



OPEN ACCESS

EDITED BY

Peter McGee,
University of Arkansas, United States

REVIEWED BY

Rosemary M. Caron,
Saint Anselm College, United States
Doug Cole,
Nottingham Trent University, United Kingdom

*CORRESPONDENCE

Jonathan Alberto Campos Trigoso
✉ jonathan.campos@untrm.edu.pe

RECEIVED 11 July 2025

ACCEPTED 25 September 2025

PUBLISHED 16 October 2025

CITATION

Portocarrero Ramos HC, Campos Trigoso JA, Cruz Caro O, Reina Marín Y, Maicelo Guevara JL, Sánchez Bardales E and Chávez Santos R (2025) Career paths and university education: factors that determine the employment status of university graduates. *Front. Educ.* 10:1664249. doi: 10.3389/feduc.2025.1664249

COPYRIGHT

© 2025 Portocarrero Ramos, Campos Trigoso, Cruz Caro, Reina Marín, Maicelo Guevara, Sánchez Bardales and Chávez Santos. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](#). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Career paths and university education: factors that determine the employment status of university graduates

Heily Concepción Portocarrero Ramos¹,
Jonathan Alberto Campos Trigoso^{1*}, Omer Cruz Caro¹,
Yuri Reina Marín¹, Jorge Luis Maicelo Guevara²,
Einstein Sánchez Bardales¹ and River Chávez Santos¹

¹Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas, Chachapoyas, Peru, ²Pontificia Universidad Católica del Perú, Lima, Peru

Employment outcomes are more strongly associated with specific career paths than with academic performance. Despite expanding university access, significant gaps persist between the training received and labor market conditions. The objective was to identify and analyze the factors that influence the employment situation of university graduates. A quantitative explanatory approach was used, with a sample of 3,009 graduates. A structured survey was administered, and the data were analyzed using Logistic regression, Lasso regression, and Random Forest models. The results show that the variables with the greatest predictive power are the type of contract, time spent working, and income level. In contrast, academic variables such as GPA and theoretical or practical training showed little relevance. In comparison, employability is more associated with specific career paths than academic merits. The study reveals important findings for universities to strengthen applied training, encourage early entry into the workforce, and develop monitoring systems that allow them to adapt their educational offerings to the real demands of the professional environment. Understanding the factors that influence graduate employability is crucial to enhancing the significance of education and improving professional opportunities.

KEYWORDS

employability, graduates, vocational training, higher education, labor market

1 Introduction

Education is a fundamental tool for empowerment in socioeconomic, political, and technical growth (Dzomeku et al., 2024). Every year, higher education institutions produce recent graduates ready for the job market (Almejas et al., 2017). As a measure of accountability and demonstration of impact, these educational institutions must show the employability profile of their graduates, as well as the impact that these institutions have on the personal and professional development of the graduates (Dewi et al., 2021; Maghamil, 2025). Professional development is defined as the process by which an individual acquires or improves the skills, information, and/or attitudes necessary for better practice (Mitchell, 2013). The economy of a nation functions through the knowledge and skills of its people, indicating that the personal and professional development of the country's workforce is fundamental for nation-building (Cruz and Alcantara, 2015). Undoubtedly, employment can be best measured through a

program's alumni, as they are considered the best proof of the program's performance (Aquino, 2015).

Higher education institutions have a key role in improving their graduates' employability (Blázquez et al., 2024; Yizengaw and Weidman, 2024), especially in developing countries, where there is a need for trained and qualified human resources for economic development and social transformation (World Bank, 2019). Graduates, in particular, are expected to have skills and competencies that are relevant and responsive to the needs and demands of employers and society (Rodzalan and Saat, 2015). However, several factors may affect graduates' employability, such as the quality of learning environments, curriculum alignment, and the development of skills and competencies (Tomlinson and Holmes, 2017).

The number of people graduating from higher education institutions has increased rapidly in recent years (Rodrigues et al., 2024). Once seen as an elite preparing for key professional and managerial roles, graduates' initial position in the labor market is more uncertain (Blokker et al., 2023). Studies show that many graduates face several barriers to finding a (good) job and often experience unemployment and underemployment after completing their degree (Clarke, 2018; Tomlinson, 2012, 2017). As a result, graduate employability is a growing concern for governments, higher education providers, and graduates themselves (Rodrigues et al., 2024).

The global market in 2024 shows progress in terms of employment (Kimeu, 2024), but significant challenges remain related to the quality of work, informality, and gender equity (Aquino, 2025). The global unemployment rate remained at a historically low level of 5% in 2024 and 2025; however, the creation of decent jobs has been insufficient, with a deficit of 402.4 million jobs (OIT, 2025), however, 66% of the working-age population between 15 and 64 years old has paid employment (OCDE, 2024); in addition, by 2030, the creation of 170 million new jobs is projected worldwide (World Economic Forum, 2025); despite this, approximately 13% of young people in 2024 will have limited participation in the labor market, especially in low-income countries (More, 2024), the labor informality remains high, with more than 2 billion workers in the informal sector, and women face the greatest disparity in labor participation and remuneration (OIT, 2024).

In the Philippines, graduates from a state university showed high employment rates between 2015 and 2019, exceeding the university's strategic objectives (Roman and Villanueva, 2023). A study in China highlighted regional disparities, with economics and management graduates struggling to secure relevant job opportunities between 2018 and 2023 (Jiang and Eliza, 2024). Student characteristics, including the employment rate and economic need, play an important role in public universities (Santos, 2018). In Russia, a significant number of graduates find jobs unrelated to their degrees, indicating a mismatch between education and labor market demands (Sekerbayeva et al., 2024). While many graduates achieve high employment rates, the relevance of their jobs to their qualifications remains a critical concern, suggesting the need for better alignment between educational outcomes and labor market needs.

The employment rate of university graduates in Peru presents a complex panorama influenced by various sociodemographic and educational factors, with approximately 36,939 graduates from Peruvian universities (Estadística de Calidad Educativa, 2025) and according to the National Superintendence of Higher University Education (Sunedu), the labor market for graduates of the university

system is around 25% (Minería y Energía, 2024), approximately 50% of graduates find employment under suitable conditions, while 29% remain unemployed, which highlights significant challenges in job placement (Yangali and Saenz, 2021). Factors such as degree type, university ranking, and socioeconomic background play a crucial role in determining employment outcomes (Yangali and Saenz, 2021). Engineering graduates have four times more employment opportunities compared to other fields (Yangali and Saenz, 2021), and 87% of education graduates find employment within 1 year (Hilario-Flores et al., 2022). Lack of experience and professional development are major obstacles for many graduates (Chotón et al., 2022). Despite these challenges, there is growing recognition of the need for educational reforms and collaborative efforts to improve the employability of graduates in a rapidly evolving labor market (Bobadilla et al., 2024). In terms of formal and independent employment, graduates reached a rate of 61.2% (Programa Nacional de Becas y Crédito Educativo - Pronabec, 2025).

Statistics on job placement do not answer questions such as the level and nature of the jobs graduates accepted, and why (Khan and Ali, 2022). Therefore, it is necessary to ask whether the graduates got a job and, more specifically, whether the job was related to their area of specialization (Pool and Sewell, 2007). The literature also emphasizes the need for empirical research into these problems (Raihan and Azad, 2023), which is why the authors undertook this study. The aim was to identify and analyze the factors that influence the employment situation of university graduates, assessing the extent to which educational, sociodemographic, and occupational variables predict graduate employability. The objective was to explore graduates' satisfaction with their first job and the factors that contribute to it, so that students, academics, and policymakers could gain insights from the study's findings.

The benefits of a follow-up study are undeniable, in addition to providing feedback on the usefulness of the curricula and training for their current jobs (Verona, 2011), a follow-up study is crucial for national development as it determines the contribution of graduates to the country's workforce (Dzomeku et al., 2024). In the context of quality assurance, information from a follow-up study could be used to drive the growth of the institution by assessing the relevance of curricula and providing empirical evidence that can be used to influence activities aimed at improving the quality of these educational institutions' programs (Sanchez et al., 2017).

2 Literature review

Employment is defined as the situation in which a person of working age engages, during a reference period, in an activity aimed at producing goods or providing services for remuneration or profit, either as an employee, self-employed worker, or contributing family worker; it also includes those who maintain a work relationship but are temporarily absent (ILO, 2024). This definition, adopted by the 19th International Conference of Labour Statisticians (ICLS), is standard in international labour studies and clearly distinguishes being employed from the attributes of job quality (formality, stability, income, social protection, and field-of-study correspondence). Employability is typically defined as an individual's employment potential in the internal and external labor market (Forrier and Sels, 2003), within this area of research, there is particular emphasis on the

immediate and long-term professional outcomes of graduates in the field of higher education research (Clarke, 2018; Donald et al., 2019), while career and psychology research focuses primarily on how employability can serve as a resource, facilitating career mobility and success (Forrier et al., 2018; Fugate et al., 2021).

Research on employment has gained considerable momentum, particularly in the field of career research (Akkermans and Kubasch, 2017; Byington et al., 2019) and educational research (Healy et al., 2022; Tomlinson, 2012). However, studies have identified employability as a key problem facing graduates (Fahimirad et al., 2019; Holmes, 2013; Okolie et al., 2020; Osmani et al., 2015). The aspect of employability varies from simple to complex measures, from simply getting a job within 6 months of graduating to how well students have practically demonstrated their knowledge, skills, and understanding in their jobs (Khan and Ali, 2022).

Research on graduate employability underscores the central role of generic and soft skills, such as critical thinking, adaptability, and digital literacy, in facilitating labor market insertion (Adegbite, 2024; Akhtar et al., 2024; Cronin et al., 2021; Succi and Canovi, 2020; Tan et al., 2023). These competencies are closely linked to practical experience, cooperative education, and career awareness (Mtawa et al., 2021; Tan et al., 2023). Work-integrated learning, in particular, has shown a strong influence on long-term career development, as it prepares students for immediate employment and professional growth (Adegbite and Adeosun, 2021; Crawford et al., 2020; Mabungela and Mtiki, 2024; Schueller, 2023). Furthermore, life and career planning knowledge, alongside digital skills, significantly enhances employability prospects (Kee et al., 2023; Khan et al., 2022). However, persistent skills gaps highlight the need for further research and curricular reforms to strengthen these competencies (Cronin et al., 2021; Scheuring and Thompson, 2025).

Research has indicated that cultivating these skills can significantly improve students' psychological well-being, academic performance, physical health, and future employment prospects (Cronin et al., 2021; Hailikari et al., 2021; Succi and Canovi, 2020). Academics stress the importance of universities providing students with ample opportunities to develop these essential life and career skills (Carrasco et al., 2024). In addition, further research is needed to delve deeper into this area, ensuring a comprehensive understanding of the impact and importance of these skills in preparing students for the workforce (Alt et al., 2023). Studies have strongly emphasized the importance and effectiveness of life and career education in the holistic development of students' employability skills (Alt et al., 2023; Cronin et al., 2021). This education focuses on improving students' social, emotional, and cognitive skills to help them effectively cope with the psychological challenges associated with employment. According to Hailikari et al. (2021), knowledge about life and career not only improves critical thinking skills and prosocial behavior but also has a far-reaching impact on aspects such as working life, job responsibilities, and future employment.

Graduate employment has long been a key attraction for higher education providers (Clarke, 2018; Jorre et al., 2021; Maxwell and Armellini, 2019; Nghia et al., 2019; Peng, 2019; Wilkes and Burns, 2019). However, research on employability among people with practical or vocational training is much less common (Akkermans et al., 2024a). In addition to vocational and educational differences, many groups have been underrepresented in employability research to date (Goulart et al., 2022). Curriculum design, continuous

improvement, and pedagogical practices have significant impacts on learning outcomes (Sánchez et al., 2024) and, eventually, on the employability of university graduates (Gawel et al., 2024).

However, unemployment can occur due to two factors: employment avenues are limited, or graduates are not sufficiently developed for the available vacancies (Affum-Osei et al., 2019; Ampong, 2020; Baah-Boateng, 2015). Assuming that there are vacancies available, studies of Agwu (2019); Bawakyillenuo et al. (2013); Oppong (2015); and Pitan and Adedeji (2012), they attributed the unemployment problem to the academic sector's inability to produce the appropriate caliber of graduates to match employment pathways. This claim suggested that the graduates produced by higher education institutions had not developed the skills required for employment. In response, Kwarteng and Mensah (2022) could this underdevelopment of the right set of skills be due to higher education institutions ignoring the needs of the workplace, or could higher education institutions somehow be unable to meet the development of these skills in students? In response, studies by Afolabi (2014); Awayiga et al. (2010); Cory and Pruske (2012); Damoah et al. (2021); Ismail et al. (2020); Sithole (2015); and Teferi (2015) they found that employers were dissatisfied with the products produced by academic institutions. On the contrary, Catalunya (2015); Lowden et al. (2012); and Tudy (2017) they observed that employers were satisfied with the level of development and associated productivity of graduates produced by higher education institutions.

