Research on Psychological Health Education of Higher Vocational College Students—Based on IF-AHP and Entropy Weight Method

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Abstract

Background: Currently, the effectiveness of psychological health education in higher vocational colleges is evidently low, with a significant mismatch between investment and demand, and a lack of targeted approaches. This inadequacy is partly due to the insufficient emphasis on the vocational aspects of such education. **Objective:** The aim is to improve the relationship between the investment in psychological health education and the level of education received by students in higher vocational colleges, thereby enhancing the effectiveness of this education. **Method:** This study constructs a psychological health needs scale for higher vocational college students through literature review, interviews, and observation. Students are invited to score the scale, and the weights of the indicators are calculated using IF-AHP and entropy weight methods. **Results:** The study develops a model based on five primary indicators: social anxiety, love frustration, academic pressure, employment pressure, and internet addiction, encompassing a total of eleven secondary indicators. The analysis of these weights reveals that students are most in need of education on academic pressure, internet addiction, and love frustration. **Conclusion:** The study suggests that academic pressure among vocational college students mainly stems from their own lack of learning ability and interest, leading them to indulge in the virtual world to escape reality. It is recommended that vocational colleges organize activities such as study experience sharing and skill-sharing sessions to enhance students' interest in learning and self-study capabilities. For issues like love frustration and social anxiety, vocational colleges could offer elective courses on college students' perspectives on love and strengthen training in social skills, helping students develop a positive social attitude. Finally, regarding employment pressure, vocational colleges should pay attention to students' negative attitudes towards employment, and alleviate future anxieties by organizing career devel-

opment symposiums, offering courses in workplace psychology, and providing internship opportunities.

Keywords

1. Introduction

Psychological health education is essential in enhancing the psychological quality of university students and fostering their holistic physical and mental development. Higher vocational education constitutes a significant segment of China's higher education system. With the increasing demand for technical and skilled talents driven by regional economic and social development, integrating psychological health education into the vocational education talent cultivation mechanism has become an imperative issue in higher vocational education (Qin & Pan, 2022). This integration aims to cultivate high-quality technical talents with robust physical and mental health.

Currently, the psychological health education in higher vocational colleges often replicates the content and organizational form of undergraduate institutions, leading to insufficient emphasis on the distinctive features of vocational education. This has resulted in several challenges: the effectiveness of psychological health education in higher vocational colleges is not optimal (Yang & Zhang, 2021), there is a mismatch between the resources allocated to psychological health education and the actual needs (Liu et al., 2022), and the lack of targeted approaches (Wu, 2021). Furthermore, courses with high enrollment rates often fail to meet the lower demands of students, while the desired needs of students are not adequately represented or fulfilled in the psychological health education curriculum (Liu et al., 2022).

Developing a psychological health education needs scale for higher vocational college students and effectively identifying and addressing these needs can enhance the relationship between the investment in psychological health education and the educational level received by the students. This approach is beneficial for improving the effectiveness of psychological health education in higher vocational colleges.

2. Development of a Framework for Psychological Health Education Needs Indicators

According to the research by Ma et al. (2019), peer interaction is a crucial source for satisfying social needs, obtaining social support, and feeling secure. For higher vocational college students, peer relationships primarily stem from classmates. The absence or poor quality of these relationships can impact an in-

dividual's emotions and personality (Liu et al., 2022), particularly in cases of romantic setbacks, which may lead to severe emotional distress or even pronounced tendencies towards self-harm or suicide (Wei, 2017). Higher vocational students, often having weaker academic foundations and professional skills, encounter numerous difficulties in their studies. They are plagued by issues like employment challenges and mismatches between their majors and interests, leading to a complete erosion of their already low enthusiasm for learning (Fu, 2019). When these students are impacted by various risk factors, negative self-schemata mediate between their traumatic experiences and psychological health (Appiah-Kusi et al., 2017; Zeynel & Uzer, 2023). Being "digital natives," they are more likely to indulge in the online world to avoid professional studies, resulting in academic burnout (Chen et al., 2022).

