



Research article

Purpose in life assessment with artificial intelligence: a contextual approach to mental health in university students

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ABSTRACT

The Purpose in Life Questionnaire (PIL) assesses life purpose and its connection to depression, anxiety and other mental disorders. This exploratory, longitudinal study investigates the sense of life purpose among 114 university students from three institutions in Mexico, using the PIL and 18 additional context-based questions. These extra items were grouped into a Contextual Opportunity Index consisting of four dimensions: demographics, academic-cultural background, access to public-private services, and lifestyle. Results show that 57% of participants reported a defined life purpose, 26.3% experienced existential uncertainty, and 16.7% showed signs of an existential void. The lifestyle dimension showed the strongest correlation with life purpose—particularly “nuclear family situation” ($r = 0.431$, $p < 0.000001$) and “structured vacation time” ($r = 0.263$, $p = 0.005$). Predictive modeling using Naive Bayes and Decision Tree classifiers revealed that students’ attitudes toward death acceptance, heavily influenced final PIL scores. Additionally, the dimensions Access to private services and Demography variables were linked to a higher PIL score. These findings suggest that both internal and contextual factors contribute to students’ psychological well-being and life meaning.

Keywords: purpose in life, predictive modeling, mental health

1. Introduction

Mental health plays a crucial role in the development of college students. The World Health Organization defines mental health as “a state of well-being in which individuals are fully aware of their abilities, can cope with the normal stresses of life, work productively, and contribute actively to their communities” [1]. Nevertheless, this integral definition of mental health is constantly challenged by the increase of mental disorders in young adults.

In Mexico, the prevalence of mental disorders has increased significantly in recent decades. The *Gaceta Médica de México*, reported in 2021 that 18.1 mil-

lion people suffered from some form of mental disorder that year, reflecting a 15.4% increase compared to 2019. This phenomenon is especially pronounced among young adults aged 20 to 29, particularly vulnerable to conditions such as anxiety and depression. According to the Mexican Observatory of Mental Health and Addictions [2], in this age group, anxiety affects 23% of women and 19.9% of men.

Regarding depression, nearly 3.6 million Mexican adults reported suffering from it in 2021, with 1% of cases being cataloged as severe enough to require specialized care. The Mexican National Survey of Self-Reported Well-Being [3] reported depressive symptoms in 15.4% of adults, with a higher prevalence among

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women (19.5%) than men. The COVID-19 pandemic exacerbated this situation, by 2020, 28% of the adult population exhibited symptoms of depression, showing a strong upward trend compared to previous years. Surveys conducted during the pandemic indicated that 64% of adolescents and 71% of young people showed depressive traits. This deterioration highlighted the structural limitations of psychological and psychiatric care in the country. Especially considering that only one in five individuals with mental disorders receives timely treatment, while 75% of severe cases go untreated [4].

The Mexican National Health and Nutrition Survey in 2021 emphasized that young people aged 18 to 29 are particularly vulnerable to experiencing existential voids, hopelessness, and risk behaviors [5]. Research by Hernández-Torrano et al. [6] reveals that a low sense of life purpose and lack of defined personal goals are associated with higher substance use and school dropout rates. Similar studies by Salazar-Pousa et al. [7] in Colombia and Gutiérrez-García and Londoño [8] in Peru, reinforce the need to address the existential dimension of student well-being as a preventive measure.

The hypothesis of this work is that the structural and contextual characteristics of income and opportunity inequality of Latin American countries might have relevant social effects in the student's sense of life purpose. Therefore, it is important to take a comprehensive approach to mental health issues, where universities play a key role to the identification and prevention of these conditions within their communities.

From a technical perspective, surveys are an affordable option to take on that task. The Purpose in Life Questionnaire (PIL), designed by Crumbaugh and Maholick [9], has been widely used to assess life purpose and its association with emotional well-being. The framework developed by Viktor Frankl's logotherapy, holds that the pursuit of personal life purpose can reduce anxiety and depression, serving as a protective factor against existential emptiness [10]. According to the author, Logotherapy not only seeks to alleviate symptoms but also provides a personal framework that strengthens resilience in the face of life's challenges.

The PIL test is a tool that has also been used in addition to in-depth interviews and other types of tests, reportedly by psychologists and psychiatrists, to confirm signs of depression and other mental disorders that find the logotherapy's framework useful. For this research, a set of selected questions from the in-depth interviews are suggested as an addition to the original questionnaire to integrate set contextual variables into the analysis.

This study adopted a mixed methodological approach combining psychometric evaluation and predictive modeling. First, the PIL was administered to three groups of university students, alongside 18 additional questions designed to capture contextual factors (Contextual Opportunity Index, COI). These questions were organized into four categories: demographics, academic-cultural background, access to services, and lifestyle. Second, the collected data was analyzed using both tra-

ditional statistical methods and machine learning techniques. The ML Predictive models were a Naive Bayes classifier and a decision tree; both trained with data from the PIL and COI to assess whether student's *sense of life purpose* could be influenced on their environmental and social conditions.

2. Theoretical and conceptual framework

Life purpose is a central concept in humanistic and existential psychology and represents the clarity with which a person identifies their goals, values, and meaning in life. In clinical and educational contexts, this construct has been considered a protective factor against various mental health issues, including anxiety, depression, and suicidal ideation [11]. From a medical and psychosocial perspective, exploring life purpose can enrich the understanding of an individual's emotional history and guide preventive strategies.

One of the most recognized tools for assessing this construct is the PIL, developed by Crumbaugh and Maholick [9]. The PIL consists of 20 Likert-scale items designed to measure an individual's perception of life purpose, existential direction, clear goals, and personal satisfaction. Its theoretical foundation lies in the principles of logotherapy developed by Viktor Frankl in 1984, which argues that the search for meaning is a primary human motivation. This perspective is particularly relevant in the context of college student's mental health, where a sense of purpose can act as a buffer against emotional suffering.

