

# Artificial Intelligence-Based Penetration Analysis of Mental Health Education in Higher Vocational Culinary Chinese Education

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**Abstract:** In China, mental health education for students is currently a prominent focus of psychological research. On the other hand, recent studies use a questionnaire evaluation and analysis to examine students' capacity to acclimate to the college experience. A thorough examination of psychological education had conflicting results. As a result, this research emphasizes how Chinese language instruction affects culinary vocational students' views of mental health education. For this study, student and education datasets are first obtained. The education dataset is normalized using the normalization approach in the preparation step to remove any unnecessary education data. After that, at the feature extraction step, the variation auto encoder (VAE) is used to convert the original input into various features. Regarding evaluating the college student's competence, the penetration analysis uses three models: the Pearson chi-square test, McNemar test, and Fisher's exact test. This study's performance is evaluated in terms of learning correctness, satisfaction, learning interest, and pre-and post-education evaluation, as well as compared to other studies to achieve the highest effectiveness in culinary students in the use of mental health education. The Origin tool is used to visualize the results of this study.

**Keywords:** Mental Health Education, penetration analysis, Normalization, variational autoencoder (VAE), Pearson Chi-Square test, McNemar test, Fisher's exact test, Origin tool, Artificial Intelligence.

## 1 Introduction

Mental health issues cause significant misery and substantial health care expenses to people and families. Vocational students are a unique demographic group going through a vital developmental transition from childhood to adulthood. Increasing research points to Vocational students as a high-risk demographic for mental health issues. While certain protective features (e.g., more excellent education) may assist vocational students, many socio-demographic variables may enhance their sensitivity to mental health issues. For example, the frequency of mental diseases varies with ethnicity. Low parental education seems to be a significant risk factor for depression among culinary vocational students. Other characteristics that may affect an individual's mental health include marital status, residence, discipline, birthplace, parental employment, and family size Taye et al., (2020). Teachers may assess students' psychological and mental health by observing their behavior in and out of class and provide psychological support to assist them in improving their academic performance. The talent training program's curriculum is complementary.

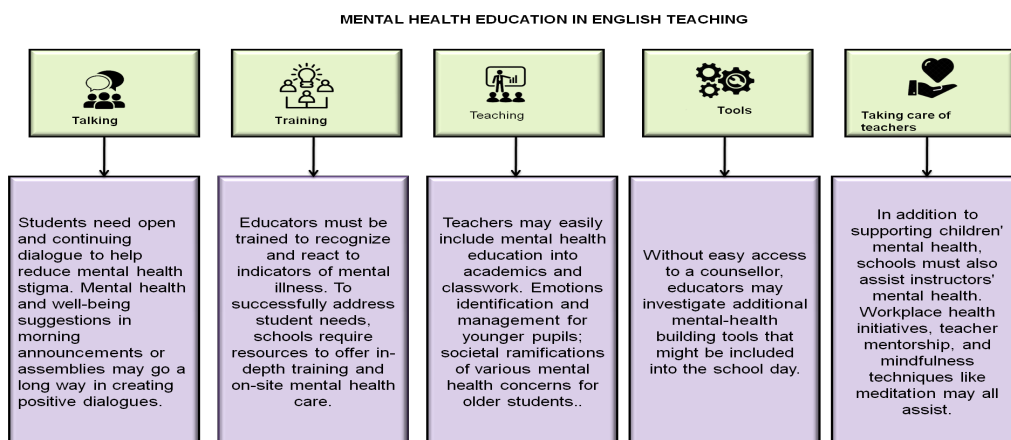
Due to inadequate and shallow comprehension of curricular group creation, instructional information across courses is seldom interoperable. Moreover, pupils' capacity to transfer data and construct a three-dimensional cognitive framework is limited. To successfully establish a professional thinking system, Shan and Liu (2021), investigating the importance of integrating the curriculum, progressively breaking down curricular boundaries, and employing more scientific teaching techniques. Fig. 1 depicts mental health education in Chinese teaching.

Untreated mental health issues in youth and early adulthood may negatively impact relationships, employee productivity, and income as an adult. Aside from the negative social consequences, mental health issues may lead to physical diseases. Adults without major mental health issues often live 25 years longer than those with untreated medical conditions. Despite the prevalence of mental health issues, many do not obtain adequate care. In reality, 40% of college students report not receiving mental health therapy. Also, according to a recent SAMHSA survey, fewer than half of individuals with mental health

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issues got treatment last year. The research also found that 63 percent of persons with significant mental health issues,

process, according to the innovative Chinese curriculum level. Because of this, we must incorporate mental health



**Fig.1:** Mental Health Education in Chinese teaching.

including severe depression, got help in the past year. The treatment gap between individuals who require mental health care and those who get it is obvious, and it is primarily due to the multiple challenges this community faces. A typical deterrent to getting therapy is the belief that one does not have a mental health issue. Vidourek and Burbage (2019), in their study, explained that more students seeking mental health care and counseling center expenditures have stayed stable over the last decade. By 2016, 88 percent of college counseling centers reported a staffing shortfall due to increased utilization and restricted funds. It takes an average of 5 days to get an appointment at certain college counseling services. There is a rising demand for primary-level preventative activities utilizing a public health perspective to promote improved mental health on college campuses as more students seek assistance from college counseling facilities and wait times for appointments expand (Gibbons et al., 2019).