Studies have identified employability as a key problem facing graduates (Fahimirad et al., 2019; Holmes, 2013; Okolie et al., 2020; Osmani et al., 2015). The aspect of employability varies from simple to complex measures, from simply getting a job within 6 months of graduating to how well students have practically demonstrated their knowledge, skills, and understanding in their jobs (F. Khan and Ali, 2022). They have also shown that digital literacy is crucial to improving graduates' job readiness (Arnold, 2023; Morgan et al., 2022). Although studies have explored the influence of digital literacy on the employability of graduates (Arnold, 2023; Goulart et al., 2022), the study identifies and analyzes the factors that influence the employment situation of university graduates; it also explores the influence of students' life and career knowledge on their employability skills, focusing specifically on the impact of work-integrated learning. It highlights the need to improve higher education institutions' curricula to provide students with essential life and career knowledge, as this area is currently lacking in emphasis (Hailikari et al., 2021; Succi and Canovi, 2020).

In recent years, work-integrated learning has been increasingly recognized as a crucial educational approach to preparing graduates to be competent and ready for the world of work (Adegbite, 2024). This approach encompasses various forms of practical experience, including internships, apprenticeships, internships, field experiences, and work study (Mpu et al., 2022; Shaleh et al., 2022). These diverse opportunities allow students to acquire valuable practical skills and knowledge for their future careers. Work-integrated learning has been closely associated with aspects of graduate employability, playing a crucial role in equipping individuals with the skills needed for future employment worldwide (Jackson and Bridgstock, 2021; Rowe and Zegwaard, 2017). The positive correlation between lifelong learning and graduate employability has been demonstrated in a variety of ways, including its impact on strengthening career prospects, developing professional networks, encouraging proactive initiative,

and developing essential leadership qualities (Adegbite and Hoole, 2024; Khan et al., 2022; Mabungela and Mtiki, 2024). This highlights the multifaceted role of lifelong learning in preparing graduates to excel in the dynamic demands of today's labor market (Adegbite, 2024).

3 Materials and methods

3.1 Place of study

This study was conducted at the Toribio Rodríguez de Mendoza National University of Amazonas (UNTRM), located in the Amazonas region of northeastern Peru. Amazonas is one of the country's 24 departments and borders Ecuador to the north, Loreto to the east, San Martín to the southeast, La Libertad to the south, and Cajamarca to the west. In terms of education, UNTRM is the university with the largest number of programs and graduates in the region. This is why the study was conducted there. The study population consisted of undergraduate graduates from 2006 through the 2023–2 semester. This includes those who graduated from university or completed the curriculum according to the academic program.

3.2 Data collection

The survey technique employed was a virtual survey, administered via Google Forms and distributed via email and WhatsApp groups by the Graduate Monitoring Department. The survey was conducted in 25 undergraduate programs, yielding a total of 3,009 graduates, representing 44% of the total population. The survey was designed in three sections: the graduate's sociodemographic profile, labor market status, and perceptions and relationship with university education.

The questionnaire was validated through expert judgment. Three evaluators with the following profiles (a doctoral methodologist, a doctoral statistician, and a researcher with prior experience in graduate studies) provided valuable feedback for defining the questionnaire before its administration. To determine reliability, the Cronbach's alpha coefficient test was applied, yielding a value of 0.78, indicating good internal consistency. This test was conducted on 5% of the total population, selected with characteristics similar to the target sample.

The data set used in the study includes graduates from 2006 to 2023. Table 1 provides information on variables that influence the employment status of graduates. Detailed information on the variables was obtained through a survey, for which all participants gave their informed consent for voluntary participation, guaranteeing the anonymity and confidentiality of their responses. A total of 3,009 graduates responded.

3.3 Data analysis

The data on graduates' employment were processed and classified using descriptive statistics and a logistic regression model. The analysis was conducted using the Python programming language (version 3.12.2). Employment status was grouped using 20 essential variables (defined as independent variables). These 20 essential variables include variables directly related to graduate employability

(gender, time since graduation, graduation status, marital status, GPA, school origin, number of children, academic degree, time spent working, career experience, contract type, sector, income, time to get first job, university has influenced the work environment, training received, basic training, specialized training, theoretical training, practical training).

According to the coding presented in Table 1, most of these variables are nominal or discrete and were incorporated into the analysis using pre-defined numeric categories. The variable "Graduation status" was treated as dichotomous (0 = No, 1 = Yes). No additional dummy variables were generated for each category; instead, the numeric codes from the table were directly used to represent the different categories in the logistic model. This coding approach facilitates the identification of each category and preserves the original structure of the questionnaire.

3.4 Regression model

The analysis used a logistic regression model, a widely applied statistical method for classification and prediction tasks (Agresti, 2007; Peng et al., 2002), which estimates the probability of a binary outcome, such as being employed or not, based on a set of independent variables (Boateng and Abaye, 2019; Hosmer and Lemeshow, 2000). This model, suitable for binary responses coded as 1 or 0 (Bewick et al., 2005; Leon, 1998), enables not only the estimation of such probabilities (King and Zeng, 2001), but also the identification of relevant risk factors and the magnitude of their influence (Sperandei, 2014). The method is based on a logit transformation, or log odds, which expresses the ratio between the probability of success and the probability of failure (Peng and So, 2002). The mathematical representation of the logistic regression model is given by the following expressions (Equations 1 and 2).

$$\text{logit}(\gamma_i) = \frac{1}{1 + e^{-\gamma_i}} + \varepsilon \quad (1)$$

$$\text{logit}\left(\frac{\gamma_i}{1 - \gamma_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n + \varepsilon \quad (2)$$

Where:

γ_i : Dependent variable (Employment situation).

β_0 : It is the intercept of the regression, which represents the initial value when all independent variables are zero.

The coefficients ($\beta_1, \beta_2, \beta_3, \dots, \beta_n$) are the estimated values that indicate the impact of each factor on the probability of the employment situation.

The coefficients ($X_1, X_2, X_3, \dots, X_n$) are the independent variables. ε : is the error term.

The logistic model was evaluated using classic fit and prediction metrics. The Hosmer-Lemeshow test confirmed a good fit between the observed and estimated values (Hosmer et al., 1989, 1998; Maydeu-Olivares et al., 2023), while the Nagelkerke coefficient showed that the independent variables explain a significant percentage of the variability in employability (Park, 2013). In addition, the precision, recall, and F1 score, together with the AUC, allowed for a detailed evaluation of the model's performance, highlighting its high capacity

TABLE 1 Variables were analyzed to evaluate the employment situation of university graduates.

Variables	Description	Guy	Range
Gender	Identify the gender of the graduates	Nominal	(1) Female (2) Male
Graduation Time	Identify the graduation time in years	Discrete	
Graduate	Identify if the graduate has a bachelor's degree	Dummy	(0) No (1) Yes
Marital status	Identify the marital status of graduates	Nominal	(1) Single (2) Married (3) Widow(er) (4) Divorced
Average	Identify the grade point average with which they graduated	Discrete	
Origin of the School	Identify the type of school of origin with which they entered the university	Nominal	(1) National College (2) Private School (3) COAR ¹
Number of Children	Identify the number of children of graduates	Discrete	
Academic Degree	Identify the type of academic degree of the graduates	Nominal	(1) Bachelor's degree (2) Master's degree (3) Doctorate
The time I spend working	Identify the time working since graduation	Nominal	(1) He did not work at any time (2) The minority of the time was spent working (3) Half the time, he was working (4) Most of the time, he was working (5) He was working all the time
Career Experience	Identify the experience of graduates in their training career	Nominal	(0) Never worked (1) Did jobs with a strict field of study match to their professional career. (2) Did occasional jobs with a field of study match to their professional career. (3) Did jobs with no field-of-study match to their professional career. (4) Did occasional jobs with no field-of-study match to their professional career.
Type of Contract	Identify employment conditions	Nominal	(0) Informal employment (1) Lessor (2) Fixed-term contract (3) Indefinite Contract
Sector	Identify the employment conditions of graduates.	Nominal	(0) Informal employment (1) Private organization (2) Public body (3) Self-employment (4) Non-governmental organization (NGO)
Income	Identify the employment conditions of graduates.	Nominal	(1) Less than S/ 1,100.00 (2) Between S/ 1,100.00 and S/ 2,500.00 (3) Between S/ 2,500.00 and S/ 4,000.00 (4) Between S/ 4,000.00 and S/ 5,000.00 (5) More than S/ 5,000.00
Time to get your first job	Identify the time to get your first job after graduating from college	Nominal	(1) From 1 to 6 months (2) From 7 months to 1 year (3) From 1 to 2 years (4) More than 3 years (5) He was already working

(Continued)

TABLE 1 (Continued)

Variables	Description	Guy	Range
The University has influenced the workplace	Identifies the perception of graduates regarding whether the university has influenced their employment	Nominal	(1) Nothing (2) Little (3) Partly (4) Much
Training Received	Identify the perception of graduates regarding the training received	Nominal	(1) Insufficient (2) Acceptable (3) Excellent
Basic Training	Identifies the perception of graduates regarding basic training courses	Nominal	(1) Insufficient (2) Acceptable (3) Excellent
Specialty Training	Identifies the perception of graduates regarding specialty training courses	Nominal	(1) Insufficient (2) Acceptable (3) Excellent
Theoretical Training	Identify the perception of graduates regarding theoretical courses	Nominal	(1) Insufficient (2) Acceptable (3) Excellent
Practical Training	Identify the perception of graduates regarding the practical courses or internships carried out	Nominal	(1) Insufficient (2) Acceptable (3) Excellent
Employment status	Identify the current employment status of graduates (are they working)	Dummy	(0) Not Employed (1) Employee

¹High Performance School.

to identify employed graduates correctly (Fawcett, 2006; Hosmer et al., 2013).

The comparison between the applied models, logistic, Lasso, and Random Forest, allows for cross-validation of the consistency of the results and highlights different approaches to employability analysis. While the logistic model offers a solid interpretive basis from classical statistics, Lasso provides simplicity and automatic variable selection capabilities, and Random Forest complements the analysis by capturing nonlinear and complex relationships between factors. The convergence of these methods reinforces the robustness of the findings and provides a comprehensive view to guide evidence-based institutional decisions.

4 Results

The survey of 3,009 university graduates (Table 2) reveals a gender distribution slightly favorable to women (51.65%) over men (48.35%), with a notable predominance of singles (86.71%) compared to other marital status categories such as married (12.63%), widowed (0.23%) and divorced (0.43%); concerning parenthood, more than half of the graduates (53.61%) do not have children, while the rest are mainly distributed among those with one child (28.15%) or two children (13.86%), with a minority of graduates with three children (3.72%) or more than four (0.66%), which suggests a profile of mostly young graduates, without formal marital commitments and with few or no parental responsibilities.

Table 3 reflects a predominantly public and undergraduate academic profile among graduates: most finished their studies 6 to 10 years ago, 89.93% hold a bachelor's degree, and 90.56% come from

TABLE 2 Descriptive statistics of the sociodemographic profile of graduates.

Variables		Frequency (3,009)	Percentage
Gender	Female	1,554	51.65
	Male	1,455	48.35
Marital status	Single	2,609	86.71
	Married	380	12.63
	Widow(er)	7	0.23
	Divorced	13	0.43
Number of children	0	1,613	53.61
	1	847	28.15
	2	417	13.86
	3	112	3.72
	More than 4	20	0.66

public schools. Postgraduate advancement is limited, with only 22.50% holding a master's and 1.69% a doctorate, highlighting a concentration at the basic level of higher education and the need to promote further academic progression.

Table 4 indicates a generally favorable employability scenario. Nearly half of the graduates (48.22%) secured employment within 6 months of graduation, while 25.66% were already working beforehand, reflecting a rapid transition to the labor market. Although 4.52% have never worked, 80.33% have held jobs related to their field, either directly or occasionally, suggesting a strong alignment between

education and employment. Regarding continuity, 72.48% reported having worked most or all of the time since graduating. However, the presence of 15.15% in jobs unrelated to their profession and 22.99% with intermittent or limited work trajectories underscores the need for support mechanisms to improve job stability and professional relevance.

Table 5 shows that most graduates (82.09%) work without a formal contract, largely due to self-employment, especially in regions

with limited formal job opportunities like Amazonas. Although 76.47% are employed mainly in the public sector (60.58%), the low presence of fixed-term (9.27%) and indefinite contracts (3.62%) reflects high informality. Income is concentrated in the S/1,100–S/4,000 range, with only 17.55% earning more, and 12.43% earning little or nothing, indicating employment vulnerability. These findings highlight the need to promote job formalization and improve income security.

Table 6 shows that while most graduates perceive their overall academic training as acceptable (68.96%), significant concerns arise regarding practical and specialized preparation. Basic and theoretical training received strong approval, with over 95 and 91% rating them as acceptable or excellent, respectively, indicating a solid academic foundation. However, 22.10% rate practical training as insufficient, suggesting a critical gap in hands-on learning and professional readiness. This points to the need to strengthen experiential components such as internships and industry engagement to enhance employability and confidence in applied skills.

Figures 1, 2 graphically present the categories and relationships that emerged from the qualitative analysis of the open-ended responses in the questionnaire administered to participants. These diagrams were built by identifying recurring themes in the written perceptions, grouping them into categories and representing their connections. Both figures were produced using the same open and axial coding procedure, differing only in the topic analysed.