Hernandez-Torrano et al. [6] conducted a bibliometric mapping study of "*Mental Health and Well-Being of University studies*". Their study covered more than 5000 journal articles from a Web of Science database for the period 1975-2020. Their key findings showed that studies about mental health of university students have been increasing in the last decades, having an important increase since 2010. Also, that while there are international studies, more than half have been conducted in the United States, recognizing there are multiple research groups participating on psychology, psychiatry and education publications.

2.1 Logotherapy and the existentialist approach in multiple contexts

Logotherapy approaches "life's purpose" as a fundamental force that enables individuals to resist hopelessness and reframe suffering. Frankl [10] argues that even in extreme conditions, it is possible to find meaning, which strengthens coping and resilience mechanisms. In this regard, the PIL provides a way to operationalize the search for meaning through a quantitative evaluation that has been validated across diverse populations.

Existential emptiness, or the lack of meaning, often manifests through demotivation, emotional isolation, and a sense of disorientation. Heisel and Flett [11] have shown that low PIL scores are associated with high

levels of depression, hopelessness, and suicidal risk. In the university setting, these manifestations are particularly relevant due to the inherent pressures of transitioning into adult life and how it affects not only their learning capabilities and student performance, but also their social skills and college experience. From a philosophical standpoint, logotherapy shares foundations with the existentialist thinking of authors like Kierkegaard, Nietzsche, and Sartre, who emphasize freedom, the will to meaning, and self-determination as essential human dimensions. These notions have been incorporated into the development and interpretation of the PIL, broadening its clinical and educational usefulness [12].

Schulenberg and Melton [12] found that college students with greater clarity of purpose reported lower stress levels and higher subjective well-being. Studies by Steger et al. [13] and Schnell et al. [14] have shown that a strong sense of life purpose is associated with greater resilience in adversity and lower emotional exhaustion in work environments, respectively. Their findings highlight the importance of strengthening existential life purpose as a priority for the university educative models. Van der Walt [15], described that while the PIL test results also have to be interpreted according to the moment of life of the participants, describing that first year students are less likely to be able to have a defined life purpose; but still, their findings on freshman students are relevant to the universities to take actions that guide students in this process.

Despite its psychometric validity, the PIL has limitations when applied in sociocultural contexts different from where it was developed. Vázquez and Castilla [16], noted that in Latin American environments, it was necessary to complement the PIL test with contextual variables; mostly, because of a cultural environment in which students are strongly influenced by family, economic, and community values. The findings of Hernandez-Torrano et al. [6] backs up this perspective as specific traditions of Western countries tend to lead these studies [17] Also considering that our cultural values and traditions do shape how mental health and mental illness are conceptualized [18]; and how individuals manifest communicate and cope with their symptoms as well as the access to different types of treatments.

2.2 AI approaches in mental health

The use of AI tools in data processing has extended broadly in the health field in recent years. Regarding mental health, this data process has different characteristics according to the data type, collection method and processing algorithm that has been chosen to fulfill a specific task. Muetunda et al. [19], explored several examples in which the use of AI algorithms has been used in mental health. Their first classification is regarding the type of AI learning process and algorithm, dividing them in two categories: a) Machine Learning (ML), in which a set of algorithms enable computers to learn from and make predictions or decisions based on selected data sets; and Deep Learning (DL), considering

the use of neural networks to model complex patterns in large amounts of data, including unstructured data as audio, images and multiformat text.

Muetunda's second classification, compared various automatic mental diagnosis solutions: a) Using ML methods for automatic diagnosis with self-reported reported questions; b) Using DL methods to study analysis behavior by studying video files of computer vision; c) Using ML algorithms to detect variables, studying stress in working employees to highlight factors of general mental stress; d) Using ML random forests to identify hidden patterns between variables to predict anxiety disorders; and e) Sensor based apps and gadgets as warning systems using biometrics. These examples also have different objectives as diagnostic, predictive or monitoring tools. Finally, as a third remark regarding the type of question in the tools, considered the difference between the type of questions as factoid (closed and specific) and non-factoid (open and more extensive) are also important considerations.

According to the data recollection and the main objective of this study, the possibility to have access to self-reported tests from college students was the ideal option to explore the general state of mind of this population. As the results might add new information to the university's crew of experts and give them a set of topics for their internal prevention campaigns, the general approaches to increase the community's well-being must remain as the main objective of this study rather than an automatic individual diagnostic tool. Nevertheless, for health professional within the universities, the PIL and the COI questionnaires, might be useful together as a complement to depth interviews, personal student work sessions and other complementary techniques.

3. Materials and methods

This exploratory and longitudinal study was designed to analyze the relationship between life purpose definition and various contextual privilege factors among Mexican university students. The main instrument was the PIL, developed by Crumbaugh and Maholick [9], which consists of 20 items distributed across dimensions such as existential direction, goal clarity, life satisfaction, and motivation. Interpretation followed the ranges established in the literature, grouping participants by their scores into three categories: defined life purpose, undefined perception, and existential vacuum [20].

To quantify contextual opportunities among university students, a composite index named COI was constructed by 18 complementary questions. The items were grouped into four conceptual categories: a) demographics (sex, age, marital status, economic dependents); b) academic and cultural background (semester, university, field of study, indigenous background, Multilingualism); c) access to public-private services (streaming, cellphone credit, healthcare, transportation, Passport status), and (4) lifestyle (family situation, structured free time, structured vacation time, interpersonal relationships). Each response was converted into an in-

teger value and then multiplied by the number of items in its respective category. These category scores were then normalized to a 7-point scale, aligned with the PIL test format.

A group of students from three universities was selected through non-probability quota sampling to answer the questionnaire. This method was chosen due to its logistical feasibility and its ability to represent groups with heterogeneous academic and socioeconomic characteristics. Data collection was carried out over a 12-month period using Google Forms, ensuring an efficient systematization of the process.