Students acquire skills in a secure environment so that they may become safe, predictable, and capable practitioners. Between the classroom and practice, students may have contradictory experiences comprehending the user's experience and applying newly taught abilities. For example, Ronning and Bjorkly, (2019), has highlighted that group practice-based training is excellent for developing phenomenological awareness and therapeutic attitude. Moreover, group-based reflection on therapeutic communication skills might be taught via simulation, role-play, and reflective practice. Students' psychology and various mental behaviors significantly influence their Chinese learning process; As a result, while caring for them, it is critical to pay attention to their physical and emotional wellbeing. We must give importance to every student's emotional state, encourage their enthusiasm for studying Chinese and give them better self-esteem and personality as they progress through the language-learning

education into Chinese teaching, focusing on students' cognitive abilities and emotional lives, to promote a harmonious balance between students' understanding, feelings, purpose, actions, and personal attributes.

When it comes to mental health education, Chinese language instruction has a significant impact on students' attitudes. Data from students and educational institutions are the starting point of this investigation. Following are the contributions of this work: By employing the normalization approach, we may balance the raw data without irrelevant or repetitive data. For extracting the significant attributes of the students from the normalized data, the VAE technique is utilized. The Pearson chi-square test, McNemar test, and Fisher's exact test are applied for performing the students' penetration analysis regarding Chinese teaching and mental health education. The origin tool is also used to depict the outcomes of this research in chart form.

The remainder of the description is divided into Segment 2: related works and problem definition, Segment 3: the proposed methods, Segment 4: result and discussion, and Segment 5: conclusion.

## 2 Related Works

QuEChERS with GC-MS was used to assess the testing technique. The results demonstrated that the students might see how nursing instructors' outlooks on the influence and development of mental health education in their courses (Rodrigues et al., 2019). In his study, Liu (2021), demonstrated a three-level network of mental health education and crisis response. However, the school's mental health education and counseling center have gradually become important in mental health education. Mental education has fully utilized their initiative and enthusiasm, effectively expanding the mental health education staff to

provide students with comprehensive services at various levels. Zhao and Zhang (2022), described the College Students (CS)' MHE (Mental Health Education) dual classroom teaching methodology. A paradigm of the online+offline dual classroom teaching method of CS MHE was built to improve the psychological quality. The study outcomes demonstrated an increase in CS mental health (Yumei & Wu 2021). Further, the authors examined positive psychology-based student management, emphasized positive personality, and developed a technique for dynamically studying students' thinking. The study of Qiao (2020), found that a mental health education course for college students has outstanding application, experience, and a diversity of teaching evaluation methods in the teaching process. Considerable consideration was devoted to this idea. A study conducted by Peterman et al. (2020), the goal was to examine the need for education in dealing with mental health issues from the cradle of adolescence. Given that the emergence of mental health illness is more common among younger people presumed to be in that category of educational accomplishment. Among other things, a complete curriculum redesign was proposed to address school-related mental health difficulties. The goal was to enhance students' mental health education, the Internet has provided many new resources and opportunities, and its usage may increase mental health education efficiency (Zhang, 2020). Since mental health education is important in improving students' overall development, this will impact total mental health education. The Internet presents unique possibilities and problems for educators and students alike, necessitating a critical examination of contemporary mental health teaching models and techniques. Liu et al. discussed the ID3 method's main material by constructing tree building algorithm. They used decision trees to predict the mental health status of an individual, and the decision tree application integration approach in MIS was studied (Liu, 2021). The study leverages computers to create a university mental health teaching platform, while big data analysis is used to assess student mental health (Liu & Liao, 2021). A study by Singh et al. (2022) employed RNN with LSTM to forecast depression using texts, which could also help prevent mental diseases and suicide attempts. Characteristics used here can considerably aid machine learning and lead to a better user experience for better services. In mental health facilities, identifying anxiety or depression from texts could forecast the ordinary and serious stages of depressive disorders. Sharing a healthcare plan strategy for everyday life status monitoring, location analysis, and mobile phone usage assessment has been proposed by (Javed et al., 2020). This strategy aims to promote cooperation across all participants in the healthcare system. According to this research, such a collaborative strategy can make a significant difference in a difficult setting. They have developed a structure that enables physicians, guardians, and representatives of the patient's immediate circle of friends and family to collaborate to create a shared healthcare process for

patients. The strategy has not been evaluated in a real context with actual people with medical problems as test subjects, which is a key shortcoming of this work. Shao and Abualhamayl (2021), include a differential equation scheme to motivate learners to engage in academic listening and continuous learning. Researchers could increase student protection and resistance by integrating enrollment quality assurance with viral infection transmission mechanisms (Hasanuddin & Siregar, 2022). Affected persons' need special education that focuses on key concerns. Throughout the entire process, academic education must be addressed. In addition, they must conduct in-depth research into certain problems. Bi and Zhang (2020), conducted a study on effective mental health counseling. They demonstrated that it is hard to incorporate a penetration strategy that does not consider the significance of Chinese education for mental health professionals and educational platforms. Table 1 depicts the explanation of the current research in tabular format.