Figure 1 illustrates the main strategies used by graduates to obtain their first job, with personal contacts standing out as the most frequent, underscoring the key role of social networks in job placement. Other strategies include submitting applications, volunteering, internships, and self-employment, especially relevant in regions with limited formal opportunities, reflecting a mix of informal

TABLE 3 Distribution of educational characteristics of graduates.

Variables		Frequency (3,009)	Percentage
Years of graduation	2	399	13.26
	3	307	10.20
	4	278	9.24
	5	186	6.18
	6 to 10	1,107	36.79
	11 to 15	443	14.73
	More than 15	289	9.6
Graduate (Bachelor)	Yes	2,706	89.93
	No	303	10.07
School of origin	Public	2,725	90.56
	Private	277	9.21
	COAR	7	0.23
Academic degree	Bachelor	2,281	75.81
	Master's	677	22.50
	Doctor	51	1.69

TABLE 4 Professional experience and job placement times.

Variables		Frequency (3,009)	Percentage
Time first job	Not yet worked	136	4.52
	From 1 to 6 months	1,451	48.22
	From 7 months to 1 year	373	12.40
	From 1 to 2 years	216	7.18
	More than 3 years	61	2.03
	He was already working	772	25.66
Career experience time	Never worked	136	4.52
	Did jobs with a strict field of study match to their professional career.	1,663	55.27
	Did occasional jobs with a field of study match to their professional career.	754	25.06
	Did jobs with no field of study match to their professional career.	211	7.01
	Did occasional jobs with no field-of-study match to their professional career.	245	8.14
Time, I dedicate to work	He never worked	136	4.52
	The minority of the time was spent working	290	9.64
	Half the time, he was working	402	13.36
	Most of the time, he was working	1,467	48.75
	He was working all the time	714	23.73

TABLE 5 Working conditions of graduates.

Variables		Frequency (3,009)	Percentage
Type of contract	Informal employment	2,470	82.09
	Lessor	151	5.02
	Fixed-term contract	279	9.27
	Indefinite Contract	109	3.62
Sector	Informal employment	136	4.52
	Private organization	836	27.78
	Public body	1823	60.58
	Self-employment	190	6.31
	Non-governmental organization	24	0.80
Income	They do not receive income	136	4.52
	Less than S/ 1,100.00	238	7.91
	Between S/ 1,100.00 to S/ 2,500.00	1,238	41.14
	Between S/ 2,500.00 to S/ 4,000.00	869	28.88
	Between S/ 4,000.00 to S/ 5,000.00	277	9.21
	More than S/ 5,000.00	251	8.34
Employment status	Not Employed	708	23.53
	Employee	2,301	76.47

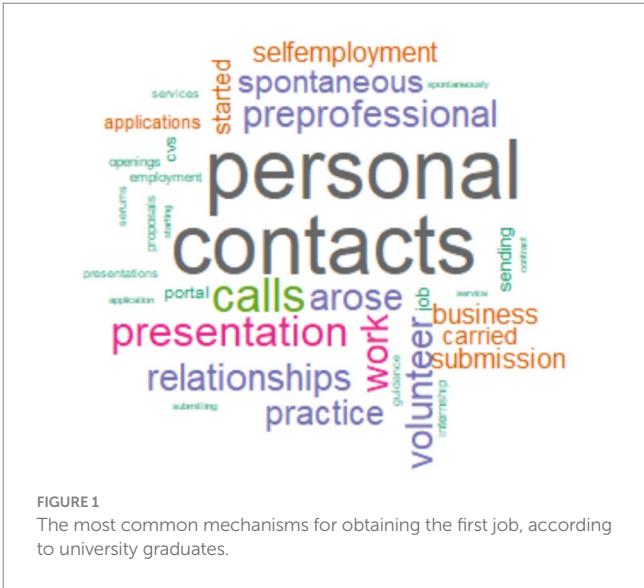
ties, proactive behavior, and practical experience in the transition to the labor market.

Figure 2 shows that employers value work experience above all in hiring decisions, followed by complementary training such as courses and diplomas. Soft skills like leadership and creativity also stand out, reflecting the importance of adaptability and interpersonal abilities. While academic degrees and university background are considered, practical experience and continuous learning weigh more heavily in the current job market.

The correlation matrix (Figure 3) shows structured relationships between academic, sociodemographic, and employment variables. There is a strong association between the different types of training (theoretical, practical, basic, and specialized), suggesting that graduates tend to evaluate their training holistically. At the employment level, variables such as time spent working and income

TABLE 6 Graduates' perception of the training received at the university.

Variables		Frequency (3,009)	Percentage
Training received	Insufficient	460	15.29
	Acceptable	2075	68.96
	Excellent	474	15.75
Basic training	Insufficient	128	4.25
	Acceptable	2,152	71.52
	Excellent	729	24.23
Specialty training	Insufficient	530	17.61
	Acceptable	1854	61.62
	Excellent	625	20.77
Theoretical training	Insufficient	248	8.24
	Acceptable	2053	68.23
	Excellent	708	23.53
Practical training	Insufficient	665	22.10
	Acceptable	1702	56.56
	Excellent	642	21.34



level show moderate correlations, indicating that a sustained employment trajectory is associated with better economic conditions. In contrast, variables traditionally valued, such as grade point average or type of school attended, show weak correlations, reinforcing the idea that employment success does not depend exclusively on academic performance, but rather on practical experience and continuity in employment.

The Random Forest analysis (Figure 4) shows that the type of contract is by far the most influential factor in analyzing the employment situation of graduates, followed by length of employment and income level. These variables far outweigh others, such as professional experience, time taken to find the first job, or employment sector. In contrast, academic variables such as grade point average, practical or theoretical training, as well as personal characteristics



FIGURE 2
Job requirements most requested by employers according to graduates' perception.

such as gender or marital status, are of almost no importance. This quantitative evidence reinforces the notion that structural conditions in the labor market and actual experience carry more weight than academic achievements in professional integration.

To optimize the model's performance, a hyperparameter tuning process was conducted using cross-validation. Different configurations of the max features parameter were evaluated, and the optimal choice was sqrt, which achieved an average cross-validation score of 0.9888 and a test set score of 0.9867. This result demonstrates the model's stability and confirms that the selected configuration provides an appropriate balance between bias and variance, maximizing predictive capacity without overfitting.

The coefficients of the logistic model (Figure 5) confirm that having a formal contract and having accumulated work experience after graduation are decisive factors in being employed. In particular, the absence of a contract is strongly associated with a lower probability of employment. Variables such as income level, professional experience, and perceived influence of the university have positive and statistically significant effects. In contrast, the contributions of academic training and personal variables such as gender or school background are minimal or even negative, which highlights a disconnect between perceived university training and the actual demands of the labor market.

Hyperparameter tuning for the logistic regression model was conducted using cross-validation, systematically testing different combinations of regularization strength (C), penalty type (penalty), and solver. The best performance was achieved with $C = 1$, penalty = 'l2', and solver = 'liblinear', reaching a validation score of approximately 0.9896. During this process, some configurations were intentionally explored even though they are not applicable by design (certain penalties are not computed with specific solvers), resulting in nan values for those combinations as expected in an exhaustive search. These non-applicable settings were automatically disregarded, and the

procedure robustly identified the optimal model, ensuring its stability and predictive validity.

The logistic model was re-estimated, treating the categorical variables as factors. Table 7 presents the disaggregated results, showing the individual effect of each sector category compared to the reference category. The model converged correctly (Pseudo $R^2 = 0.2470$; LLR p -value = $7.002e-135$) and explains about 24.7% of the variability in employment status, indicating a moderate but significant fit. The results confirm that time dedicated to working is the strongest predictor: each increase on the "time working" scale multiplies the odds of being employed by approximately 2.6. Income level also has a positive and increasing effect as one moves from one salary category to another, and within the university employment field, it is observed that working "partly" and, especially, "much" in areas related to one's university studies significantly increases the probability of employment compared to the reference category. Likewise, longer time since graduation and a higher academic average are associated with a greater likelihood of being employed. In contrast, certain types of professional experience and most of the grouped sector categories did not show statistically significant effects. These estimates make it possible to clearly identify which variables and which specific levels significantly influence the probability of being employed.

The model demonstrates solid goodness-of-fit indicators that support its validity and explanatory strength. The Pseudo R^2 value of 0.3329 suggests that approximately 33.3% of the variability in graduates' employment status is explained, which is considered acceptable in social science contexts, given the complexity of the phenomenon (Long, 1997; McFadden, 1974; Mulaik, 2005). Additionally, the likelihood ratio test yielded a highly significant p -value ($1.492e-223$), confirming that the inclusion of predictors significantly improves model fit compared to the null model (Hosmer et al., 2013; Trzęsiok, 2019).

The ROC curve of the logistic regression model (Figure 6) yields an area under the curve (AUC) of 0.86, indicating excellent discriminatory power to predict who is employed and who is not. This value reflects the model's robust performance in differentiating between graduates according to their employment status, supporting the usefulness of the selected variables and the methodological approach applied. In complex social contexts such as the labor market, achieving this level of accuracy reaffirms the relevance of the model as a tool for institutional monitoring and decision-making aimed at improving the professional integration of graduates.

The evaluation metrics (Table 8) show that the predictive model has robust overall performance, correctly classifying 84% of all graduates and achieving a weighted average F1 score of 0.83, reflecting a good balance between precision and sensitivity. Although the model identifies employed graduates with high efficiency (94% recall), its ability to correctly detect those who are unemployed is more limited (51% recall). This difference is explained by the uneven distribution of classes in the sample. Nevertheless, the results support the usefulness of the model as a reliable tool for institutional monitoring of employability.

To complement the traditional logistic regression model, a Lasso regression (Least Absolute Shrinkage and Selection Operator) was applied to assess its predictive performance and variable selection capacity in the analysis of graduate employability. By applying a penalty to the coefficients, Lasso reduces many to zero, which is especially advantageous in models with numerous predictors, as it enhances interpretability and

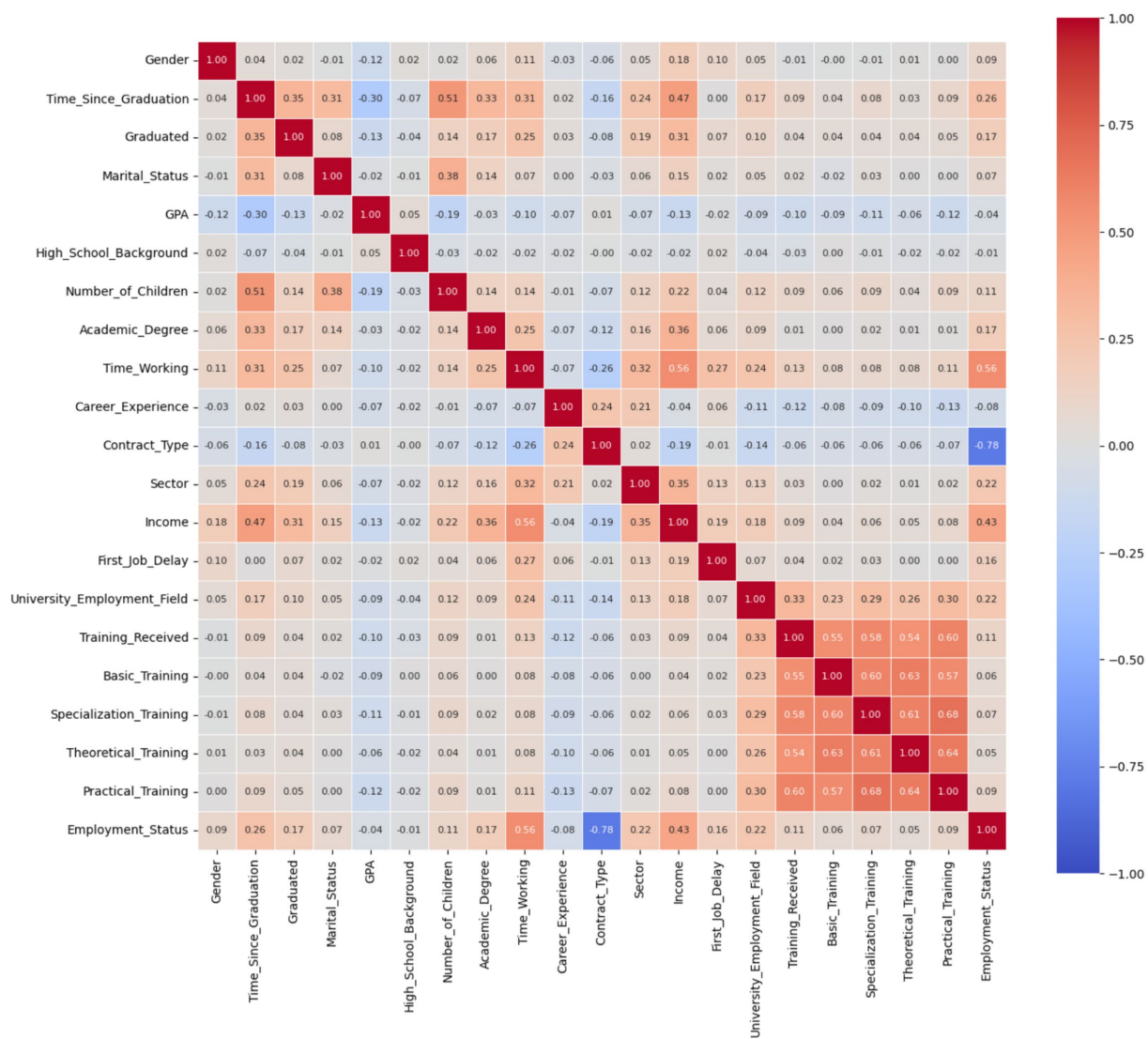


FIGURE 3
Correlation matrix between sociodemographic, academic, and employment variables of graduates.

minimizes overfitting (Tibshirani, 1996). In this study, the same variables from the logistic model were used to contrast a classical explanatory approach with one focused on parsimony and predictive robustness. The results are shown in Table 9.