In the first interpretation stage, the data was analyzed using conventional statistical tools and the MATLAB software. The later to perform descriptive and inferential analyses, including correlations between PIL scores and the contextual variables. Subsequently, in the second interpretation stage, two predictive models using machine learning in RapidMiner using Naive Bayes classifier and decision tree. The goal of this stage was to explore the potential of data analysis to automatically predict the level of defined life purpose based on the 18 contextual variables or its four dimensions. Then, a supervised learning approach was used to compare the life purpose categories with the contextual ones, using final score and interpretation of the PIL test as the target variable.

4. Results

4.1 PIL results and individual interpretation

The first part of the analysis focused on the results of the PIL test and its original items. Of the 114 valid responses, 57% of the students demonstrated a defined life purpose, while 26.3% showed existential uncertainty, and 16.7% reported levels related to an existential void. A basic report was created to reflect these results using heatmap tables and circular graphs as shown in Figure 1. A second collection of graphs shows how three subcategories that group some of the items were able to influence the final scores and its interpretation: 1) Cognitive component (1,2,4,6,8,12,16,18); Motivational component (3,5,9,10,11,13,14,17,20); and Affective component (7,15,19), taken from [21].

The original scale of each one of the items remained calculated as in the original test, with a Likert 1 to 7 value response. The final score was interpreted in this study, the overall score on the PIL was interpreted based on a widely used three-level classification system applied in previous research.

Considering the maximum score of 140 points (20 items rated on a 7-point Likert scale); individuals scoring below 90 points are understood to experience a state of existential void, while scores between 90 and 105 reflect uncertainty regarding life purpose. In contrast, scores above 105 indicate a clearly defined sense of meaning and life purpose. This interpretative framework has been adopted in several studies [16, 20].

After the initial results of the test were calcu-

lated, an additional correlation process started using the MATLAB software. The 18 additional questions were tested for relevant correlations with the final three value scale of the PIL's interpretation of the scores. In this case, the variable "nuclear family situation" showed a moderate positive correlation with the PIL score ($r = 0.431788$, $p < 0.000001$), indicating that students with stable family relationships tend to report a higher sense of life purpose. Likewise, the variable "structured vacation time" showed a low but significant positive correlation ($r = 0.262523$, $p = 0.004776$), indicating that recreation also influences, though to a lesser extent, existential perception.

Figure 2 presents two boxplots that explore key associations between life purpose and contextual variables. Subfigure 2a shows the relationship between life purpose definition groups and family situation. A clear upward trend is observed: as family ratings increase, so do the PIL scores. Groups 1 and 2 exhibit medians above 106, indicative of a well-defined life purpose, while lower-rated groups cluster in the range associated with existential uncertainty. Subfigure 2b illustrates the correlation between structured vacation time and life purpose. Groups 1 and 2 display higher medians, suggesting a stronger sense of life purpose among individuals with more organized vacation habits. In contrast, Group 1 shows greater variability, indicating a broader range of purpose-related experiences.

4.2 COI results and Individual Interpretation

The COI was designed with the aid of two medical specialists to integrate a multidimensional assessment of structural and material conditions affecting the mental health and life purpose of university students. This index took a critical approach to inequality and considers how each variable reflects disparities in the student's college experience opportunities. The COI scoring is grounded in intersectional and cumulative inequality frameworks, where multiple disadvantage dimensions compound mental health outcomes [22, 23, 24]. Also, some empirical precedents include the Multidimensional Poverty Index; the Social Deprivation Index and the School Climate Index [25, 26, 27].

To calculate the COI, a four-step method was conducted. First, the complementary items were divided into four dimensions of structural disadvantage: demographics, academic-cultural background, access to public/private services, and lifestyle. The items were presented in a questionnaire with two types of answers: binary and ordinal. The item descriptions and score ranges are shown in Table 1.

For instance, "multilingualism" and "passport status" exemplify markers of privilege tightly linked to economic stability and social capital in a highly unequal country like Mexico. Multilingual ability points to access to quality education, immersion programs, or private language schools, which are predominately available to students from higher-income families. Similarly, holding a passport not only reflects financial sol-