**Table 1:** Description of current research.

References	Explanation	Drawbacks
Rodrigues et al., (2019).	As per this work, the students may see how nursing instructors' perspectives on many fields influence the development of mental health education in their courses.	Practicum education in mental health must consider the institution's interests and the organization's social, economic, and political drivers. Students in nursing programs need to reconsider the current state of mental health education by taking a critical attitude and engaging in political activism.
Liu (2021).	A three-level network of mental health education and crisis response is described. However, the school's mental health education and counseling center has gradually become a vital force in mental health education work and has fully utilized their	Lack of efficiency

	initiative and enthusiasm, effectively expanding the mental health education staff to provide students with comprehensive services at various levels.			stages of depressive disorders.	
			Javed et al., (2020).	Sharing a healthcare plan strategy for everyday life status monitoring, location analysis, and mobile phone usage assessment has been proposed in [27]. This strategy aims to promote cooperation across all participants in the healthcare system. According to this research, such a collaborative strategy can make a significant difference in a complex setting. They have developed a structure that enables physicians, guardians, and representatives of the patient's immediate circle of friends and family to collaborate to create a shared healthcare process for patients.	The strategy has not been evaluated in a natural context with actual people with medical problems as test subjects, which is a vital shortcoming of this work.
Qiao (2020).	According to the author, a mental health education course for college students has good application, experience, and a range of instructional evaluations in the teaching process. Considerable consideration was devoted to this idea.	Additional research is required.			
Liu and Liao (2021).	This research created a university mental health teaching platform; the study leverages computers, while extensive data analysis is used to assess existing student mental health.	Big Data is only a technique for analyzing large amounts of data. Proper study and innovation in mental health teaching necessitate instructors and professionals with backgrounds in psychology.			
Amanat et al., (2022).	They used RNN with LSTM to forecast depression using texts, which could help prevent mental diseases and suicide attempts. Characteristics used here can considerably aid machine learning and lead to a better user experience for better services. In mental health facilities, identifying anxiety or depression from texts could be used to forecast the ordinary and severe	Limited samples		Shao and Abualhamayl (2021). This author includes a differential equation scheme to motivate learners to engage in academic listening and continuous learning. Researchers could increase student protection and resistance by integrating enrolment quality assurance with viral infection transmission mechanisms. 'Affected persons' need special education that focuses on critical concerns.	Throughout the entire process, academic education must be addressed. In addition, they must conduct in-depth research into specific problems.

## 2.1 Problem Statement

In the Chinese teaching for higher vocational cooking major students, due to the outstanding shortcomings of the existing education system, teachers often strengthen literary knowledge, reading and writing skills in class, while ignoring the development of learners. After decades of hard work, although Chinese students have learned reading skills, mastered writing skills, and memorized many writers' works, they are still prone to making communication errors. This illustrates that even if students acquire some basic language skills, they are unable to use them effectively in the workplace. With the increase in cross-cultural and transnational contact, higher vocational Chinese language teachers are facing new challenges. Requirements for students wishing to learn applied language skills have increased significantly. The lack of a professional language learning environment is a major problem. The new Chinese language classes are running very efficiently because students are eager to learn about the career topics they have just encountered and are willing to try new things. As time goes by and the difficulty of knowledge increases, many learners begin to lose their way. Since the effectiveness of the teaching process is directly related to students' success, we strive to find the most enjoyable combination of higher vocational Chinese teaching and mental health education.

## 3 Proposed Work

The proposed research looks at how Chinese language instruction affects students' views of mental health education. Initially, this study collects student and educational statistics. During preprocessing, the education dataset is normalized to remove unnecessary education information. Culinary vocational students in China get mental health instruction, and the analysis employs student capacity models (3 models). The models include Pearson chi-square, McNemar, and Fisher's exact test. Fig.2 indicates the schematic representation of this research.

### 3.1 Survey Design and Data Collection

The data collection process commenced on May 26th and concluded on June 3rd, 2023. Initially, the survey targeted students solely in Jiangsu province. However, due to a low response rate, the survey's scope was expanded to encompass a more diverse representation by including students from Shaanxi, Hubei, Beijing, Heilongjiang, and Guangdong provinces.

### 3.2. Sampling Strategy

The survey aimed for a representative sample by extending beyond a single province, encompassing diverse regions across China. This expansion sought to capture a broader demographic and geographic representation among vocational students.

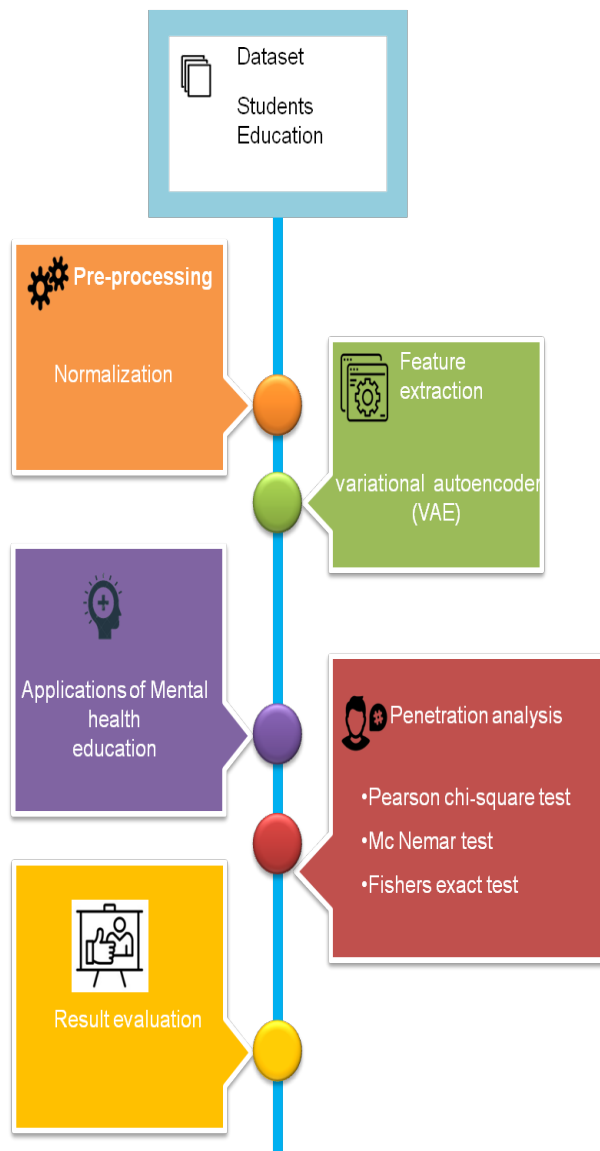


Fig. 2: Depiction of the complete research.