The Lasso model reinforces the message that only a small set of variables is truly relevant for predicting employability. Of the 20 initial variables, only two, the type of contract and the time worked since graduation, have coefficients other than zero. This means that these two factors have a substantial weight in the prediction, while the rest of the variables, including grade point average, university education, gender, or educational level, do not contribute relevant information to the model. This parsimony of the model not only improves its generalizability but also guides institutional interventions toward what matters.

The ranking generated from the Lasso model (Table 10) places the type of contract as the most decisive factor for employment, followed by time worked, professional experience, and income level. It is striking that variables traditionally considered relevant in the academic environment, such as specialized training, grade point

average, or even academic degree, are at the bottom of the list with coefficients close to zero. This confirms a sustained trend throughout the study: the employability of graduates depends more on their actual exposure to the labor market and the formality of their employment than on their academic achievements or personal circumstances. For this model, the penalization hyperparameter α was tuned using cross-validation, yielding an optimal value of 0.00139. With this adjustment, a mean squared error (MSE) of 0.0371 was achieved, substantially improving over the initial model (MSE = 0.0629). This result confirms that the chosen level of penalization provides an appropriate balance between bias and variance, enabling the selection of only truly predictive variables and reducing the risk of overfitting.

5 Discussion

From the logistic regression model, it was evident that the time spent working after graduation is the factor with the greatest positive

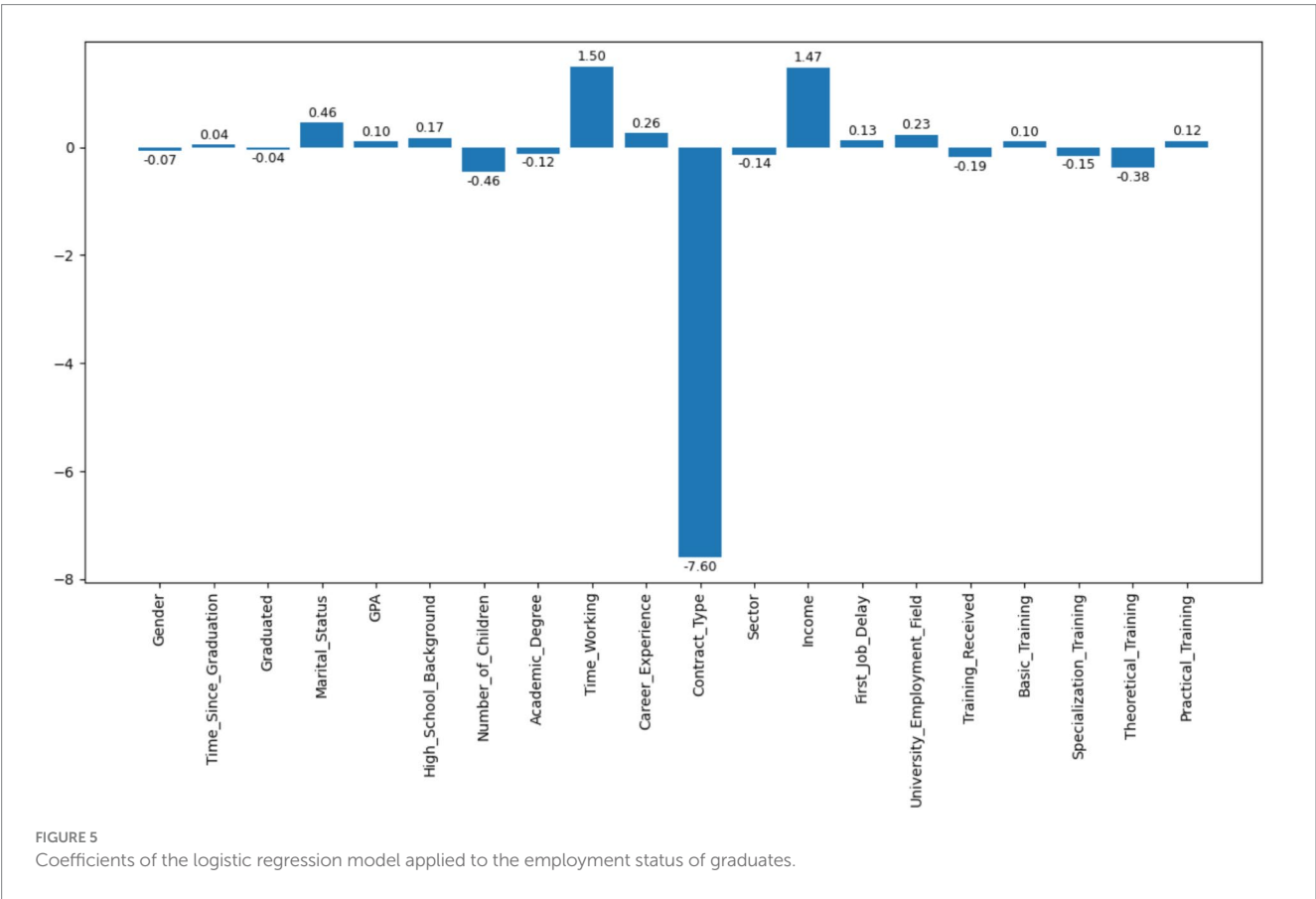
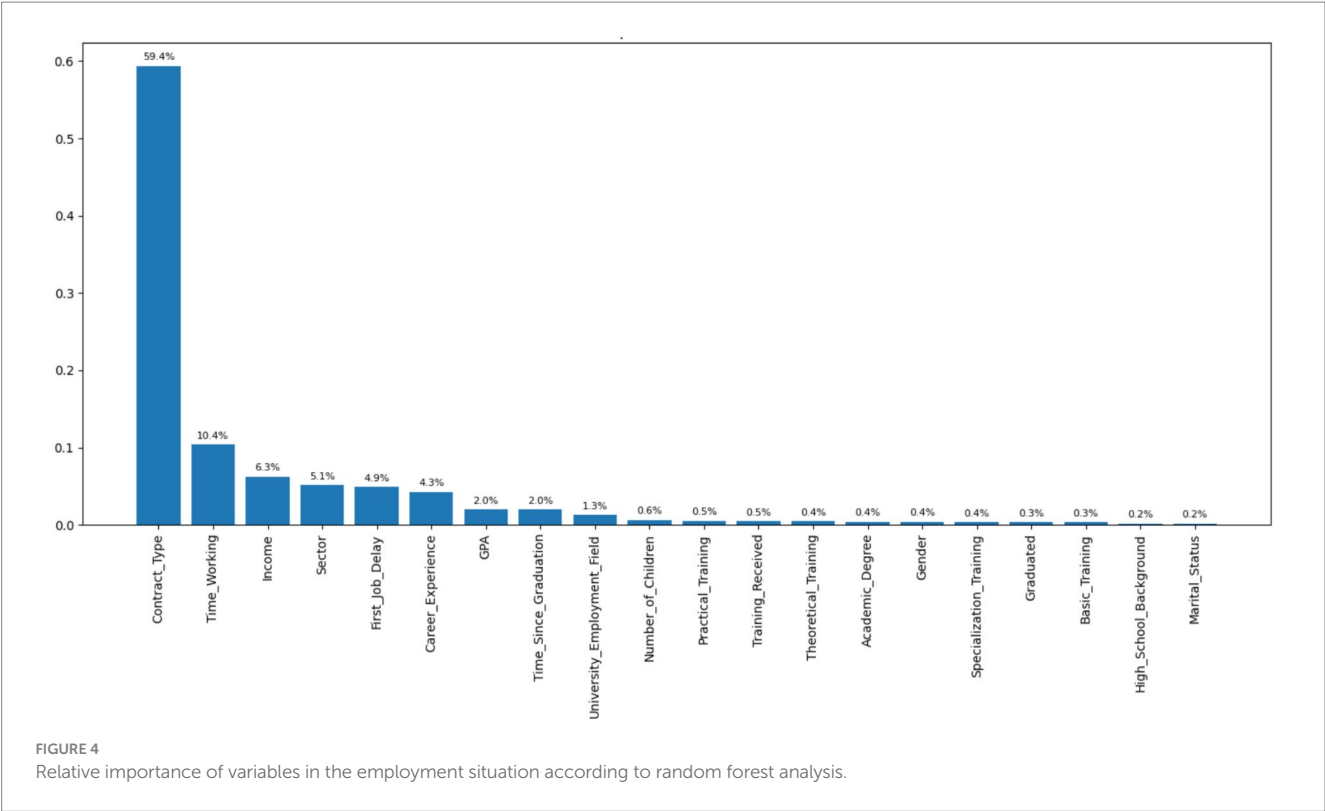


TABLE 7 Logistic regression estimates by levels of the categorical variables.

Variables							
Dep. variable: employment status			No. observations:			2,873	
Model:	Logit		Df Residuals:			2,849	
Method:	MLE		Df Model:			23	
			Pseudo R-squ.:			0.2470	
			Log-Likelihood:			−1079.8	
			LL-Null:			−1434.0	
			LLR <i>p</i> -value:			7.002e-135	
	Coef.	Std. Err.	Z	<i>p</i> > z		[0.025]	[0.975]
Intercept	−4.5319	1.781	−2.544	0.011		−8.023	−1.041
University Employment Field							
Little	0.0054	0.168	0.032	0.974		−0.324	0.334
Partly	0.3326	0.146	2.272	0.023	*	0.046	0.620
Much	0.7133	0.173	4.120	0.000	**	0.374	1.053
Sector							
Private organization	0.0148	0.125	0.119	0.906		−0.230	0.259
Public body	−0.3856	0.222	−1.739	0.082		−0.820	0.049
Self-employment (incl. NGO)	−0.4029	0.530	−0.760	0.447		−1.441	0.636
Graduated							
Yes, Bachelor's degree	−0.3045	0.183	−1.664	0.096		−0.663	0.054
Marital Status							
Married	0.5643	0.870	0.649	0.517		−1.141	2.269
Single	0.4583	0.860	0.533	0.594		−1.227	2.144
Widow(er)	1.6260	1.559	1.043	0.297		−1.430	4.682
Gender							
Male	0.0796	0.114	0.699	0.485		−0.144	0.303
Academic Degree							
Doctorate	0.1361	0.769	0.177	0.860		−1.371	1.643
Master's degree	0.0260	0.160	0.163	0.871		−0.287	0.339
High school background							
National college	−0.9673	1.253	−0.772	0.440		−3.424	1.489
Private school	−0.9512	1.264	−0.752	0.452		−3.429	1.52
Time working	0.9544	0.068	14.077	0.000	**	0.822	1.087
Income	0.4930	0.079	6.210	0.000	**	0.337	0.649
Career experience	−0.2148	0.057	−3.754	0.000	**	−0.327	−0.103
Time since graduation	0.0565	0.018	3.144	0.002	**	0.021	0.092
GPA	0.1360	0.051	2.656	0.008	**	0.036	0.236
Theoretical training	−0.0559	0.107	−0.522	0.602		−0.266	0.154
Number of children	−0.0380	0.079	−0.480	0.631		−0.193	0.117
First job delay	0.0128	0.035	0.369	0.712		−0.055	0.081

To ensure model convergence and obtain stable estimates, the categories Self-employment and NGO were combined into a single level (Self-employment (incl. NGO)). This allowed the logistic model to converge properly and makes it possible to display the detailed effect of each level of the categorical variables relative to their reference category.

weight, which indicates that maintaining a constant career path significantly increases the probability of being employed. This finding aligns with studies such as those of [Jackson and Wilton \(2017\)](#) and [Clarke \(2018\)](#), who argue that employment status is increasingly a

function of accumulated professional experience and less formal academic qualifications. The second strongest predictor was income level, reinforcing the idea that economic stability is closely linked to sustainable employment. The perception of institutional impact was