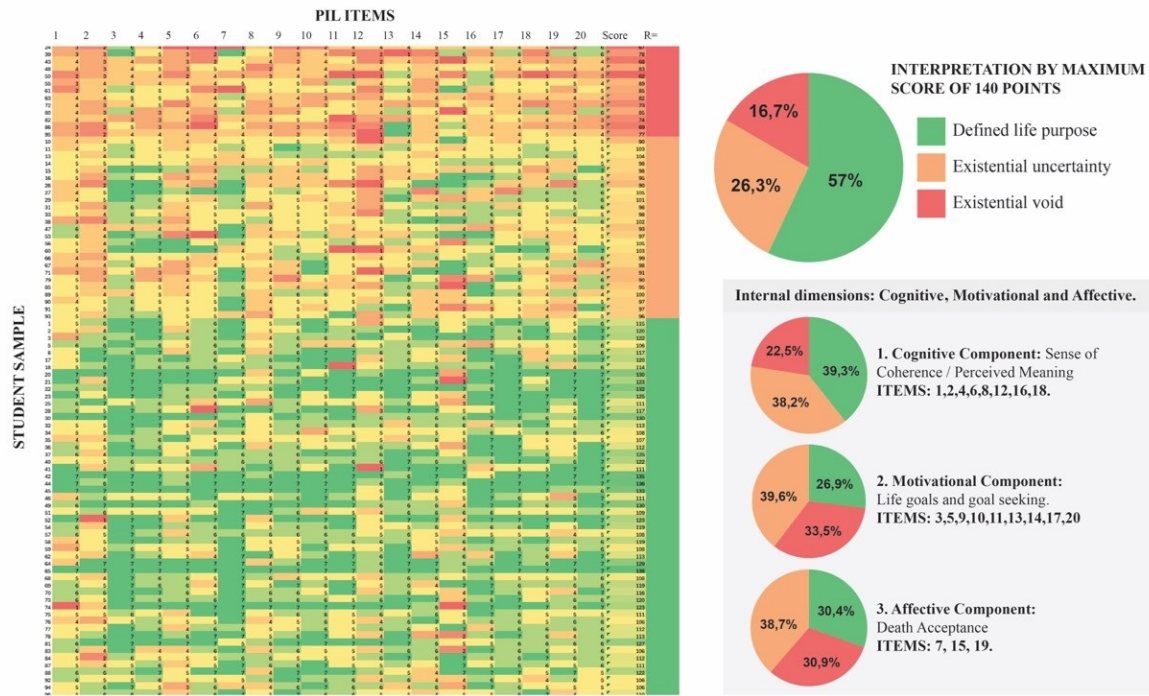


Figure 1. PIL interpretation analysis by final scores and internal dimensions. Heatmap and sector charts created in Microsoft Excel.

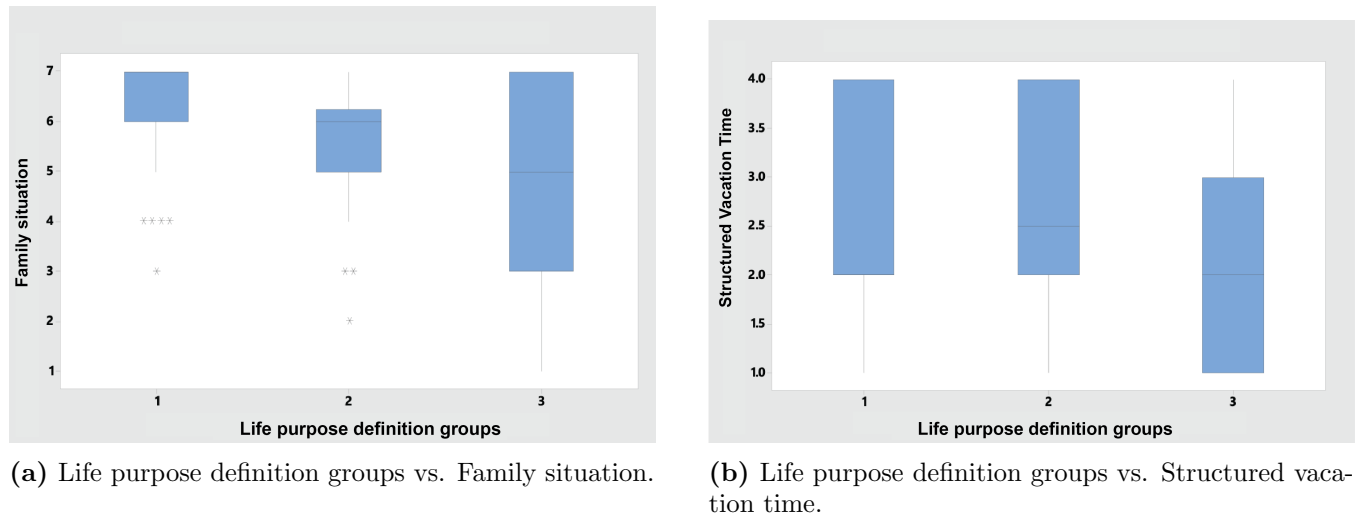


Figure 2. Boxplots comparing life purpose definition groups with contextual variables.

Table 1. COI dimensions and item descriptions (2025)

Dimension	Item description
Demographics	Sex; age; marital status; economic dependents
Academic-Cultural Context	University type; field of study; semester; multilingualism; indigenous identity; passport status
Access to Services	Digital services; cellphone coverage/data; health services; transport services
Lifestyle and Routines	Family situation; interpersonal relationships; rest; structured vacation time

veny but also indicates greater economic mobility and exposure to international experiences, elements that foster broader perspectives and opportunities for self-actualization.

The items including marital status, economic dependents, and age group were selected considering that students who bear financial or caregiving responsibilities may face greater challenges in dedicating time and resources to their personal development. Similarly, to reflect academic and cultural background variables, their field of study and indigenous identity, might illuminate inequalities within educational pathways and cultural capital. Students from underrepresented or marginalized groups, such as those from indigenous backgrounds, often encounter systemic obstacles that limit access to resources, mentorship, or academic opportunities.

Secondly, all these dimensions were chosen to collectively capture different aspects of contextual opportunity. Each dimension was first scored separately and then normalized to a 1–7 scale. Together, these dimensions reveal how the intersection of privilege and access creates stratified experiences of meaning-making among university populations.

Thirdly, to quantify contextual differences in opportunity, each response was converted into an integer value and aggregated within its corresponding dimension. To align the dimensions with the PIL test’s 7-point scale, each raw dimension score was normalized as shown in Equation 1:

$$\text{Norm}_x = 1 + 6 \times \frac{R_x - R_{\min}}{R_{\max} - R_{\min}} \quad (1)$$

where R_x is the raw score for category x , and $R_{\min}$ and $R_{\max}$ are the theoretical minimum and maximum possible values, respectively.

This transformation ensures that each dimension contributes equally to the composite score and reflects the cumulative impact of contextual opportunity on well-being [28].

Finally, the four resulting scores were added to produce a total index score ranging from 4 to 28, to facilitate analysis and interpretation. The normalized scores for the four dimensions were summed as shown in Equation 2:

$$\text{COI}_{\text{Total}} = N_D + N_C + N_S + N_L \quad (2)$$

where N_D, N_C, N_S, N_L are the normalized scores for the Demographics, Cultural/Academic, Services, and Lifestyle dimensions, respectively.

$$\text{COI}_{\text{Total}} \in [4, 28] \quad (3)$$

The continuous index was then scaled to a [0–1] range and grouped into *five bands of contextual opportunity* according to the results in: Low (0.00–0.15), Moderate (0.16–0.41), Reasonable (0.42–0.58), High (0.59–0.74), and Very high (0.75–1.00) contextual opportunity. Table 2 shows the general results by category and percentage.