### 3.3 Demographic Factors

The survey considered key demographic factors such as gender, age distribution, academic domain (for example, Science and Engineering, Economic Management, Social Science/Art, Other Domains), and education degree (for example, UG, PG, PhD, Professional).

### 3.4 Statistical Analysis

The collected data was analyzed in terms of seeking social support, avoidance, mental disengagement, and humanitarian aspects. This analysis included counts and percentages for each factor within the surveyed population to provide a comprehensive overview.



### 3.5 Enhancing Validity

The inclusion of multiple provinces and a diverse range of academic domains and educational degrees aimed to ensure a more robust and comprehensive representation of vocational students' perspectives on mental health education.

Overall, the survey design sought to mitigate biases by expanding the participant pool across various regions and demographics, aiming for a more inclusive and representative sample of vocational students in China. This broader scope enhances the study's validity by encompassing a diverse range of perspectives and backgrounds, thus strengthening the potential generalizability of the findings.

**Table 2:** Data description.

Factors	Count (n)	percentage	
Gender			
Male	225	40.23	
female	334	59.54	
Age			
18-22	280	51.02	
23-27	191	34.66	
28-32	65	11.23	
>33	22	3.41	
Domain			
Science and Engineering	125	22.56	
Economic management	326	58.32	
Social Science/Art	57	10.26	
Other domains	51	8.69	
Education degree			
UG	336	58.33	
PG	152	28.45	
PhD	56	9.88	
Professional	10	2.6	

### 3.6 Education

According to the study of Haslam and Lusher (2011), clinical psychology has the most history in the psychological study of mental health, focusing on examining and treating mental illnesses and disorders that may help individuals feel better or inspire positive sentiments in pupils.

### 3.7 Preprocessing using Normalization

Incomplete or fraudulent data are shared in unfiltered data. It was cleaned and standardized to eliminate recurring and duplicate sounds and missing data. The size of university records necessitates specimen compression.

Image retrieval algorithms are required to filter out the non-significant features from the dataset. Pre-processing might normalize the dataset. The c-count is defined as follows in Equation (1):

$$C = [(N - \beta) / \tau] \quad (1)$$

The mean of the data  $\beta$  is expressed here, while the  $\tau$  standard deviation is hinted. And C is (Equation (2)):

$$C = \frac{N - \bar{N}}{Sd} \quad (2)$$

The specimen's mean is N, and the standard deviation is Sd.

An example of a random specimen as in Equation (3):

$$C_s = \delta_0 + \delta_1 N_p + \rho_r \quad (3)$$

The defects that depend on  $\tau^2$  are represented by p.

As seen in Equation (4), the faults should not be interdependent.

$$i_n \sim \sqrt{D} \frac{i}{\sqrt{i^2 + d - 1}} \quad (4)$$

The random parameter is I.

Then standardizes the variable's movements using standard deviation for calculating the momentary scale deviation, as in equations (5) and (6).

$$MMS = \frac{\mu^{mms}}{\theta^{mms}} \quad (5)$$

Here, momentary scale is denoted by mms.

$$\mu^{mms} = \text{Ex}(N - \beta)^{MMS} \quad (6)$$

N = random variable, Ex = anticipated values.

$$\theta^{mms} = (\sqrt{\text{Ex}(M - \beta)^{MMS}})^2 \quad (7)$$

$$i_d = \frac{mms}{N} \quad (8)$$

From equation (8), the coefficient of variance is denoted as  $i_d$ . Setting all parameters to 0 or 1 stops the characteristic scaling operation. This method is called unison-based Normalization. This is the typical formula (Equation (9)).

$$N' = \frac{(i - i_{min})}{(i_{max} - i_{min})} \quad (9)$$

The information may be maintained after Normalization, and its length and irregularity can be preserved. This phase reduces or eliminates information delays. It may then be utilized to feed the following stages.

### 3.8 Feature extraction using variational autoencoder (VAE)

VAE differs from auto-encoder because it gives a statistical way of defining the data collection observations in latent space. So with VAE, the encoder has a probability distribution throughout the bottleneck layer rather than producing a single result. The VAE's entire layout is depicted in Figure 3.

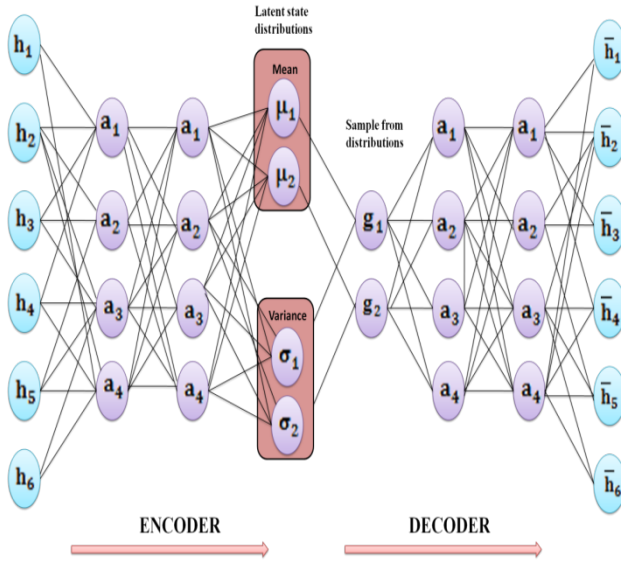


Fig. 3: Framework of VAE.