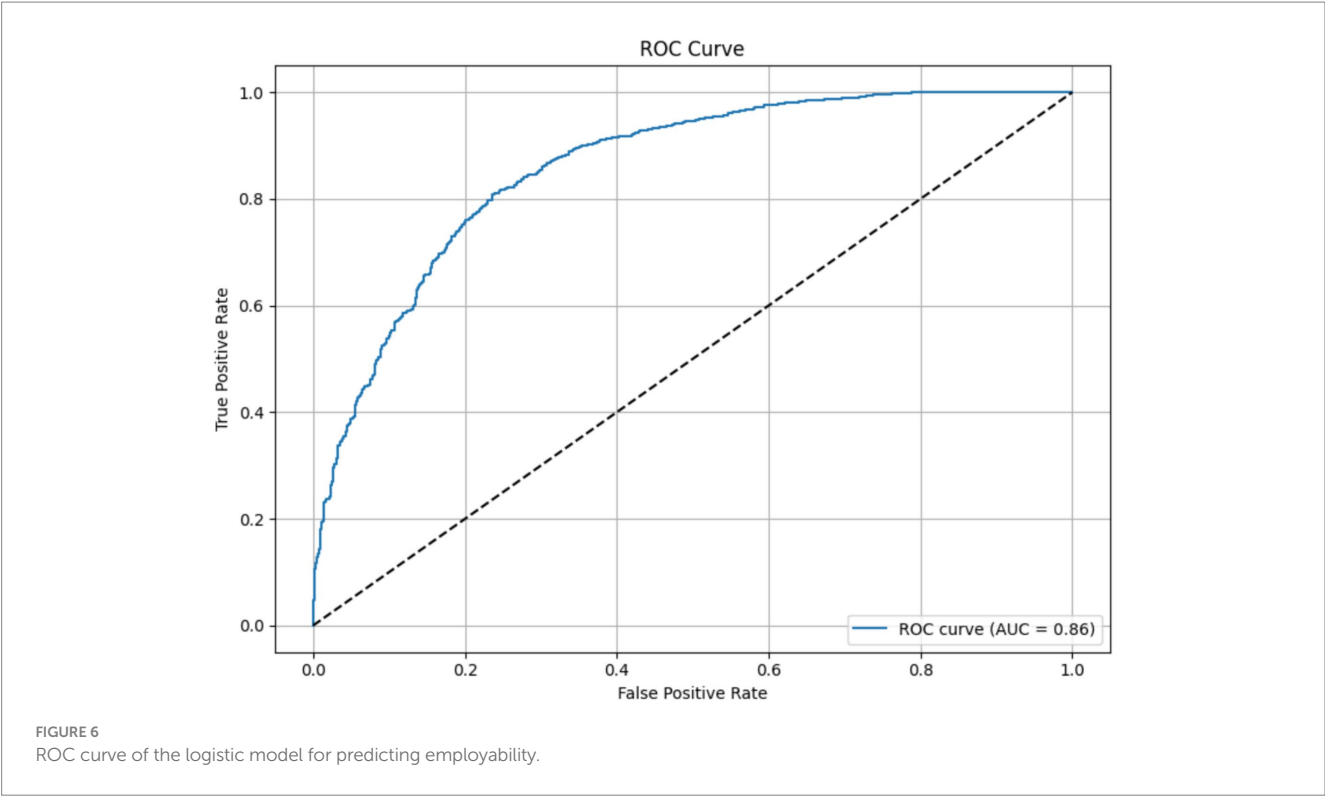


TABLE 8 Metrics for evaluating the predictive performance of the logistic model.

Variables	Precision	Recall	F1 score	Support
Not employed	0.74	0.51	0.60	708
Employed	0.86	0.94	0.90	2,301
Accuracy			0.84	3,009
Avg macro	0.80	0.73	0.75	3,009
Weighted avg	0.83	0.84	0.83	3,009

also significant, suggesting that the prestige or symbolic capital of the university influences job placement, a relationship also reported by Holmes (2013).

The Lasso model, for its part, stood out for its ability to automatically select variables, eliminating those with no predictive value. Of the 20 variables analyzed, only two retained non-zero coefficients: contract type (−0.38) and time spent working (0.12). The automatic elimination of variables such as academic average, degree achieved, or perception of practical training confirms what was pointed out by Akkermans et al. (2024a) in dynamic labor markets, the actual quality of work matters more than academic achievement. This result is consistent with Lasso’s parsimony logic, which prioritizes simple but predictive models (Hastie et al., 2009; Tibshirani, 1996).

The prominence of work experience, income, and employment sector among key predictors reinforces that real-world exposure and contractual conditions outweigh academic credentials in determining employability. This aligns with Jackson and Bridgstock (2021), who emphasize the growing relevance of practical experience and social capital developed beyond academia. In contrast, variables like GPA,

academic background, and degree level show minimal or no predictive value, underscoring their limited role in explaining employment outcomes. These findings support the view that employability depends less on classroom learning and more on how that knowledge is applied in professional contexts (Succi and Canovi, 2020). Accordingly, consistent employment history and access to formal work emerge as more reliable indicators of professional integration than academic achievements (Jackson and Wilton, 2017; Succi and Canovi, 2020).

The Random Forest algorithm, for its part, quantitatively confirmed the hierarchy of relative importance: the type of contract explained 59.4% of the variance in employability, followed by time spent at work (10.4%), income (6.3%), employment sector (5.1%), and time to get the first job (4.9%). This technical precision allows us to affirm that 86% of the model’s correct predictions are explained by just five variables, all related to real-life employment conditions and trajectories. As they warn Breiman (2001) and Kuhn and Johnson (2013), the strength of the Random Forest approach lies in its ability to capture non-linear interactions and complex effects between variables, which reinforces the validity of these results.

These findings indicate that, in contexts like Peru, graduate employment status is driven more by structural conditions and post-graduation experiences, such as job formality, work continuity, and income stability, than by academic credentials. As Forrier et al. (2018) suggest, employability is a dynamic resource shaped by individual and contextual factors. The minimal influence of academic variables (coefficients < 0.01) across all models reveals a concerning gap between university training and labor market demands, echoing Holmes (2013) critique of outdated educational approaches. In response, scholars such as Akkermans et al. (2024b, 2024c), Donald et al. (2024), Healy (2023) advocate for a multi-level rethinking of employability that integrates experiential learning and stronger ties with the

TABLE 9 Coefficients of the Lasso regression model on graduate employability.

Gender	0.000000
Time since graduation	0.006866
Graduated	0.000000
Marital status	0.000000
GPA	−0.000000
High school background	−0.000000
Number of children	0.000000
Academic degree	0.000000
Time working	0.083653
Career experience	0.000000
Contract type	−0.225578
Sector	0.000000
Income	0.000000
First job delay	0.000000
University employment field	0.000000
Training received	0.000000
Basic training	0.000000
Specialization training	0.000000
Theoretical training	0.000000
Practical training	0.000000
dtype: float64	
MSE: 0.06297690580872446	

productive sector. While studies in developed contexts link education level to self-employment (Burkov and Murzina, 2015), the evidence here underscores that, under structural informality, labor outcomes hinge more on employment conditions than academic achievements.

The weak or null weight of variables traditionally valued by educational institutions is striking, such as the academic average (Lasso coefficient ≈ 0 ; Random Forest significance $< 1\%$), or theoretical and practical training, which in all models presented negligible coefficients. This coincides with the findings of Succi and Canovi (2020), who demonstrated that employers value practical and transferable skills acquired outside the classroom much more than academic performance per se. Indeed, discontinuous career paths, lack of formalization, and weak connection to the productive environment emerge as the main barriers to effective integration.

An additional aspect to consider is that, although the models confirm the low weight of academic variables, the university degree can gain greater relevance when it is linked to professional internships, placements, and experiential learning opportunities. These mechanisms allow the knowledge acquired in the classroom to be translated into applied skills in workplace contexts, strengthening graduates' capacity to respond to market demands. As noted by Jackson and Bridgstock (2021) and Mtawa et al. (2021), the academic credential is reinforced when it integrates supervised work experiences that consolidate more stable and transferable career paths.

International literature has consistently shown that dual education systems and practical learning models, such as Work

TABLE 10 Ranking of the importance of variables in the Lasso model.

N°	Variable	Coefficient
10	Contract type	−0.380672
8	Time working	0.116069
9	Career experience	0.04297
12	Income	0.042204
11	Sector	0.041337
7	Academic degree	−0.017195
14	University employment field	0.012103
18	Theoretical training	−0.010022
15	Training received	0.009761
6	Number of children	−0.008995
13	First job delay	0.008928
3	Marital status	0.00769
16	Basic training	−0.003091
4	GPA	0.002684
0	Gender	−0.001484
1	Time since graduation	−0.000631

Best alpha (penalization strength): 0.00139; Mean Squared Error (MSE): 0.0371.

Integrated Learning (WIL), can enhance graduates' employability by combining academic training with formal work experience (Amelina and Tarasenko, 2024; Kravchenko, 2020; Kucher, 2023; Olha et al., 2024). Graduates of dual programs demonstrate higher employment rates and shorter job search periods because employers value the practical experience acquired during training (Opushko et al., 2023; Oswald-Egg and Renold, 2021), which fosters the development of professional, methodological, personal, and social skills essential for employability (Helyer and Lee, 2014; Jackson and Tomlinson, 2022). Although the present study does not directly measure participation in WIL or its impact, these findings support the importance of structured cooperation between educational institutions and companies to align programs with real market needs and ensure the relevance of certified competencies (Iryna and Viktoriia, 2021; Yaroshenko, 2023). In the Peruvian context, and particularly in Amazonas, the limited formalization of internships and placements constrains the extent to which the degree fulfills its role as an employability credential; therefore, expanding mechanisms of labor market insertion and practical training is suggested as a key strategy to reduce the gap between university education and labor market demands.

The findings reveal that, although 76.47% of graduates are currently employed, a high 82.09% lack a formal contract, which demonstrates a labor insertion characterized by informality and precarious conditions. Following Clarke (2018), this situation reflects that employment alone is not a sufficient indicator of professional success, but rather the quality of employment, its stability, and its alignment with the skills developed during academic training must be considered. Tomlinson and Holmes (2017) this gap between training and the market is one of the main challenges facing higher education today.

In the Peruvian context, where around 72% of the employed population works under informal conditions and is not protected

by occupational health and safety regulations nor contributes to EsSalud, according to data from the Ministry of Labour and Employment Promotion (Canchari, 2025), and where recent national reports show that informality remains above 73% (Observatorio CEPLAN, 2024). National research such as Torres (2019) demonstrates that structural factors, such as region of residence, type of institution attended and access to networks, significantly influence the time graduates take to secure their first job and the conditions of that initial employment. Within this framework, the UNTRM, as the main public university in the region, plays a strategic role by linking academic training with professional placements and state programmes to improve the quality of its graduates' employment and adapt the global concept of "employability" to a context characterised by high informality and uneven regional development.

Studies have shown that advanced predictive models can predict graduate employability with remarkable accuracy, while also demonstrating that labor market factors outweigh traditional academic achievement. Zheng and Chen (2024), for example, achieved an accuracy of over 90% by combining chaotic analysis and support vector machines, and highlighted that sectoral and temporal dynamics have a greater influence than academic averages. Along the same lines, Somers (2023) emphasizes that applied digital skills, such as cybersecurity, data analysis, and e-commerce, significantly increase formal hiring rates. Programs such as "Penang Young Digital Talent" (Kee et al., 2023) confirm this trend, showing that skills such as digital literacy and collaborative communication are directly related to the perception of employability. Likewise, Zhang et al. (2025) identified a high demand for technical skills such as Python programming, R, and statistics in the highest-paying jobs in the scientific sector. These findings reinforce the urgent need to update university training programs, integrating emerging technologies and strengthening relationships with the productive sector to improve the job placement of graduates.

A notable result is that 48.22% of graduates obtained their first job within 6 months of graduating, and 25.66% were already working during their training. This reinforces the evidence from previous studies, such as those by Mtawa et al. (2021) and Adegbite and Adeosun (2021), which emphasizes the importance of work-integrated learning to strengthen career paths. These practical experiences, whether internships, volunteering, or part-time jobs, not only enhance technical skills but also develop essential soft skills such as adaptability, communication, and leadership (Adegbite and Hoole, 2024; Jackson and Bridgstock, 2021). Similarly, Blázquez et al. (2024) found that 73.7% of graduates who had ever held a paid job found their first job within the first year after graduation.

Although 82.09% of graduates lack a formal contract, this figure must be contextualized within Amazonas, where self-employment often compensates for the scarcity of formal jobs. Despite only 6.31% identifying as self-employed, many informal activities likely go unreported. This reflects both structural challenges and opportunities for higher education institutions. UNTRM has fostered entrepreneurship through training, incubation, and outreach, potentially nurturing an entrepreneurial mindset among its graduates. As noted by

Guerrero and Urbano (2012) and Nabi et al. (2017), regional universities can drive local entrepreneurial ecosystems. Anubhav et al. (2024) further emphasize that university-led entrepreneurship may serve as a territorial development strategy. However, as Clarke (2018), Alt et al. (2023), Morante et al. (2024), and Pantaleón et al. (2023) and others caution, entrepreneurship alone is insufficient without institutional support ensuring decent work conditions and social protection. For it to become a viable path to employment, Rae (2007) and Sánchez (2013) stress the need for early integration into curricula, accompanied by strategic guidance and policies promoting formalization.