In light of this, the paper posits that psychological health education for higher vocational students should primarily focus on the following aspects: social anxiety, romantic setbacks, academic pressure, employment pressure, and internet addiction. By reviewing literature, conducting interviews, and observing higher vocational students, a psychological health education needs scale for these students was constructed, as shown in Table 1.

3. Research Methodology

3.1. Intuitionistic Fuzzy Analytic Hierarchy Process (IF-AHP)

The Intuitionistic Fuzzy Analytic Hierarchy Process (IF-AHP) is a method that can determine the ranking of overall indicator weights based on the scoring of pairwise comparisons between indicators at each level. The incorporation of intuitionistic fuzzy numbers into the Analytic Hierarchy Process (AHP) addresses the issue of semantic ambiguity that can arise during the scoring process of AHP

Table 1. Psychological health needs assessment scale for vocational college students.

Primary Indicators:	Secondary Indicators:
X1 Social Anxiety	X11 Concern about being isolated by social groups (Wang et al., 2023)
	X12 Feeling exhausted in social relationships (Zhang & Wang, 2021)
X2 Romantic Setbacks	X21 Difficulty moving on from sadness post-breakup (Wang et al., 2023)
	X22 Repeated disappointments in pursuing romantic relationships (Chao, 2023)
X3 Academic Stress	X31 Lack of interest in studies (Wang et al., 2023)
	X32 Desire to improve academic performance but feeling incapable (Chao, 2023)
X4 Employment Pressure	X41 Uncertainty about future employment direction (Chao, 2023)
	X42 Setting high employment goals but lacking the ability to achieve them (Chao, 2023)
	X43 Disinterest in employment, preferring to rely on parents (Peng & Yu, 2023)
X5 Internet Addiction	X51 Reluctance to quit internet addiction, enjoying immersion in the online world (Zhang & Wang, 2021)
	X52 Desire to overcome internet addiction but finding it challenging to do so (Wang et al., 2023)

(Sadiq & Tesfamariam, 2009). The operational steps of IF-AHP are as follows:

1) Constructing the Hierarchical Structure Model

Develop a hierarchical structure model for the demand indicators, as illustrated in **Figure 1**.

In this model, A represents the Goal Layer; B signifies the Primary Indicator Layer, comprising m primary indicators, denoted as B_β for the β-th primary indicator ($\beta = 1, 2, \cdots, m$); C is the Secondary Indicator Layer, under each primary indicator there are n secondary indicators, represented as $C_{\beta,\eta}$ for the η-th secondary indicator under the β-th primary indicator.

2) Constructing the Intuitionistic Fuzzy Complementary Judgment Matrix

Let X be the set of evaluation indicators, represented as $X = (x_1, x_2, \cdots, x_n)$. Based on the relative importance of attributes, a pairwise comparison is conducted for the factors $x_1, x_2, \cdots, x_n$, resulting in the formation of a judgment matrix:

$$A = \left(a_{ij}^{(k)}\right)_{n \times n}, a_{ij} = (\mu_{ij}, v_{ij}), (i, j = 1, 2, \cdots, n)$$

In this matrix, μ_{ij} and v_{ij} respectively represent the membership degree and non-membership degree of the decision-maker's pairwise comparison between alternatives x_i and x_j. The value $1 - \mu_{ij} - v_{ij}$ represents the degree of hesitation of the decision-maker.

3) Consistency Test for Intuitionistic Fuzzy Complementary Judgment Matrix

$$I(A, B) = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} |a_{ij} + b_{ij} - 1|}{n^2} \tag{1}$$

When the compatibility index $I(A, A^*) \leq 0.1$ of the fuzzy judgment matrix A and its characteristic matrix is less than or equal to 0.1, the judgment matrix A is considered satisfactorily consistent. Consequently, it is approximately inferred that the corresponding intuitionistic fuzzy judgment matrix is also consistent.