### 3.9 Choice of VAE for Feature Extraction

The selection of Variational Autoencoder (VAE) for feature extraction stems from its distinct ability to define observations within a dataset in a latent space statistically. Unlike traditional autoencoders that produce a deterministic bottleneck layer output, VAE employs a probabilistic distribution throughout the bottleneck layer, allowing for greater flexibility in representing the data.

### 3.10 Rationale behind VAE Selection

The rationale for opting for Variational Autoencoders (VAE) in this study is rooted in their unique suitability to capture the intricate relationships between Chinese language instruction and mental health education in vocational culinary students. VAE's capacity to represent complex data in a latent space using probabilistic features aligns with the nuanced nature of understanding how language instruction influences mental health perceptions. By handling uncertainty through probabilistic modeling, VAE accommodates the multifaceted aspects inherent in students' attitudes towards mental health education in a vocational setting. The incorporation of KL-divergence in the loss function enables the model to minimize discrepancies between perceived and actual distributions,

aligning with the study's goal of accurately representing the intricate interplay between language instruction and mental health education. Hence, VAE emerges as an apt choice, offering a framework to uncover the subtleties and uncertainties within the dataset pertaining to vocational culinary students' perspectives on mental health education influenced by Chinese language instruction.

### 3.11 Practical implementation of VAE

The VAE's implementation starts with the encoder, which transforms the input data into a latent space where each feature is represented by a probability distribution. This step enables the extraction of essential characteristics in a more flexible and nuanced manner, accommodating uncertainties present in the dataset. Subsequently, the decoder reconstructs the data based on these probabilistic representations obtained from the encoder. By leveraging these probabilistic distributions instead of fixed values, the decoder effectively learns to generate outputs that encapsulate the inherent variability and complexity of the original dataset. This approach enhances the model's ability to capture intricate patterns and variations within the data, contributing to a more comprehensive feature extraction process.

A distribution  $g$  is given, and we wish to create a random sample of the form  $h$  from it. To put it another way, we're trying to figure out  $P(g|h)$ .

We may accomplish this by following equation (10):

$$P(g|h) = \frac{P(h|g)P(g)}{P(h)} \tag{10}$$

$P(h)$  could be hard to calculate, however, as in equation (11).

$$P(h) = \int P(h|g)P(g)dg \tag{11}$$

This frequently results in a distribution that is difficult to solve. As a result, to obtain a feasible distribution, we must close  $p(g|h)$  to  $q(g|h)$ . As a first step, we'll attempt to decrease the KL-divergence loss, a measure of how two very similar distributions are together (as in Equation (12)).

$$\min KL(q(g|h)||P(g|h)) \tag{12}$$

The preceding "minimization problem" can be solved to the below "maximization problem" by reducing the problem depicted in Equation (13).

$$W_{q(g|h)} \log P(g|h) - KL(q(g|h)||P(g)) \tag{13}$$

Reconstruction probability and similarity to previous distribution  $p$  were first and second terms, respectively.

Two phrases make up the complete loss as indicated in equation (14), reconstructive error and KL-divergence loss:

$$\text{loss} = M(h, \hat{h}) + \sum_j KL(q_j(g|h)||P(g)) \quad (14)$$

As a result, the underlying codes retain their analytical properties, making the decoder more user-friendly and the process more efficient. The decoder then attempts to get the model information using the underlying regulations. A neural network with weight, for example, “ $\mathbf{Y}$ ” indicates a conditional probability (shown in Equation (15)),

$$P_{\mathbf{Y}} = (g|h) \quad (15)$$

It is necessary to apply a new VAE approach. To preserve ambiguity within the networks, the decoder's sources are derived from the distribution of underlying codes. The encoder is then designed to create two factors: the average and deviation vector of the underlying regulations. The two components are then combined to form a normal distribution, which is subsequently utilized to choose a signal for the decoder.

### 3.12 Penetration analysis

For mental health education, penetrating behavior is the most essential and fundamental method and an increasingly crucial aspect of students' overall development.

### 3.13 Pearson Chi-Square test and its significance

The Pearson Chi-Square test holds significant relevance due to its efficacy in hypothesis testing, particularly in scenarios where factors are minimal, resembling conditions often found in medical trials. This statistical method distinguishes itself by providing precise insights into the significance of variability and effectively identifying specific groups responsible for these distinctions (as elucidated in Equation (16)) below.

The Chi-Square analysis offers valuable capabilities to assess the importance of variability within categorical data. It does not merely identify differences but also elucidates which groups contribute to these variations, making it an indispensable tool for this research context. In this study focusing on the influence of Chinese language instruction on students' perceptions of mental health education, the Chi-Square test serves as a robust means to analyze potential differences among student demographics. Its ability to provide specific information on group distinctions adds depth to the analysis, enabling a nuanced understanding of variations in perspectives regarding mental health education across different demographic groups. This test significantly enhances the study's comprehensiveness by revealing nuanced insights within the dataset.

$$\sum y_{j-k}^2 = \frac{(P-F)^2}{F} \quad (16)$$

Where: P = present point

F = real point

$Y^2$  = Chi-square value

$\sum Y^2$  = Total of all cell Chi-square values.