In this regard, the results of this study provide relevant empirical evidence to understand the limited weight of academic credentials in the labor market. Although university and technical degrees have traditionally been regarded as the main gateway to employment, our findings reveal that formal academic achievements carry less importance than practical experience and structural labor market conditions. This observation aligns with the global debate on the value of postsecondary education, where scholars and policymakers increasingly question whether traditional credentials are sufficient to ensure sustainable employability. Consistent with recent studies (Akkermans et al., 2024a; Alt et al., 2023), our results underscore the need to promote more flexible training models that integrate early work experience, the development of digital competencies, and short-cycle certifications, thereby enhancing the real value and relevance of postsecondary education.

Despite the progress, a structural weakness in practical training persists, evidenced by the 22.1% of graduates who consider it insufficient. This limitation, as noted by Succi and Canovi (2020), reduces young people's ability to respond effectively to the demands of the work environment. In addition, Alt et al. (2023) point out that training focused on life and career skills not only improves employability but also psychological well-being. In line with Akkermans et al. (2024b) and Akkermans et al. (2024a) the results of this study reinforce the need to strengthen the link between universities and the world of work, integrating real-life work experiences into training. This requires rethinking curricula, consolidating partnerships with employers, and strengthening the practical component of each program to ensure sustainable and relevant employability.

6 Conclusion

This study demonstrates that the employment status of university graduates is not primarily determined by academic performance or sociodemographic characteristics, but by factors directly linked to actual work experience and structural labor market conditions. The statistical models applied, logistic regression, Lasso regression, and Random Forest, concur in indicating that contract type, time spent working, and income level are the most consistent and significant predictors of employment status. Specifically, contract type explained more than 59% of the variance in the Random Forest model, while in the Lasso model, only two variables retained predictive weight, time worked, and employment contract.

Likewise, it is confirmed that positive perceptions of institutional influence also play a significant role in job placement, especially in regional contexts such as Amazonas, where the local prestige of the university can facilitate access to job networks. In contrast, variables such as theoretical and practical training, specialty training, and academic average showed low predictive capacity, highlighting a worrying disconnect between current curriculum design and labor market demands.

The results also reflect a high rate of employment without a formal contract (82.09%), which suggests precarious employment, but which may also be linked to forms of self-employment and entrepreneurship, favored by the university in a region with low productive diversification. This finding highlights the need for policies to promote entrepreneurship, but also to support them toward formal employment. Although many graduates can quickly enter the labor market, access to formal employment remains limited. Furthermore, students' critical perception of practical training suggests the need to strengthen this component as a key tool for an effective transition to employment.

The study provides robust empirical evidence for redesigning institutional employability strategies, aimed not only at guaranteeing access to employment but also at improving their quality, stability, and professional relevance. Specifically, it suggests incorporating mandatory professional internships linked to the productive sector, establishing job placement centers that provide personalized support, and promoting experiential learning through applied projects. It is also key to promote entrepreneurship incubators with a regional focus, geared toward formal and sustainable self-employment, and strengthening training in highly in-demand digital competencies and transversal skills. From an educational perspective, it is important to implement a graduate tracking system that allows for continuous monitoring of the impact of higher education on career paths. These actions, coordinated between universities, the state, and the productive sector, are essential for moving toward more inclusive and sustainable employability that is in line with the dynamics of the current socioeconomic environment.

However, the study has limitations. The analysis is based on data from a single university. It is conducted using a cross-sectional approach, which limits the possibility of generalizing the findings or analyzing the evolution of career trajectories over time. Therefore, future research should expand its scope to include inter-institutional samples, incorporate longitudinal methodologies, and consider the employers' perspective. This broader approach will allow for a deeper identification of the skills truly valued in the labor market and strengthen the connection between higher education and employment, especially in regional contexts such as the Peruvian Amazon, where universities play a key role in their graduates' professional and economic development.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Ethics statement

Ethical approval was not required for the studies involving humans, as all participants gave their written consent to participate in the study on a voluntary basis. The studies were conducted in accordance with the local legislation and

institutional requirements. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

HP: Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft. JC: Conceptualization, Funding acquisition, Investigation, Methodology, Resources, Validation, Writing – original draft. OC: Conceptualization, Investigation, Methodology, Software, Validation, Writing – original draft, Writing – review & editing. YR: Conceptualization, Investigation, Supervision, Visualization, Writing – original draft. JM: Investigation, Methodology, Software, Writing – original draft. ES: Conceptualization, Investigation, Validation, Visualization, Writing – original draft. RC: Investigation, Resources, Validation, Visualization, Writing – original draft.

Funding

The author(s) declare that financial support was received for the research and/or publication of this article. Support was provided by National University Toribio Rodriguez of Mendoza of Amazonas.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

Any alternative text (alt text) provided alongside figures in this article has been generated by Frontiers with the support of artificial intelligence and reasonable efforts have been made to ensure accuracy, including review by the authors wherever possible. If you identify any issues, please contact us.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2025.1664249/full#supplementary-material>

References

- Adegbite, W. M. (2024). Unpacking mediation and moderating effect of digital literacy and life-career knowledge in the relationship between work-integrated learning and graduate employability. *Social Sci. Hum. Open* 10:101161. doi: 10.1016/j.ssaho.2024.101161
- Adegbite, W. M., and Adeosun, O. T. (2021). Fourth industrial revolution skillsets and employability readiness for future job. *Global J. Soc. Sci. Stu.* 7, 35–49. doi: 10.20448/807.7.1.35.49
- Adegbite, W. M., and Hoole, C. (2024). The nexus of work integrated learning and skills among engineering students in Nigerian universities: a structural equation model approach. *J. Teach. Learn. Grad. Employ.* 15, 91–107. doi: 10.21153/jtlge2024vol15no1art1824
- Affum-Osei, E., Asante, E. A., Forkouh, S. K., Aboagye, M. O., and Antwi, C. O. (2019). Unemployment trends and labour market entry in Ghana: job search methods perspective. *Labor Hist.* 60, 716–733. doi: 10.1080/0023656X.2019.1640356
- Afolabi, S. O. (2014). Quality of accounting graduates: a survey of employers in Nigeria. *IOSR J. Bus. Manag.* 16, 29–42. doi: 10.9790/487X-161122942
- Agresti, A. (2007). Building and applying logistic regression models. Ed. John Wiley & Sons. Hoboken, NJ. New York, NY: Wiley, 137–172.
- Agwu, E. (2019). Government assisted programs and unemployment reduction in developing economies: a study of Nigeria and Ghana. *Int. J. Manag. Econ. Soc. Sci.* 8:18. doi: 10.32327/IJMESS/8.4.2019.18
- Akhtar, P., Moazzam, M., Ashraf, A., and Khan, M. N. (2024). The interdisciplinary curriculum alignment to enhance graduates' employability and universities' sustainability. *Int. J. Manag. Educ.* 22:101037. doi: 10.1016/j.ijme.2024.101037
- Akkermans, J., Donald, W. E., Jackson, D., and Forrier, A. (2024a). Are we talking about the same thing? The case for stronger connections between graduate and worker employability research. *Career Dev. Int.* 29, 80–92. doi: 10.1108/CDI-08-2023-0278
- Akkermans, J., and Kubasch, S. (2017). Trending topics in careers: a review and future research agenda. *Career Dev. Int.* 22, 586–627. doi: 10.1108/CDI-08-2017-0143
- Akkermans, J., Le Blanc, P., Van der Heijden, B., and De Vos, A. (2024b). Toward a contextualized perspective of employability development. *Eur. J. Work Organ. Psychol.* 33, 1–10. doi: 10.1080/1359432X.2023.2291763
- Akkermans, J., Tomlinson, M., and Anderson, V. (2024c). Initial employability development: introducing a conceptual model integrating signalling and social exchange mechanisms. *Eur. J. Work Organ. Psy.* 33, 54–66. doi: 10.1080/1359432X.2023.2186783
- Almejas, B. C., Marasigan, J. C., Morante, T. A., Lim, E. J. A., and Catuday, R. A. (2017). Teacher Education Graduates: A Tracer Study. *Int. Conf. Law Bus. Educ. Corporate Soc. Responsibility* 22, 69–74. doi: 10.17758/URUAE.UH09171010
- Alt, D., Naamati-Schneider, L., and Weishut, D. J. N. (2023). Competency-based learning and formative assessment feedback as precursors of college students' soft skills acquisition. *Stud. High. Educ.* 48, 1901–1917. doi: 10.1080/03075079.2023.2217203
- Amelina, S., and Tarasenko, R. (2024). Dual form of education: the experience of german higher education institutions. *Hum. Stu.: Pedagogics Psychol. Philos.* 15, 8–14. doi: 10.31548/hspedagogi15(2).2024.8-14
- Ampong, E. (2020). Graduate unemployment in Ghana: challenges and workable strategies. *Int. J. Res. Publications* 57:1344. doi: 10.47119/IJRP100571720201344
- Anubhav, K., Dwivedi, A. K., and Aashish, K. (2024). Entrepreneurship education in higher education (2002–2022): a technology-empowered systematic literature review. *Int. J. Manag. Educ.* 22:100993. doi: 10.1016/j.ijme.2024.100993
- Aquino, A. (2015). Teacher education graduate tracer study from 2010 to 2014 in one State University in Batangas, Philippines. *Asia Pac. J. Multidiscip. Res.* 3, 45–50.
- Aquino, M. (2025). Desempleo baja en América Latina en 2024, pero brecha de desigualdad crece, dice OIT. Available online at: <https://www.reuters.com/world/americas/unemployment-dips-latin-america-2024-inequality-gap-grows-ilo-says-2025-02-12/> (accessed December 2, 2025).
- Arnold, S. (2023). Skills narratives amongst media degree graduates and students: discourses of hard and soft skills in education-to-work journeys. *Ind. High. Educ.* 37, 485–495. doi: 10.1177/0950422221138742
- Awayiga, J. Y., Onumah, J. M., and Tsamenyi, M. (2010). Knowledge and skills development of accounting graduates: the perceptions of graduates and employers in Ghana. *Acc. Educ.* 19, 139–158. doi: 10.1080/09639280902903523
- Baah-Boateng, W. (2015). Unemployment in Ghana: a cross sectional analysis from demand and supply perspectives. *Afr. J. Econ. Manag. Stud.* 6, 402–415. doi: 10.1108/AJEMS-11-2014-0089
- Bawakyillenuo, S., Akoto, I. O., Ahiadeke, C., Bortei-Doku, E., and Kweku, E. (2013). Tertiary education and industrial development in Ghana. Available online at: <https://www.theigc.org/sites/default/files/2015/02/Bawakyillenuo-Et-Al-2013-Working-Paper.pdf> (accessed February 12, 2025).
- Bewick, V., Cheek, L., and Ball, J. (2005). Statistics review 14: logistic regression. *Crit. Care* 9, 112–118. doi: 10.1186/cc3045
- Blázquez, M., Pérez, M. A., and Sánchez-Mangas, R. (2024). Overeducation under different macroeconomic conditions: how Spanish university graduates fit in the labor market? *J. Policy Model* 47:448–470. doi: 10.1016/j.jpolmod.2024.10.001
- Blokker, R., Akkermans, J., Marciniak, J., Jansen, P. G. W., and Khapova, S. N. (2023). Organizing school-to-work transition research from a sustainable career perspective: a review and research agenda. *Work Aging Retire.* 9, 239–261. doi: 10.1093/workar/waad012
- Boateng, E. Y., and Abaye, D. A. (2019). A review of the logistic regression model with emphasis on medical research. *J. Data Anal. Inf. Process.* 7, 190–207. doi: 10.4236/jdaip.2019.74012
- Bobadilla, J., González, C., Bobadilla, A., Medina, A., and Sánchez, E. J. (2024). Situación laboral de los egresados de las universidades sudamericanas: Una revisión sistemática. *Comuni@cción: Revista de Investigación En Comunicación y Desarrollo* 15, 79–91. doi: 10.33595/2226-1478.15.1.934
- Breiman, L. (2001). Random forests. *Mach. Learn.* 45, 5–32. doi: 10.1023/A:1010933404324
- Burkov, A., and Murzina, E. A. (2015). Using the comprehensive confirmatory factor analysis method of structural equation modeling in the process of graduates employment. *Mediterr. J. Soc. Sci.* 22:668. doi: 10.5901/mjss.2015.v6n6s2p668
- Byington, E. K., Felps, W., and Baruch, Y. (2019). Mapping the journal of vocational behavior: a 23-year review. *J. Vocat. Behav.* 110, 229–244. doi: 10.1016/j.jvb.2018.07.007
- Carrasco, A. M., Sánchez, E., Reina, Y., Cruz, O., Chávez, R., and Maicelo, Y. d. C. (2024). Comprehensive wellness in university life: an analysis of student services and their impact on quality of life. *J. Educ. Soc. Res.* 14:514. doi: 10.36941/jesr-2024-0190
- Catalunya, A. Q. U. (2015). Universities and employment in Catalonia 2014. Survey of the employment outcomes of the graduate population from Catalan universities. Sant Cugat del Vallès. Barcelona: Agència per a la Qualitat del Sistema Universitari de Catalunya.
- Chotón, M. R., Auquiñivín, E. A., Zuta, V., and Cruzalegui, R. J. (2022). Situación laboral de los egresados en las universidades públicas en Perú. *Rev. Venez. Gerenc.* 27, 995–1008. doi: 10.52080/rvgluz.27.8.17
- Clarke, M. (2018). Rethinking graduate employability: the role of capital, individual attributes and context. *Stud. High. Educ.* 43, 1923–1937. doi: 10.1080/03075079.2017.1294152
- Cory, S. N., and Pruske, K. A. (2012). A factor analysis of the skills necessary in accounting graduates. *J. Bus. Accounting* 5, 121–128.
- Crawford, A., Weber, M. R., and Lee, J. (2020). Using a grounded theory approach to understand the process of teaching soft skills on the job so to apply it in the hospitality classroom. *J. Hosp. Leis. Sport Tour. Educ.* 26:100239. doi: 10.1016/j.jhlste.2020.100239
- Cronin, L., Allen, J., Ellison, P., Marchant, D., Levy, A., and Harwood, C. (2021). Development and initial validation of the life skills ability scale for higher education students. *Stud. High. Educ.* 46, 1011–1024. doi: 10.1080/03075079.2019.1672641
- Cruz, L. T., and Alcantara, N. V. (2015). Tracer study of RTU graduates: an analysis. *Res. World* 5, 66–76.
- Canchari, D. (2025). Perú: 7 de cada 10 trabajadores son informales, ¿cómo opera el mercado más grande del país?. Available at: <https://larepublica.pe/economia/2025/04/28/peru-7-de-cada-10-trabajadores-son-informales-como-opera-el-mercado-mas-grande-del-pais-hnews-1758432>
- Damoah, O. B. O., Peprah, A. A., and Brefo, K. O. (2021). Does higher education equip graduate students with the employability skills employers require? The perceptions of employers in Ghana. *J. Furth. High. Educ.* 45, 1311–1324. doi: 10.1080/0309877X.2020.1860204
- Dewi, N. R., Listiaji, P., Taufiq, M., Savitri, E. N., Yanitama, A., and Herianti, A. P. (2021). Development of a tracer study system for graduates of the integrated science department, Universitas Negeri Semarang. *J. Phys. Conf. Ser.* 1918:042010. doi: 10.1088/1742-6596/1918/4/042010
- Donald, W. E., Baruch, Y., and Ashleigh, M. (2019). The undergraduate self-perception of employability: human capital, careers advice, and career ownership. *Stud. High. Educ.* 44, 599–614. doi: 10.1080/03075079.2017.1387107
- Donald, W. E., Van der Heijden, B. I. J. M., and Baruch, Y. (2024). Introducing a sustainable career ecosystem: theoretical perspectives, conceptualization, and future research agenda. *J. Vocat. Behav.* 151:103989. doi: 10.1016/j.jvb.2024.103989
- Dzomeku, V. M., Kusi Amponsah, A., Boateng, E. A., Antwi, J., Adoliwine Amooba, P., Deo Gracious, P., et al. (2024). Tracer study to assess the employability of graduates and quality of a nursing program: a descriptive cross-sectional survey. *Int. J. Afr. Nurs. Sci.* 20:100673. doi: 10.1016/j.ijans.2024.100673
- Estadística de Calidad Educativa (2025). Egresados de Universidades Peruanas. Available online at: https://escale.minedu.gob.pe/otras-publicaciones/-/document_library_display/cKN9/view/10193159/69913?_110_INSTANCE_cKN9_redirect=https%3A%2F%2Fescale.minedu.gob.pe%2Fotras-publicaciones%2F%2Fdocument_library_display%2FcKN9%2Fview%2F10193159 (accessed June 23, 2025).
- Fahimrad, M., Kumar Nair, P., Shakib Kotamjani, S., Mahdinezhad, M., and Bao Feng, J. (2019). Integration and development of employability skills into Malaysian

