotiation, and teamwork to discuss leadership competencies in an entrepreneur.

However, Ruedas Sampedro et al. also consider that perceived social influence in their close environment affects entrepreneurial intention [21]. Indeed, Pacheco-Ruiz et al. affirm that the success or failure of entrepreneurial projects is also affected by the economic and social context, requiring support from involved actors [22]. Additionally, for Gamero and Ostos, contact networks are an important enhancer for other factors as they allow obtaining information and knowledge to connect ideas with entrepreneurial opportunities [19].

Finally, it is advisable for entrepreneurs to always be knowledgeable about digital tools for managing social networks and content creation, as we are in the era of digital transformation [23]. However, it is crucial to understand the psychological, and emotional factors and entrepreneurial attitude as analyzed in this research with university students.

In conclusion, this study demonstrates a significant and positive correlation between psychological and emotional factors and entrepreneurial attitudes among students from the Faculty of Engineering at a private university in Arequipa. High levels of achievement motivation, self-efficacy, self-confidence, and growth mindset are evident among students—crucial factors for entrepreneurial success. Additionally, good results were observed in conflict resolution capacity, idea generation, and innovation culture. These findings suggest a favorable psychological and emotional profile for entrepreneurship among students, although areas for improvement, such as conflict resolution in some cases, were identified. This study provides valuable information for universities and business incubators to integrate entrepreneurial development programs that foster these skills, enhancing entrepreneurship and contributing to the economic and social development of the region.

VI. FUTURE WORK

For future research, it is recommended to expand the analysis to various factors that could influence the entrepreneurial attitude of students in private universities in Arequipa. These factors include social factors, analyzing how personal networks and connections influence the predisposition toward entrepreneurship; economic factors, evaluating the impact of local economic conditions, such as access to financing and government policies, on entrepreneurial attitude; educational factors, investigating how training in soft skills like communication, leadership, and teamwork affects entrepreneurial attitude; personal factors, examining the effect of personal aspects such as upbringing and family experiences on entrepreneurial attitude; and cultural factors, exploring how local cultural norms and values influence students' inclination toward entrepreneurship. Additionally, it is suggested to conduct similar studies across different academic disciplines to gain a more comprehensive view of how entrepreneurial attitude varies in different fields of study.

ACKNOWLEDGMENT

We thank the private university in Arequipa, especially the Innovation and Development Directorate for the opportunity to manage university startups, and the Technology and Knowledge Transfer Directorate for providing linkage with stakeholders from the different Professional Schools.

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