4) Determining the Weights of Primary Indicators

Suppose the intuitionistic fuzzy judgment matrix representing the relative importance of primary indicator b_i to primary indicator b_j is given as:

$$B_{m*m} = (b_{ij})_{m*m}, b_{ij} = (\mu_{ij}, v_{ij}, \pi_{ij})$$

where $i, j = 1, 2, \cdots, m$, μ_{ij} and v_{ij} are the membership and non-membership
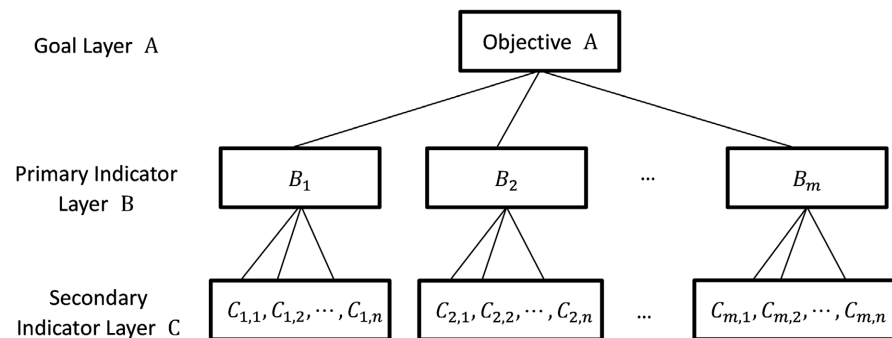

Figure 1. Hierarchical structure model of demand indicators.

degrees, respectively, for the pairwise comparison of attributes b_i and b_j, and π_{ij} is the degree of hesitation. The transformation formula used to convert the intuitionistic judgment matrix into intuitionistic fuzzy numbers during calculation is as follows:

$$\omega^{\mathrm{T}} = \left(\omega_1, \omega_2, \cdots, \omega_m \right) = \left[\frac{\sum_{j=1}^m b_{1j}}{\sum_{i=1}^m \sum_{j=1}^m b_{ij}}, \frac{\sum_{j=1}^m b_{2j}}{\sum_{i=1}^m \sum_{j=1}^m b_{ij}}, \cdots, \frac{\sum_{j=1}^m b_{mj}}{\sum_{i=1}^m \sum_{j=1}^m b_{ij}} \right]$$

$$= \left[\begin{array}{c} \left(\dfrac{\sum_{j=1}^m \mu_{1j}}{\sum_{i=1}^m \sum_{j=1}^m \mu_{ij}}, \dfrac{\sum_{j=1}^m v_{1j}}{\sum_{i=1}^m \sum_{j=1}^m v_{ij}} \right) \\ \left(\dfrac{\sum_{j=1}^m \mu_{2j}}{\sum_{i=1}^m \sum_{j=1}^m \mu_{ij}}, \dfrac{\sum_{j=1}^m v_{2j}}{\sum_{i=1}^m \sum_{j=1}^m v_{ij}} \right) \\ \vdots \\ \left(\dfrac{\sum_{j=1}^m \mu_{mj}}{\sum_{i=1}^m \sum_{j=1}^m \mu_{ij}}, \dfrac{\sum_{j=1}^m v_{mj}}{\sum_{i=1}^m \sum_{j=1}^m v_{ij}} \right) \end{array} \right]^{\mathrm{T}}$$

(2)

The calculation for the score weights of the primary indicators is as follows:

$$H\left(B_\beta \right) = \frac{1 - v_\beta}{1 + \pi_\beta}, \beta = 1, 2, \cdots, m \tag{3}$$

Following the meticulous execution of the normalization calculation, the ensuing result is as follows:

$$\sigma_\beta^1 = \frac{H\left(B_\beta \right)}{\sum_{\beta=1}^m H\left(B_\beta \right)}, \beta = 1, 2, \cdots, m \tag{4}$$