higher education context: review of the literature. *Int. J. Higher Educ.* 8, 26–35. doi: 10.5430/ijhe.v8n6p26

Fawcett, T. (2006). An introduction to ROC analysis. *Pattern Recogn. Lett.* 27, 861–874. doi: 10.1016/j.patrec.2005.10.010

Forrier, A., De Cuyper, N., and Akkermans, J. (2018). The winner takes it all, the loser has to fall: provoking the agency perspective in employability research. *Hum. Resour. Manag. J.* 28, 511–523. doi: 10.1111/1748-8583.12206

Forrier, A., and Sels, L. (2003). The concept employability: a complex mosaic. *Int. J. Hum. Resour. Dev. Manag.* 3:102. doi: 10.1504/IJHRDM.2003.002414

Fugate, M., van der Heijden, B., De Vos, A., Forrier, A., and De Cuyper, N. (2021). Is what's past prologue? A review and agenda for contemporary employability research. *Acad. Manag. Ann.* 15, 266–298. doi: 10.5465/annals.2018.0171

Gawel, A., Giovannetti, M., Li Pomi, G., Stefańska, M., Olejnik, I., Kulaga, B., et al. (2024). Stakeholder-centered development of new curriculum content in higher education: a case study in creating a course on the green and digital transformation of SMEs. *Stud. High. Educ.* 49, 2133–2152. doi: 10.1080/03075079.2023.2293923

Goulart, V. G., Liboni, L. B., and Cezarino, L. O. (2022). Balancing skills in the digital transformation era: the future of jobs and the role of higher education. *Ind. High. Educ.* 36, 118–127. doi: 10.1177/09504222211029796

Guerrero, M., and Urbano, D. (2012). The development of an entrepreneurial university. *J. Technol. Transf.* 37, 43–74. doi: 10.1007/s10961-010-9171-x

Hailikari, T., Katjavuori, N., and Asikainen, H. (2021). Understanding procrastination: a case of a study skills course. *Soc. Psychol. Educ.* 24, 589–606. doi: 10.1007/s11218-021-09621-2

Hastie, T., Tibshirani, R., and Friedman, J. (2009). The elements of statistical learning. New York, NY: Springer.

Healy, M. (2023). Careers and employability learning: pedagogical principles for higher education. *Stud. High. Educ.* 48, 1303–1314. doi: 10.1080/03075079.2023.2196997

Healy, M., Hammer, S., and McIlveen, P. (2022). Mapping graduate employability and career development in higher education research: a citation network analysis. *Stud. High. Educ.* 47, 799–811. doi: 10.1080/03075079.2020.1804851

Helyer, R., and Lee, D. (2014). The role of work experience in the future employability of higher education graduates. *High. Educ. Q.* 68, 348–372. doi: 10.1111/hequ.12055

Hilario-Flores, N. E., Pucuhuaranga-Espinoza, T. N., Huamán-Huayta, L. A., Lazo-Piñas, M., and Maldonado-Córdova, K. M. (2022). Evaluación del perfil de egreso en el grado de educación según egresados y empleadores en una universidad peruana. *Cultura Educación Sociedad* 14, 29–50. doi: 10.17981/culteduc.14.1.2023.02

Holmes, L. (2013). Competing perspectives on graduate employability: possession, position or process? *Stud. High. Educ.* 38, 538–554. doi: 10.1080/03075079.2011.587140

Hosmer, D. W., Jovanovic, B., and Lemeshow, S. (1989). Best subsets logistic regression. *Biometrics* 45:1265. doi: 10.2307/2531779

Hosmer, D. W., and Lemeshow, S. (2000). Applied logistic regression. New York, NY: Wiley.

Hosmer, D. W., Lemeshow, S., and Sturdivant, R. X. (1998). The multiple logistic regression model. *Applied Logistic Regression*. 1, 25–37.

Hosmer, D. W., Lemeshow, S., and Sturdivant, R. X. (2013). Applied logistic regression. New York, NY: Wiley.

Iryna, M., and Viktoriia, K. (2021). Dual education in partnership modernization with employers. *Herald Kyiv Nat. Univ. Trade Econ.* 139, 139–154. doi: 10.31617/visnik.knute.2021(139)10

Ismail, Z., Ahmad, A. S., and Ahmi, A. (2020). Perceived employability skills of accounting graduates: the insights from employers. *Elem. Educ. Online* 19, 36–41. doi: 10.17051/ilkonline.2020.04.104

Jackson, D., and Bridgstock, R. (2021). What actually works to enhance graduate employability? The relative value of curricular, co-curricular, and extra-curricular learning and paid work. *High. Educ.* 81, 723–739. doi: 10.1007/s10734-020-00570-x

Jackson, D., and Tomlinson, M. (2022). The relative importance of work experience, extra-curricular and university-based activities on student employability. *Higher Educ. Res. Dev.* 41, 1119–1135. doi: 10.1080/07294360.2021.1901663

Jackson, D., and Wilton, N. (2017). Perceived employability among undergraduates and the importance of career self-management, work experience and individual characteristics. *High. Educ. Res. Dev.* 36, 747–762. doi: 10.1080/07294360.2016.1229270

Jiang, J. p., and Eliza, B. A. (2024). Employment trends and challenges for economics and management graduates: insights from 2018–2023. *World J. Adv. Res. Rev.* 24, 1384–1396. doi: 10.30574/wjarr.2024.24.3.3829

Jorre, T., Boud, D., and Johnson, E. D. (2021). Assessment for distinctiveness: recognising diversity of accomplishments. *Stud. High. Educ.* 46, 1371–1382. doi: 10.1080/03075079.2019.1689385

Kee, D. M., Anwar, A., Gwee, S. L., and Ijaz, M. F. (2023). Impact of acquisition of digital skills on perceived employability of youth: mediating role of course quality. *Information* 14:42. doi: 10.3390/info14010042

Khan, F., and Ali, M. (2022). Exploring the gap between expected and actual return on investment of business graduates from employability: evidence from a developing country. *Int. J. Manag. Educ.* 20:100717. doi: 10.1016/j.ijme.2022.100717

Khan, N., Sarwar, A., Chen, T. B., and Khan, S. (2022). Connecting digital literacy in higher education to the 21st century workforce. *Knowl. Manag. E-Learn.* 14, 46–61. doi: 10.34105/j.kmel.2022.14.004

Kimeu, C. (2024). La economía verde podría generar 3,3 millones de empleos en África para 2030, según un informe. Available online at: <https://www.theguardian.com/global-development/article/2024/jul/26/green-economy-could-generate-33m-jobs-across-africa-by-2030-report> (Accessed June 24, 2025).

King, G., and Zeng, L. (2001). Logistic regression in rare events data. *Polit. Anal.* 9, 137–163. doi: 10.1093/oxfordjournals.pan.a004868

Kravchenko, O. (2020). Overview of world experience in regards to the dual form of education. *Young. Scientist* 10:28. doi: 10.32839/2304-5809/2020-10-86-28

Kucher, O. (2023). International experience in implementation of dual education. *Bulletin Alfred Nobel Univ. Pedagogy Psychol.* 2, 70–82. doi: 10.32342/2522-4115-2023-2-26-8

Kuhn, M., and Johnson, K. (2013). Applied predictive modeling. New York, NY: Springer New York.

Kwarteng, J. T., and Mensah, E. K. (2022). Employability of accounting graduates: analysis of skills sets. *Heliyon* 8:e09937. doi: 10.1016/j.heliyon.2022.e09937

Leon, A. C. (1998). “Descriptive and inferential statistics” in Comprehensive clinical psychology. eds. C. Bradley and M. B. Pierce (Amsterdam: Elsevier), 243–285.

Long, J. S. (1997). Regression models for categorical and limited dependent variables. London: Sage Publications.

Lowden, K., Hall, S., Elliot, D., and Lewin, J. (2012). Employers' perceptions of the employability skills of new graduates. Glasgow: University of Glasgow SCORE Centre & Edge Foundation.

Mabungela, M., and Mtiki, V. (2024). Accelerating graduate employability through work-integrated learning. *Res. Soc. Sci. Technol.* 9, 291–304. doi: 10.46303/ressat.2024.17

Maghamil, C. W. (2025). Graduate education and its influence on employability and career progression: a tracer study of La Salle university graduates. *Asian J. Educ. Soc. Stu.* 51, 70–78. doi: 10.9734/ajess/2025/v51i11727

Maxwell, R., and Armellini, A. (2019). Identity, employability and entrepreneurship: the CHANGE framework of graduate attributes. *High. Educ. Skills Work-Based Learn.* 9, 76–91. doi: 10.1108/HESWBL-02-2018-0016

Maydeu-Olivares, A., Shi, D., Pavlov, G., and Ferraz, R. (2023). “Model-data fit evaluation: item fit and model selection” in International encyclopedia of education (fourth edition). eds. P. Peterson and E. Baker (Amsterdam: Elsevier), 260–272.

McFadden, D. (1974). Conditional logit analysis of qualitative choice behavior. *Front. Eco.* 22, 105–142.

Minería y Energía (2024). Desafíos y oportunidades en la empleabilidad de egresados universitarios en el Perú. La Molina: Minería y Energía.