Expected Chi-Square values are determined as equation (17):

$$F = \frac{N_S \times N_D}{O} \quad (17)$$

Where: F = reflects the work value of the unit,

$N_D$  = denotes that cell nucleus row edge,

$N_S$  = denotes that cell's row edge, and

O = reflects the sample group as a whole.

The sample size is split by the product of the row marginal and the column marginal for each cell, and it is depicted in Equation (18).

$$y^2 = \frac{(P-F)^2}{F} \quad (18)$$

Correlation measures are statistical assessments of the strength of a relationship. The Cramer's V test is the most often utilized Chi-square strength test. Using the formula below, it's easy to calculate out, as in Equation (19):

$$\sqrt{\frac{y^2/O}{(l-1)}} = \sqrt{\frac{y^2}{O(l-1)}} \quad (19)$$

The Chi-square statistic is a powerful data analysis tool that may reveal much about the nature of research data.

### 3.14 McNemar test

A (2\*2) cross categorization of associated (or related) solutions to a dichotomous issue perfectly describes the McNemar testing. The McNemar testing is a form of chi-square assessment, which utilizes dependent (i.e., associated or matched) information instead of independent (unconnected) specimens. The important features for utilizing the McNemar test in this particular study is given below.

### 3.15 Rational behind the McNemar Test

The McNemar test, well-suited for assessing changes within related paired data, aligns seamlessly with this study focus on the impact of Chinese language instruction on students' mental health education perceptions. By specifically analyzing paired responses from pre and post assessments, this statistical tool evaluates alterations in the ratio of correct responses before and after treatment,



precisely addressing the study's objective. Its reliance on associated or matched data rather than independent specimens suits the paired comparisons in the research. The McNemar test ensures an assessment of equivalency between pre and post treatment correct response ratios, thus effectively uncovering shifts in students' mental health education perspectives following exposure to Chinese language instruction. Moreover the McNemar test is a non-parametric statistical tool that is distributed less and could be applied with non-normally distributed sets of data & samples. In a standard (2\*2) structure, Table 3 shows behavioral responses to one of the issues.

**Table 3:** Data configuration for assessment of associated solutions.

Pre-assessment	Post-assessment		
	Correct	Incorrect	Total
Correct	R	W	S <sub>1</sub> = R + W
Incorrect	T	U	N-S <sub>1</sub>
Total	S <sub>2</sub> = R + T	N-S <sub>2</sub>	N

Here, R=the percentage of participants that answered correctly in the Pre-assessment & Post-assessment.

W=the amount of participants who replied correctly on the Pre-assessment but wrongly on the Post-assessment

T=amount of participants who replied wrongly on the Pre-assessment but correctly on the follow-up

U=the number of participants who replied wrongly on the Pre-assessment & Post-assessment

N=amount of related matches in overall

S<sub>1</sub>=the overall amount of participants who replied correctly in the Pre-assessment

S<sub>2</sub>= the overall amount of participants who replied correctly in the Post-assessment

The P<sub>1</sub>=pre-assessment ratio of accurate solutions, i.e., (S<sub>1</sub>/N)

The P<sub>2</sub>=post-assessment percentage of correct answers, i.e., (S<sub>2</sub>/N)

Let's say we want to look at variations in the ratio of participants who received relevant solutions before and after the treatment. We'll verify and confirm that P<sub>1</sub> = P<sub>2</sub>.

The McNemar examine, in a manner, utilizes information from two inconsistent cells, W and T, when the modification has happened to assess the equivalency of the two ratios (i.e., marginal homogeneity).

The McNemar method's incorrect statistic is indeed a chi-square analysis (with one degree of freedom) indicated by (W - T)<sup>2</sup> / (W + T), whereas the correct statistic was (|W - T| - 1)<sup>2</sup> / (W + T).

### 3.16 Fisher's Exact test and its significance

The utilization of Fisher's exact test in this study derives from its unique applicability in scenarios involving small sample sizes, offering a precise determination of departure from expected principles without reliance on estimates that might become less accurate with larger sample groups. As the investigation encompasses varied provinces and demographic factors in evaluating mental health education perceptions influenced by Chinese language instruction, the Fisher's exact test stands out due to its suitability for any random model. Its computation involving binomial coefficients, efficiently computed using computer subroutines, avoids excessive factorial calculations. This test, named after its originator Ronald Fisher, facilitates precise determination of probabilities associated with table variations without necessitating factorial computations, ensuring a thorough assessment of the observed data's departure from expected patterns in the context of mental health education perceptions post-language instruction exposure.

$$Q = \frac{\binom{S_1}{g_{111}} \binom{S_2}{g_{211}}}{\binom{O}{D_1! D_2!}} \tag{20}$$

As per Equation (20), there are two binomial coefficients in the numerator, and in the denominator, there is a binomial coefficient. As a result, having a computer subroutine for computing a binomial coefficient is efficient. By calculating the binomial coefficient, they may avoid adding three factorials for each binomial coefficient, as indicated in equations (21) and (22).

$$\frac{O!}{Y!(O-Y)!} \tag{21}$$

$$\frac{(O)(O-1)(O-2)...(Y+1)}{(O-Y)!} \tag{22}$$

Feldman and Kluge demonstrated that after the chance of the table of expected data has been calculated, the possibility of each more severe table may be found using a simple approach that requires no factorials at all. If one label the lowest of the four table frequency as I, and the other three frequencies as Q, and f, in clockwise order from I (as in Equation (23)).

$$\hat{Q} = \frac{g_b g_e}{g_c g_d} Q \quad (23)$$

If the hypothesis being tested requires the other alternative one tailed probability, it may be calculated as equation (24):

$$Q = \frac{g_c g_d'}{g_b g_e} \hat{Q} \quad (24)$$

The second tail's  $Q_s$  are then added to  $Q_1$ , the probability specified above for the one-tailed test.