5) Ascertain the Weights of Secondary Indicators

Similarly, based on formulas (2) to (4), the normalized relative weights of the secondary indicators under the β-th primary indicator, denoted as $\sigma_{\beta,\eta}^2$, can be calculated. Subsequently, each normalized relative weight of the secondary indicators, $\sigma_{\beta,\eta}^2$, is multiplied by the absolute weight of their respective primary indicator, denoted as σ_β^1, to yield the absolute weights of the secondary indicators:

$$\sigma_i = \sigma_\beta^1 \sigma_{\beta,\eta}^2, i = 1, 2, \cdots, N \tag{5}$$

3.2. Entropy Weight Method

The concept of entropy (Zhang, 2016; Lu, 2015) was initially introduced in 1854 by the German physicist Rudolph Clausius, to represent the uniformity of energy distribution in space. With the advancement in the study of entropy, in 1948, Claude E. Shannon, the founder of information theory, proposed the concept of "information entropy". The magnitude of information entropy of a certain indicator can reflect the significance of that indicator in comprehensive analysis. Utilizing this method to assign weights in comprehensive evaluations can reflect the outcomes in a more objective and authentic manner. The computational

steps for the entropy weight method are as follows:

Let $S_1, S_2, \cdots, S_l$ represent l experts, and $C_1, C_2, \cdots, C_N$ denote N evaluation objects. $\sigma_i^\xi \left(\xi = 1, 2, \cdots, l; i = 1, 2, \cdots, N \right)$ represents the rating given by the ξ-th evaluation expert to the i-th evaluation object. The rating vector of the ξ-th expert for all evaluation objects is: $\sigma^\xi = \left(\sigma_1^\xi, \sigma_2^\xi, \cdots, \sigma_N^\xi \right)^{\mathrm{T}}$, and the evaluation results of the expert group form the matrix: $\sigma = \left(\sigma_i^\xi \right)_{l*N}$. The optimal expert S_* is selected based on the highest consistency with the evaluation results of the expert group, and their rating vector is: $\sigma^* = \left(\sigma_1^*, \sigma_2^*, \cdots, \sigma_N^* \right)^{\mathrm{T}}$. The quality of each expert is measured by the magnitude of the difference between their rating results and those of the optimal expert S_*, set as:

$$\sigma_i^* = \frac{\sum_{\xi=1}^{l} \sigma_i^\xi}{l}, \left(\xi = 1, 2, \cdots, l; i = 1, 2, \cdots, N \right) \tag{6}$$

The level vector of expert evaluation is:

$$E^\xi = \left(e_1^\xi, e_2^\xi, \cdots, e_N^\xi \right)$$

In the formula:

$$e_i^\xi = 1 - \frac{\left| \sigma_i^\xi - \sigma_i^* \right|}{\max \left(\sigma_i^\xi \right)}, \left(\xi = 1, 2, \cdots, l; i = 1, 2, \cdots, N \right) \tag{7}$$

Reflects the level of evaluation results made by expert S_ξ for the evaluation objects $C_1, C_2, \cdots, C_N$.

Consequently, a fidelity-based expert evaluation result assessment model can be established:

$$h_i^\xi = \begin{cases} -e_i^\xi \ln e_i^\xi, \dfrac{1}{e} \le e_i^\xi \le 1 \\ \dfrac{2}{e} - e_i^\xi \left| \ln e_i^\xi \right|, 0 < e_i^\xi < \dfrac{1}{e} \end{cases}, \xi = 1, 2, \cdots, l; i = 1, 2, \cdots, N \tag{8}$$

$$H^\xi = \sum_{i=1}^{N} h_i^\xi \tag{9}$$

The evaluation level of experts on a given problem can be measured through this model by the uncertainty of the evaluation results they provide. The degree of uncertainty is represented by the fidelity value H^ξ. A smaller H^ξ implies a higher level of expertise, and thus greater credibility of the evaluation results; conversely, a larger H^ξ indicates lower credibility of the expert's evaluation outcomes. Therefore, the corresponding weight p^ξ of an expert in the evaluation process is represented by the following equation:

$$p^\xi = \frac{1/H^\xi}{\sum_{\xi=1}^{l} 1/H^\xi}, \xi = 1, 2, \cdots, l \tag{10}$$

The larger the value of p^ξ, the greater the weight of expert ξ's opinion in the evaluation.