The results on Table 2 show that *Low and Moderate opportunities* are more common in the student sample and while it might not necessarily affect their life purpose directly, the next section allowed us to find hidden relations between both PIL and COI results.

After collecting and interpreting the data from all the students, an internal validation of the COI was also conducted. To improve the internal consistency of the COI, a psychometric refinement using a correlation analysis revealed that five items—specifically items 4, 6, 7, 9, and 16—showed weak or even negative correlations with the overall index score. When these items were removed from the scale, it resulted in an increase of the Cronbach’s alpha from 0.58 to 0.60. This value represents the minimum threshold commonly accepted for exploratory research and supports the internal coherence of the remaining items. While item 4 and 6 are still relevant for general statistic purposes according to the mental health experts, they might not be part of an updated COI; and items 9 and 16 should be substituted. This refinement serves as a preliminary step toward transitioning from an exploratory framework to a more robust descriptive or explanatory study design in future research, larger groups of students and using probabilistic sampling methods.

4.3 Machine learning algorithms

To explore the predictive relationship between contextual variables and the presence of life purpose among university students, this study employed two supervised

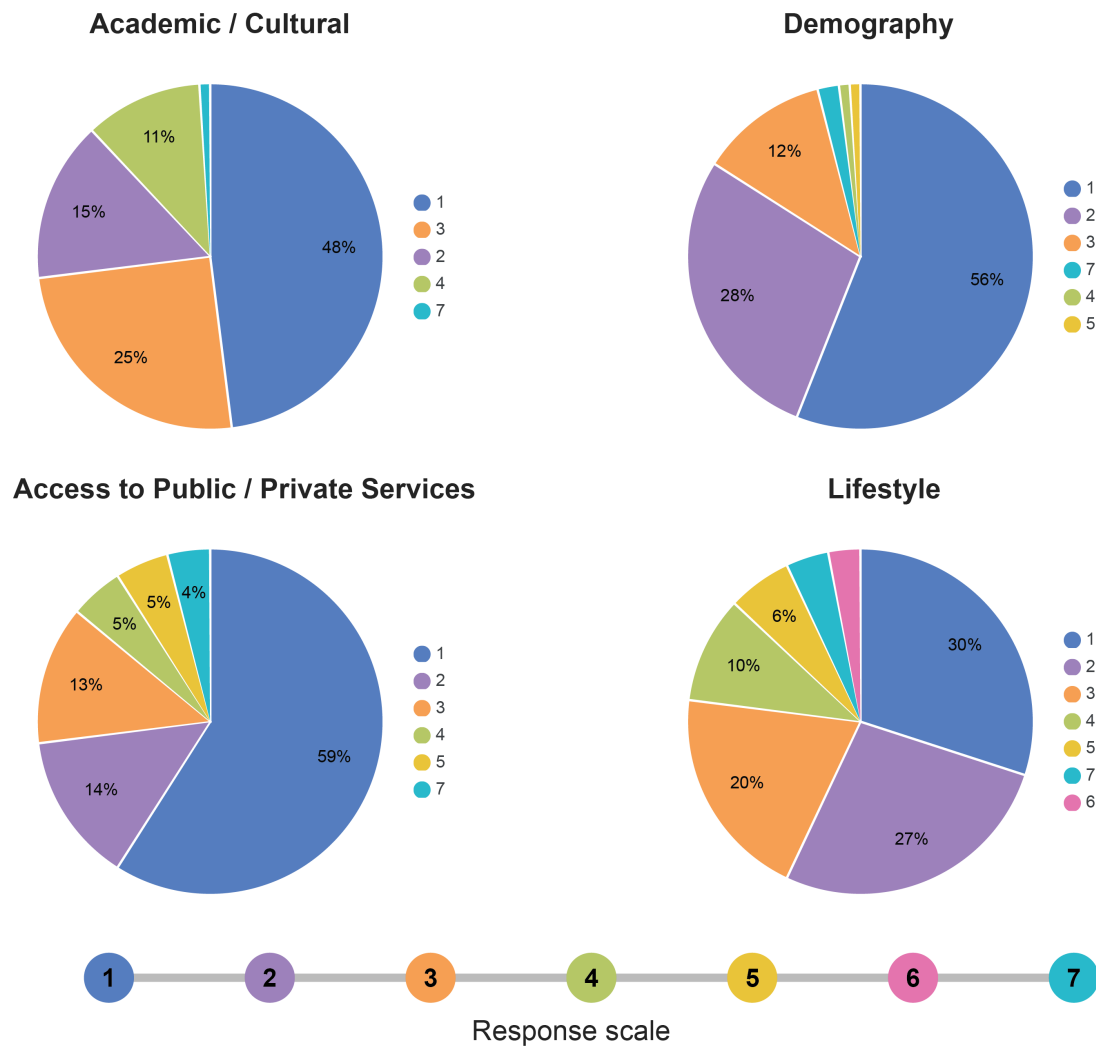


Figure 3. COI scores by category in a 7-point scale created in Microsoft Excel.

Table 2. Opportunity bands by percentage results (2025).

Opportunity Band	Percentage
Low Opportunity	47%
Moderate Opportunity	47%
Reasonable Opportunity	3%
High Opportunity	3%
Very High Opportunity	0%

machine learning models: Naive Bayes and decision tree classifiers. These models were selected for their interpretability and suitability for categorical and ordinal data, which matched the structure of the survey responses.