## 4 Result

The findings of psychological education penetration analysis differ. So, this research looks at how Chinese language instruction affects students' views of mental health education. Initially, this study collects student and educational statistics. During preprocessing, the education dataset is normalized to remove unnecessary education information. VAE is then used to extract features from the original data. Culinary vocational students in China get mental health instruction, and the penetration analysis uses three college student capacity models. The models include Pearson chi-square, McNemar, and Fisher's exact test. The existing method includes Meta-analysis, Person-centered analysis, Cross-sectional analysis, and Cluster analysis.

### 4.1 Learning Accuracy

Learning accuracy offers the classification of needed health information. We get more learning accuracy using the computation (25) than prior strategies.

$$A = \frac{(T+U)}{(T+U+V+W)} \quad (25)$$

Here, "true positive=T=amount of right forecasts of a positive sample, true negative=U=amount of right forecasts of a negative sample, false positive=V=amount of wrong forecasts of a positive sample, and false negative=W=amount of wrong forecasts of a negative sample." Fig.4 depicts the comparison of learning efficiency. Compared to the existing works (Meta-analysis, person-centered analysis, cross-sectional analysis, and cluster analysis), the proposed work has higher learning accuracy.

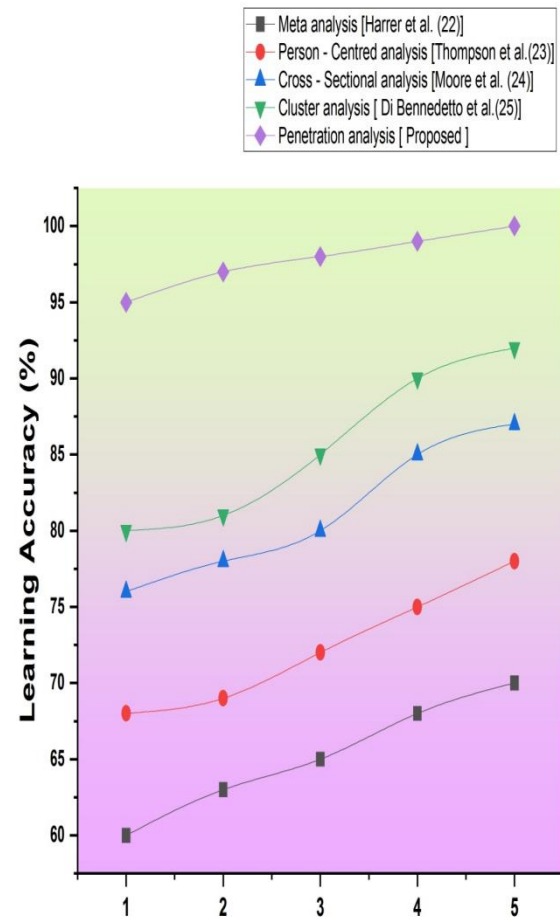


Fig.4: Comparison of learning accuracy.

### A. Satisfaction Level

Learning satisfaction is the outcome of students' engagement in education-learning activities. Fig.5 depicts the satisfaction level of proposed and existing methods. The suggested work is more accurate than current works (Meta-analysis, person-centered analysis, cross-sectional analysis, and cluster analysis).

### 4.2 Learning interest of Culinary vocational students

Students' interest in mental health education is described as their ease of interacting with the subject matter. According to the suggested approach for predicting student mental health through mental health education, Fig.6, we can calculate student interest in learning in the circumstances like completely inconsistent; the comparison does not match, uncertain, more in line with, absolutely suited.

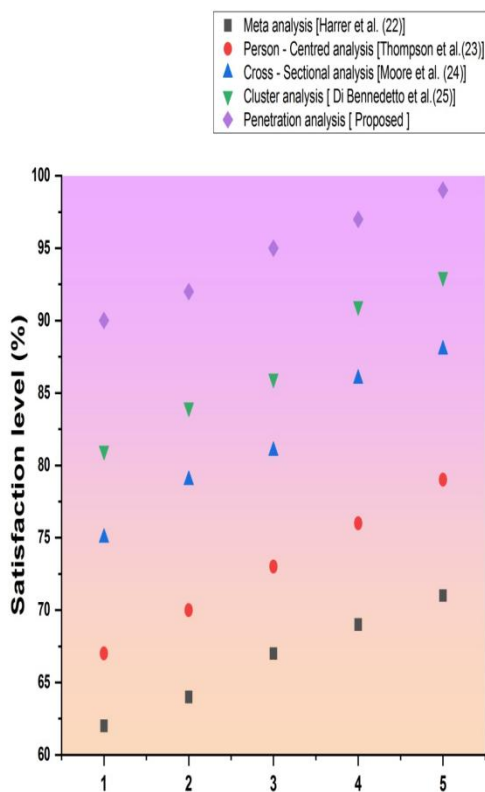


Fig. 5: Satisfaction level of proposed and existing methods.