4. Analysis of Results

According to the higher vocational student mental health needs scale determined in Table 1, a hierarchical model of needs indicators was constructed, and a survey questionnaire was designed and distributed. A total of 56 higher vocational students participated in scoring the IF-AHP scoring sheet. After filtering, 43 valid questionnaires were obtained, with an effectiveness rate of approximately 76.79% (as shown in Figure 2).

Upon further examination of the 43 valid questionnaires and following the procedure outlined in Formula (1), 34 questionnaires that did not pass the consistency test were eliminated, and an additional 6 were discarded through manual selection due to being filled out inattentively. Consequently, 3 questionnaires suitable for Intuitionistic Fuzzy Analytic Hierarchy Process analysis were obtained. Based on the scoring of these three students and applying Formulas (2) to (5), the weights of the secondary indicators for mental health education needs were determined as:

$$\sigma^1 = (0.095, 0.095, 0.076, 0.125, 0.076, 0.125, 0.062, 0.070, 0.074, 0.077, 0.127)$$

$$\sigma^2 = (0.088, 0.114, 0.095, 0.095, 0.090, 0.116, 0.072, 0.072, 0.062, 0.074, 0.122)$$

$$\sigma^3 = (0.099, 0.099, 0.074, 0.122, 0.122, 0.074, 0.068, 0.068, 0.068, 0.102, 0.102)$$

Utilizing the computational formulas (6) to (10) of the Entropy Weight Method, the expert weights of the three students were calculated to be 0.356, 0.335, and 0.309, respectively. By aggregating these expert weights with their scoring results, the final weights and importance ranking of the student mental health service need indicators were obtained, as shown in Table 2.

$$\sigma = (0.068, 0.068, 0.068, 0.099, 0.099, 0.122, 0.074, 0.074, 0.122, 0.102, 0.102)$$

5. Discussion

5.1. Academic Pressure Pronounced, Internet Addiction Prevalent

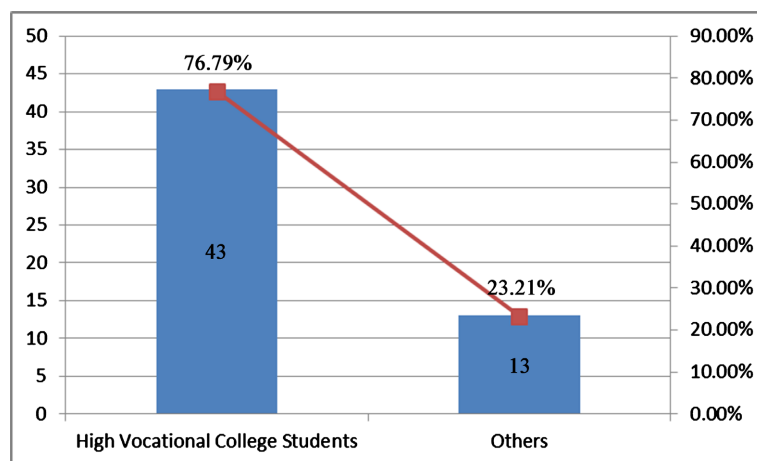This study, through an analysis of the weight of indicators for the mental health

Figure 2. Identities of the scorers.

Table 2. Importance ranking of mental health education need indicators for higher vocational college students.