Mitchell, R. (2013). What is professional development, how does it occur in individuals, and how may it be used by educational leaders and managers for the purpose of school improvement? *Prof. Dev. Educ.* 39, 387–400. doi: 10.1080/19415257.2012.762721

Morante, M. A., Sánchez, A. J., Cruz, O., Bautista, E. I., and Escobedo, P. (2024). Entrepreneurship and entrepreneurial innovation of university students, Amazonas, Peru. *Int. J. Innov. Res. Sci. Stud.* 7, 901–913. doi: 10.53894/ijriss.v7i3.2975

More, R. (2024). El desempleo juvenil mundial está disminuyendo y se prevé que siga disminuyendo. Available online at: <https://www.reuters.com/world/global-youth-unemployment-decline-seen-falling-further-report-finds-2024-08-11/> (Accessed August 11, 2025).

Morgan, A., Sibson, R., and Jackson, D. (2022). Digital demand and digital deficit: conceptualising digital literacy and gauging proficiency among higher education students. *J. High. Educ. Policy Manag.* 44, 258–275. doi: 10.1080/1360080X.2022.2030275

Mpu, Y. N., Hackmack, K., and Roy, I. (2022). Teacher educator reflections on preparing first year pre-service teachers for school-based work integrated learning in an online learning environment. *Res. Soc. Sci. Technol.* 7, 18–35. doi: 10.46303/ressat.2022.15

Mtaw, N., Fongwa, S., and Wilson-Strydom, M. (2021). Enhancing graduate employability attributes and capabilities formation: a service-learning approach. *Teach. High. Educ.* 26, 679–695. doi: 10.1080/13562517.2019.1672150

Mulaik, S. A. (2005). “Goodness of fit” in Encyclopedia of statistics in behavioral science. eds. B. Everitt and D. C. Howell (New York, NY: Wiley).

Nabi, G., Liñán, F., Fayolle, A., Krueger, N., and Walmsley, A. (2017). The impact of entrepreneurship education in higher education: a systematic review and research agenda. *Acad. Manage. Learn. Educ.* 16, 277–299. doi: 10.5465/amle.2015.0026

Nghia, T. L. H., Giang, H. T., and Quyen, V. P. (2019). At-home international education in Vietnamese universities: impact on graduates' employability and career prospects. *High. Educ.* 78, 817–834. doi: 10.1007/s10734-019-00372-w

OCDE (2024). Empleo. Paris: OCDE.

- OIT (2024). Is wage inequality decreasing globally? Colorado, BO: OIT.
- OIT (2025). Perspectivas Sociales y del Empleo en el Mundo Tendencias 2025. Colorado, BO: OIT.
- Okolie, U. C., Igwe, P. A., Nwosu, H. E., Eneje, B. C., and Mlanga, S. (2020). Enhancing graduate employability: why do higher education institutions have problems with teaching generic skills? *Policy Futures Educ.* 18, 294–313. doi: 10.1177/1478210319864824
- Olha, R., Yuri, C., and Konon, B. (2024). Implementation of foreign experience of dual education and its integration in Ukraine. *Bulleti. Chernivtsi Inst. Trade Econ.* 3, 149–164. doi: 10.34025/2310-8185-2024-3.95.10
- Oppong, S. (2015). Managing graduate unemployment in emerging economies: critical analysis of the skills mismatch and oversupply theses. *Business Excellence* 9, 1–14. <https://hrca.hr.hr/139871>
- Opushko, N., Frytsiuk, V., and Gubina, S. (2023). Current trends in the development of dual education in German higher schools. *Acad. Notes Series Pedagog. Sci.* 1:209. doi: 10.36550/2415-7988-2022-1-209-396-403
- Osmani, M., Weerakkody, V., Hindi, N. M., Al-Esmail, R., Eldabi, T., Kapoor, K., et al. (2015). Identifying the trends and impact of graduate attributes on employability: a literature review. *Tertiary Educ. Manag.* 21, 367–379. doi: 10.1080/13583883.2015.1114139
- Oswald-Egg, M. E., and Renold, U. (2021). No experience, no employment: the effect of vocational education and training work experience on labour market outcomes after higher education. *Econ. Educ. Rev.* 80:102065. doi: 10.1016/j.econedurev.2020.102065
- Observatorio CEPLAN. (2024). Persistencia de la informalidad laboral y del empleo vulnerable. Available at: https://observatorio.ceplan.gob.pe/ficha/t29?utm_source=
- Pantaleón, A. J., Bueloth, M., Altamirano, F. R., Caro, O., and Román, C. (2023). Amazonas: gaps in tourism entrepreneurship. *Rev. Gestão Soc. Ambient.* 17:e03463. doi: 10.24857/rgsa.v17n4-020
- Park, H.-A. (2013). An introduction to logistic regression: from basic concepts to interpretation with particular attention to nursing domain. *J. Korean Acad. Nurs.* 43, 154–164. doi: 10.4040/jkan.2013.43.2.154
- Peng, M. (2019). Testing the mediating role of student learning outcomes in the relationship among students' social capital, international mindsets, and employability. *Asia-Pac. Educ. Res.* 28, 229–237. doi: 10.1007/s40299-018-00431-3
- Peng, C.-Y. J., Lee, K. L., and Ingersoll, G. M. (2002). An introduction to logistic regression analysis and reporting. *J. Educ. Res.* 96, 3–14. doi: 10.1080/00220670209598786
- Peng, C.-Y. J., and So, T.-S. H. (2002). Logistic regression analysis and reporting: a primer. *Underst. Stat.* 1, 31–70. doi: 10.1207/S15328031US0101_04
- Pitan, O. S., and Adedeji, S. O. (2012). Skills mismatch among university graduates in the Nigerian labor market. *US-China Education Review A* 1, 90–98.
- Pool, L. D., and Sewell, P. (2007). The key to employability: developing a practical model of graduate employability. *Educ. Train.* 49, 277–289. doi: 10.1108/00400910710754435
- Programa Nacional de Becas y Crédito Educativo - Pronabec (2025). Más empleo e ingresos: estudio revela que egresados de crédito educativo del Pronabec obtienen mejores resultados laborales. Lima: Programa Nacional de Becas y Crédito Educativo - Pronabec.
- Rae, D. (2007). Connecting Enterprise and graduate employability: challenges to the higher education's culture and curriculum? *Educ. Train.* 49, 605–619.
- Raihan, M. Z., and Azad, M. A. K. (2023). A bibliometric review on outcome-based learning for graduate employability: mapping the research front. *J. Educ.* 203, 73–91. doi: 10.1177/00220574211016444
- Rodrigues, R., van Harten, J., De Cuyper, N., Grosemans, I., and Butler, C. (2024). On your marks, get set, go! Jumping the hurdles of employability development at an early career stage. *J. Vocat. Behav.* 151:103999. doi: 10.1016/j.jvb.2024.103999
- Rodzalan, S. A., and Saat, M. M. (2015). The perception of critical thinking and problem solving skill among Malaysian undergraduate students. *Procedia. Soc. Behav. Sci.* 172, 725–732. doi: 10.1016/j.sbspro.2015.01.425
- Roman, A. G., and Villanueva, R. U. (2023). Graduate employment rate of one state university of the Calabarzon region in Philippines: a retrospection. *IJERE* 12:667. doi: 10.11591/ijere.v12i2.24795
- Rowe, A. D., and Zegwaard, K. E. (2017). Developing graduate employability skills and attributes: curriculum enhancement through work-integrated learning. *Asia-Pac. J. Coop. Educ.* 18, 87–99.
- Sánchez, J. C. (2013). The impact of an entrepreneurship education program on entrepreneurial competencies and intention. *J. Small Bus. Manag.* 51, 447–465. doi: 10.1111/jsbm.12025
- Sanchez, J., Andrade, C., Torres, J., Rebolledo, N., and Fullea, J. (2017). Determination of reinforced concrete durability with on-site resistivity measurements. *Mat. Struct.* 50:884. doi: 10.1617/s11527-016-0884-7
- Sánchez, E., Reina, Y., Cruz, O., Torres, M., Carrasco, A. M., and Chávez, R. (2024). Analysis of social demand and labor supply for university study programs: case study in the province of Rodríguez de Mendoza, Amazonas region. *Cogent Education* 11:589. doi: 10.1080/2331186X.2024.2406589
- Santos, A. G. (2018). Explaining the employment rate of recent Texas public university graduates. *Student Affairs on Campus* 3:40. doi: 10.54155/saoc.v3i1.40
- Scheuring, F., and Thompson, J. (2025). Enhancing graduate employability – exploring the influence of experiential simulation learning on life skill development. *Stud. High. Educ.* 50, 256–270. doi: 10.1080/03075079.2024.2334837
- Schueller, J. (2023). Transnational education, labor market outcomes and graduate employability: a scoping review. *Career Dev. Int.* 28, 196–216. doi: 10.1108/CDI-05-2022-0121
- Sekerbayeva, A., Tamenova, S., Tarman, B., Razakova, D., and Satpayeva, Z. (2024). Analysis of employment factors for university graduates in Kazakhstan. *Probl. Perspect. Manage.* 22, 683–695. doi: 10.21511/ppm.22(2).2024.53
- Shaleh, M., Awad, F. B., and Rezki, A. (2022). Counseling based on local wisdom for conflict settlement in the workplace: a case study in Kendari. *J. Soc. Stud. Educ. Res.* 13, 125–142.
- Sithole, S. T. M. (2015). Information technology knowledge and skills accounting graduates need. *Int. J. Bus. Soc. Sci.* 6, 47–52.
- Somers, C. (2023). The importance of digital skills for SMEs. Available online at: https://digital4business.eu/the-importance-of-digital-skills-for-smes/?utm_source=chatgpt.com (accessed August 9, 2023).
- Sperandei, S. (2014). Understanding logistic regression analysis. *Biochem. Med.* 24, 12–18. doi: 10.11613/BM.2014.003
- Succi, C., and Canovi, M. (2020). Soft skills to enhance graduate employability: comparing students and employers' perceptions. *Stud. High. Educ.* 45, 1834–1847. doi: 10.1080/03075079.2019.1585420
- Tan, E., Mwangabi, F., Lim, T., and Lim, A. (2023). Graduate employability concerns amidst a crisis: student perspectives from Singapore on COVID-19. *Ind. High. Educ.* 37, 370–383. doi: 10.1177/0950422221126420
- Teferi, E. (2015). Perception towards the role of higher accounting and finance education in meeting industry needs. Ethiopia: The case of some selected institutions in Ethiopia.
- Tibshirani, R. (1996). Regression shrinkage and selection via the lasso. *J. R. Stat. Soc. Ser. B Stat. Methodol.* 58, 267–288. doi: 10.1111/j.2517-6161.1996.tb02080.x
- Tomlinson, M. (2012). Graduate employability: a review of conceptual and empirical themes. *High. Educ. Policy* 25, 407–431. doi: 10.1057/hep.2011.26
- Tomlinson, M. (2017). Forms of graduate capital and their relationship to graduate employability. *Educ. Train.* 59, 338–352. doi: 10.1108/ET-05-2016-0090
- Tomlinson, M., and Holmes, L. (2017). Graduate employability in context: theory, research and debate. Cham: Springer.
- Trześciok, M. (2019). Measuring the quality of multivariate statistical models. *Acta Univ. Lodz. Folia Oecon.* 6, 99–100. doi: 10.18778/0208-6018.339.06
- Tudy, R. A. (2017). Employers' satisfaction on the performance of new college graduates. *SLONGAN* 3, 49–63.
- Verona, L. J. (2011). A Tracer Study of the Employment Status of PUPQC AY 2004–2005. Quezon City.
- Wilkes, J., and Burns, A. (2019). A decade of agriculture graduates' employability and career pathways. International journal of innovation in science and mathematics. *Education* 27:1. doi: 10.30722/IJISME.27.04.001
- World Bank (2019). Population, female (% of total population). London: World Bank.
- World Economic Forum (2025). Informe sobre el futuro del empleo. London: World Economic Forum.
- Yangali, J. S., and Saenz, P. Y. (2021). Factors influencing the labour market insertion of undergraduate graduates from Peruvian universities. *TURCOMAT* 12, 4740–4749. doi: 10.17762/turcomat.v12i3.1921
- Yaroshenko, O. (2023). A dual form of acquiring higher education as a way to meet labor market requirements for the practical training of graduates. *Probl. Educ.* 1, 62–77. doi: 10.52256/2710-3986.1-98.2023.04
- Yizengaw, J. Y., and Weidman, J. C. (2024). Higher education, gender, and job opportunities of engineering graduates in Ethiopia: an exploratory study. *Int. J. Educ. Dev.* 109:103078. doi: 10.1016/j.ijedudev.2024.103078
- Zhang, G., Wang, L., Shang, F., and Wang, X. (2025). What are the digital skills sought by scientific employers in potential candidates? *J. High. Educ. Policy Manag.* 47, 20–37. doi: 10.1080/1360080X.2024.2374392
- Zheng, L., and Chen, L. (2024). "Prediction Model of Graduate Employment Rate Based on Chaotic Analysis and Least Squares Support Vector Machine," in 2024 International Conference on Computers, Information Processing and Advanced Education (CIPAE), 497–501.