The Naive Bayes model, grounded in probabilistic reasoning, was particularly useful for handling multidimensional categorical data efficiently and offered rapid results even with a relatively small sample size. In parallel, the decision tree modeling allowed for the identification of nonlinear patterns and interaction effects between COI dimensions as variables, offering interpretable decision rules that aligned with the exploratory goals of the research.

4.3.1 Naive Bayes model in Rapid Miner

In this exploratory sample, the Naive Bayes model demonstrated high classification performance across both iterations. In a first implementation, it achieved an accuracy of 94.05%, with near-perfect classification for the “Defined Life Purpose” and “Existential Vacuum” categories, and minor confusion between “Defined” and “Undefined” cases. The second, improved model reached an accuracy of 96.67%, correctly classifying all cases of “Existential Vacuum” and “Undefined Purpose,” with only one misclassification in the “Defined Life Purpose” group. The full process of the implementation is shown in Figure 4. From left to right, 1) an Excel file was imported as a database with four variables, the three categories of the PIL test and the total score of the sum of the COI dimensions, 2) the data was distributed to train the model (70%) and to test it (30%) using two performance tests.

The report visualization tool of RapidMiner showed interesting results, especially in the combination of the PIL results classification (color dots), the COI dimension score and the death acceptance affective component. The results are shown in Figure 5.

4.3.2 Decision tree model in RapidMiner

The decision tree model further reinforced these insights by identifying Services, Demography, Lifestyle, and Cultural engagement, as the most relevant predictors in that order. Participants with greater access to public and private services and with the higher demographic indicators were more likely to exhibit a defined sense

of life purpose. In contrast, limited access to services and less structured lifestyle patterns, tended to associate with existential ambiguity. While the visual representation of Figure 6 might be difficult to read, the path from the service access and the demography dimensions at the left side, shows a shorter route.

The Access to private / public services variable serves as a strong initial discriminator, while Academic/Cultural and Lifestyle help refine the classification deeper in the tree. According to the results and considering the 7-scale normalization of the data, a Defined Life Purpose is strongly associated with High levels of Services (> 3.5) and Demography (> 1.5); while with moderate to high levels of Lifestyle and Academic/Cultural scores, especially when Service dimensions is between 2.5 and 3.5 points. It is relevant to see that even when services access might be low, a high Lifestyle score can still predict a defined purpose, potentially linked with the first part of our analysis.

5. Conclusions

The incorporation of the COI alongside the PIL deepened the understanding of university students’ sense of purpose by systematically integrating contextual variables, including demographics, academic-cultural background, access to services, and lifestyle. This novel methodological expansion provided an enriched, culturally relevant perspective, allowing the study to link life purpose to broader social and material dimensions. By quantifying the contextual opportunities available to students, the COI highlighted structural inequalities that shape their psychological well-being and existential outlook.

The findings of the study strongly align with Viktor Frankl’s logotherapy principles and the existentialist perspective, emphasizing the central role of meaning-making as a protective factor against mental health challenges. Frankl’s concept of the will meaning posits that a clear sense of purpose enables individuals to resist despair and find resilience in the face of adversity. This theoretical foundation is evident in the results, which demonstrate how family relationships, structured vacation time, and access to private and public services related to life quality, correlate positively with higher scores of life purpose.

The significant influence of contextual variables, such as structured vacation patterns and nuclear fam-

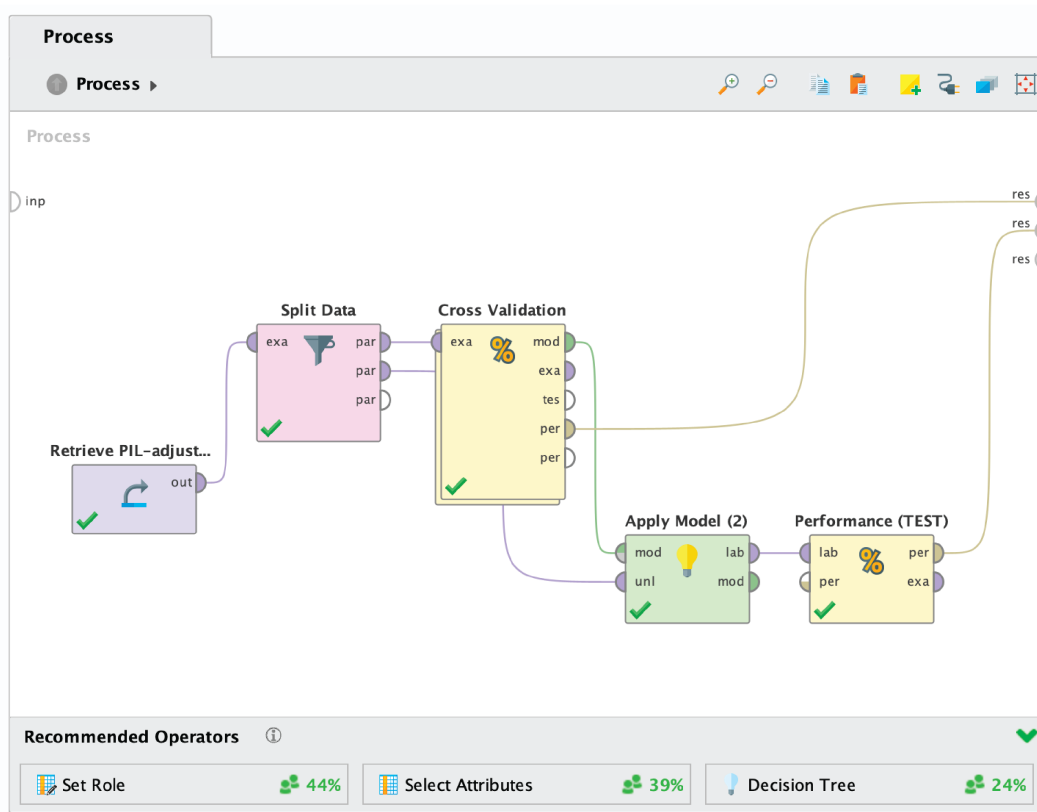


Figure 4. RapidMiner Process Interface with Naive Bayes model.