Primary Indicators:	Secondary Indicators:	Weight	Ranking under Primary Indicators	Overall Ranking
X1 Social Anxiety	X11 Concern about being isolated by social groups	0.038	2	10
	X12 Feeling exhausted in social relationships	0.064	1	7
X2 Romantic Setbacks	X21 Difficulty moving on from sadness post-breakup	0.089	2	5
	X22 Repeated disappointments in pursuing romantic relationships	0.096	1	4
X3 Academic Stress	X31 Lack of interest in studies	0.129	2	2
	X32 Desire to improve academic performance but feeling incapable	0.147	1	1
X4 Employment Pressure	X41 Uncertainty about future employment direction	0.048	2	9
	X42 Setting high employment goals but lacking the ability to achieve them	0.018	3	11
	X43 Disinterest in employment, preferring to rely on parents	0.053	1	8
X5 Internet Addiction	X51 Reluctance to quit internet addiction, enjoying immersion in the online world	0.107	1	3
	X52 Desire to overcome internet addiction but finding it challenging to do so	0.072	2	6

education needs of vocational college students, finds that indicators related to academic pressure are more important compared to other mental health education needs. This discovery points out that the main psychological stress faced by vocational students stems from the challenges of learning. Particularly for those students who faced setbacks in college entrance exams and then transferred to vocational colleges, they encounter difficulties in adapting to new teaching methods and enhancing their self-learning abilities. For students who lack interest in their studies but still need to participate in educational activities, they may feel increased psychological pressure due to their peers' diligence, with internet addiction becoming their primary way of diverting attention. Therefore, in providing mental health education to students, vocational colleges can invite outstanding alumni to share their learning experiences and organize book sharing sessions and weekly skill workshops within the class to create an atmosphere of loving learning and skills among the student body. This is especially encouraging for those who like to play with their phones during class, stay up late playing games, or browse short videos, as it increases their sense of achievement and distracts their attention from the internet, enabling them to devote more energy to studying, life, and self-improvement.

5.2. Love Setbacks Hard to Overcome, Social Exhaustion Common

The research results indicate a strong need for mental health education among vocational college students in dealing with setbacks in romantic relationships, particularly in cases of unrequited love or repeated romantic failures. Considering that most of these students are around 20 years old and are still in the

process of developing mature perspectives on love, they frequently encounter repeated disappointments and difficulties in moving past breakups during their romantic pursuits. Vocational colleges can provide mental health education by offering elective courses like "College Students' Perspectives on Love," which can help students build emotional confidence and resilience against psychological challenges. Additionally, students also face challenges in their interactions with classmates and roommates. They often feel exhausted and uneasy in social situations, worried about being ostracized by their social groups, leading to social anxiety. Therefore, vocational colleges should assist students in developing positive and healthy social perspectives as part of their mental health education. This could include organizing various social activities and emotional management courses to enhance social skills, thereby strengthening students' self-awareness and ability to manage emotional issues effectively.

5.3. Pervasive Employment Apathy, Preference for Indolence over Ambition

The analysis of indicator weights in this study reveals a prevalent attitude of apathy towards employment among vocational college students, characterized by a lack of interest in job searching, a tendency to depend on parents for a passive lifestyle, and confusion about future career paths. To address this attitude, vocational colleges should implement a variety of measures within their mental health education programs to cultivate a proactive and ambitious employment mindset among students. For instance, organizing seminars on career development and mental health, introducing courses in workplace psychology, and encouraging active participation in internships and social practice activities can facilitate a better understanding of professional fields among students, help in clarifying their career planning, and alleviate anxieties about the future.

This study initially established a system of indicators for the psychological health education needs of vocational college students, and determined the weights and importance rankings of these indicators through the Intuitionistic Fuzzy Analytic Hierarchy Process (IF-AHP) and the Entropy Weight Method. Based on the weights of these indicators, recommendations for improvements in psychological health education in vocational colleges were provided. However, this process primarily relied on secondary data surveys and qualitative analysis, lacking the rigor of quantitative analysis. Additionally, the limited number of valid questionnaires might lead to deviations between the survey results and actual scenarios. Therefore, future research could incorporate quantitative analysis methods such as reliability and validity testing during the indicator selection phase to enhance the study's rigor. Moreover, increasing the sample size in questionnaire surveys would also ensure the reliability of the survey results.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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