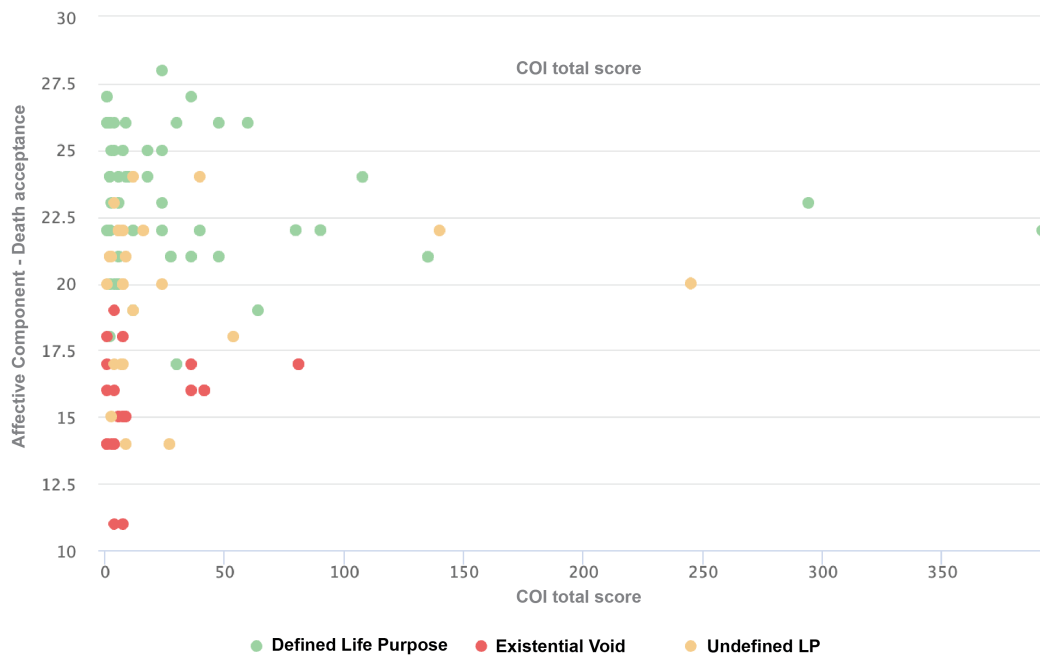


Figure 5. Scatter bubble plot graph generated by RapidMiner comparing COI total score with PIL Score in three colors.

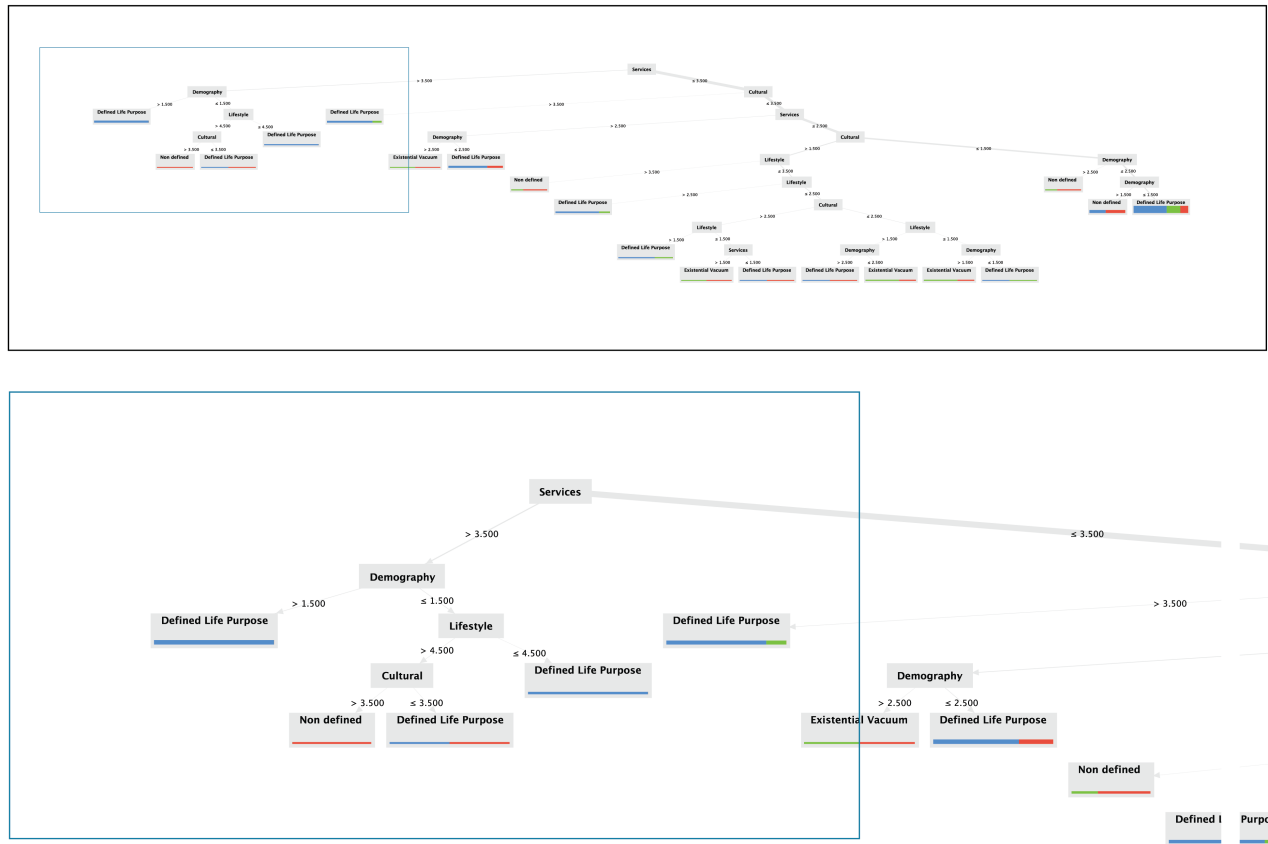


Figure 6. RapidMiner Decision tree results focusing on Services > Demography > Defined Life Purpose.

ily situations, underscores that existential well-being does not arise solely from intrinsic personal effort but is deeply shaped by external social and material conditions. By incorporating the COI, the study not only validates the core tenets of logotherapy but also expands its applicability to diverse cultural and socioeconomic settings, illustrating how structural factors can either hinder or facilitate the pursuit of life purpose. This integration reaffirms the need for culturally informed approaches in applying logotherapy to address mental health issues, particularly within university settings where uncertainty is often magnified.

Regarding key findings for decision-making, the results suggest that access to private and public services, cultural engagement, and structured lifestyle elements may support collaborations with local businesses to offer low-cost transportation, campus food services, and campus life activities. A student life department could directly address these possibilities. Other important elements are the role of the “nuclear family situation” showed a moderate positive correlation with PIL scores ($r = 0.431$), while structured vacation patterns demonstrated a smaller but significant impact ($r = 0.263$). These results underscore the interplay between affective, economic, and organizational factors in cultivating a sense of purpose, emphasizing the need to address these dimensions in university mental health strategies. In this case, the promotion of family activities as community members and of weekend and leisure activities could be added to the list. A list of potential projects for universities is condensed in Table 3.

The study’s application of advanced machine learning techniques, including Naive Bayes and decision tree classifiers, validated the relevance of contextual variables in predicting life purpose outcomes. In this exploratory sample, the Naive Bayes model achieved an accuracy of 96.67%, correctly classifying most cases across “Defined Life Purpose,” “Existential Vacuum,” and “Undefined Purpose” categories. Similarly, decision tree analysis revealed actionable patterns, with “Services,” “Demographics,” and “Lifestyle” emerging as the most predictive dimensions. These findings suggest the potential of machine learning to generate actionable insights for early identification of at-risk groups and the development of targeted interventions.

As an exploratory study, the 16.7% of participants that experienced significant levels of existential void is an important group to look up for. With broader contextual issues such as lack of support networks, emotional isolation, and limited structured rest contributing to this state, the psychology departments might also consider implementing similar studies to find student with specific need. Overall, these insights call for institutional policies prioritizing connection, belonging, and personal growth within the student body. The results also indicate that high COI scores linked to better access to resources and structured routines can buffer existential uncertainty, reinforcing the importance of addressing structural inequities that impact well-being.

All universities have the potential to replicate this, and other mixed-methods approaches, combining diagnostic tools with machine learning and predictive modeling, to guide innovative and data-driven mental health strategies. These methodologies provide a replicable framework, offering institutions the ability to scale diagnostics from individual interventions to larger populations using digital methods to keep nourishing AI algorithms.

Mental health is not as an individualized challenge but as a collective institutional responsibility encompassing education, family involvement, workload optimization, and normalized self-care practices. The need for cross-cutting institutional strategies that bridge academic, family, and social dimensions is evident to foster meaningful life purpose and emotional resilience among students. As scholars, these conclusions are an invitation to replicate and expand this methodology to additional contextual dimensions, refine intervention models, and promote holistic well-being as a foundational aspect of higher education. By leveraging tools like the COI and predictive analytics, institutions can contribute to addressing the broader systemic challenges impacting mental health and existential purpose in the academic environment.

Ethics statement

This study used anonymized data collected via an online survey. No personally identifiable information was collected. Ethical approval was deemed unnecessary according to the guidelines of Instituto Tecnológico de Orizaba, TecNM.

CRedit authorship contribution statement

Guillermo Alfredo Arriola-Carrera: Methodology, Writing – original draft; **Eduardo Roldán-Reyes:** Conceptualization, Supervision; **Pedro Humberto Velázquez-Morales:** Project administration, Writing – review & editing; **Víctor Méndez-García:** Software, Validation.

Declaration of generative AI and AI-assisted technologies in the writing process

The authors utilized Grammarly and JustDone to refine sentence structure and enhance readability. No content was generated by AI; all scientific insights and original ideas are the authors’ own.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Table 3. Potential strategies for university projects, a preventive approach from the results (2025).

Key Finding	Associated Variable	Implication	Institutional Recommendation
57% of students show a defined life purpose, but 16.7% report an existential void	PIL total score	A significant group of students is at risk of existential crisis	Implement periodic PIL screenings to identify at-risk groups and refer them to counseling services
Moderate correlation between family situation and life purpose ($r = 0.43$)	Nuclear family situation	Family environment directly influences life purpose perception	Develop family engagement programs and invite family members to wellness and mental health events
Structured vacation habits positively correlate with life purpose ($r = 0.26$)	Structured vacation time	Rest routines strengthen existential well-being	Establish official academic disconnection weeks and promote healthy leisure planning workshops
94% of the sample showed low or moderate contextual opportunity	COI total score	Students face considerable inequality in material and cultural conditions	Design social mobility programs: transportation, food, scholarships, and access to extracurricular activities
Access to services strongly predicts life purpose according to the decision tree	Access to services (COI)	Basic economic infrastructure enhances sense of life purpose	Provide support for health-care, internet access, food, and transportation for vulnerable students
Students with high PIL and COI scores show greater well-being	PIL and COI integrated	Psychological well-being and life purpose are deeply shaped by structural factors	Integrate the COI as an institutional well-being indicator to monitor student living conditions
High predictive accuracy of Naive Bayes and decision tree models	AI application	AI can efficiently identify risk profiles	Implement early warning dashboards using AI algorithms to enable personalized prevention

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