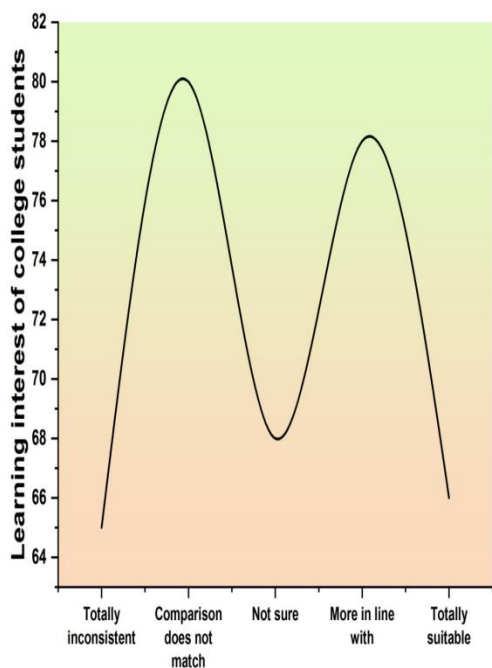


Fig.6: Learning interests of Culinary vocational students.

### 4.3 Analysis of Pre and post-education

To measure student mental health, provide mental health education, and evaluate the effects. Stress, anxiety, depression, and behavioral disorders are assessed pre-and post-education. Fig.7 shows the analysis of pre and post-education.

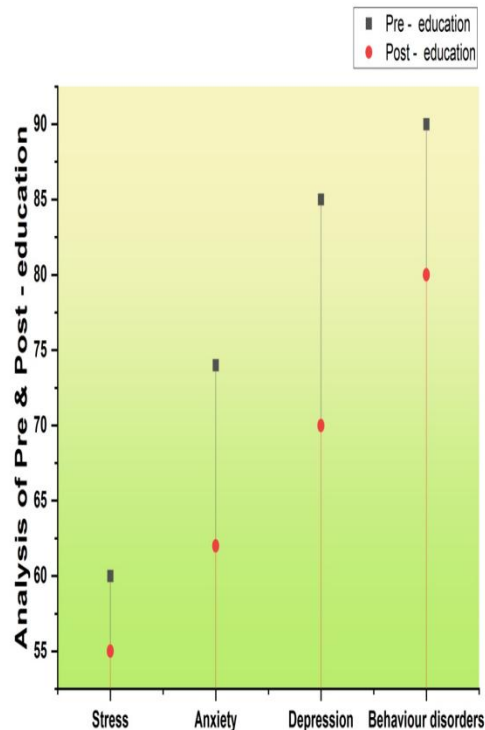


Fig. 7: Analysis of pre and post-education.

### 4.4 Results for Penetration analysis

The penetration analysis uses three models for the college student's capacity: Pearson chi-square, McNemar, and Fisher's exact test.

### 4.5 Pearson chi-square test

The parameters are normal, minimum to moderate, and severe to excessive in the Pearson chi-square test. Table.4 indicates the results of the Pearson chi-square test.

Table 4: Results of the Pearson chi-square test.

Coping strategy	Mean±SD	F	P
Seek help from others	1.96 ± 0.72	276.652	<0.001
Average	a, b		
To a limited extent severe to out of the	2.0 ± 0.86a		
	3.52 ± 0.25b		

ordinary			
Avoidance Average To a limited extent severe to out of the ordinary	2.13 ± 0.11 a, b 1.68 ± 0.45a 2.78 ± 0.33b	233.985	<0.001
Mental disengagement Average To a limited extent severe to out of the ordinary	1.97 ± 0.90 a, b 3.26 ± 0.65a 3.10 ± 0.11b	266.359	<0.001
Humanitarian Average To a limited extent severe to out of the ordinary	3.51 ± 0.71 a, b 2.63 ± 0.51a 1.97 ± 0.66b	246.481	<0.001

#### 4.6 McNemar test

Statistical analysis using the McNemar test, the feature includes coping strategy, mean and standard deviation, F-static, and probability value. Table.5 describes the results of the McNemar test.

**Table 5:** Results of McNemar test.

Coping strategy	Mean±SD	F	P
Seek social support Average To a limited extent severe to out of the ordinary	1.68 ± 0.22 a, b 2.06 ± 0.42a 3.04 ± 0.31b	271.112	<0.001
Avoidance Average To a limited extent severe to out of the ordinary	1.13 ± 0.61 a, b 2.68 ± 0.05a 1.78 ± 0.38b	234.255	<0.001
Mental disengagement Average To a limited extent severe to out of the ordinary	2.97 ± 0.95 a, b 3.51 ± 0.91a 2.16 ± 0.31b	259.312	<0.001
Humanitarian Average To a limited extent severe to out of the ordinary	2.16 ± 0.77 a, b 1.61 ± 0.11a 3.25 ± 0.58b	248.412	<0.001

#### 4.7 Fisher's exact test

In Fisher's exact test, the assessed features are seeking social support, avoidance, mental disengagement, and humanitarian. Table.6 illustrates the results of Fisher's accurate test.

**Table 6:** Fisher's exact test results.

Coping strategy	Mean±SD	F	P
Seek social support Average To a limited extent severe to out of the ordinary	1.25 ± 0.52 a, b 2.55 ± 0.19a 3.02 ± 0.77b	274.822	<0.001
Avoidance Average To a limited extent severe to out of the ordinary	1.93 ± 0.45 a, b 2.68 ± 0.81a 3.28 ± 0.49b	234.165	<0.001
Mental disengagement Average To a limited extent severe to out of the ordinary	1.62 ± 0.83 a, b 2.34 ± 0.63a 1.94 ± 0.40b	267.346	<0.001
Humanitarian Average To a limited extent severe to out of the ordinary	2.51 ± 0.68 a, b 1.59 ± 0.49a 3.01 ± 0.71b	241.470	<0.001

### 5 Discussion

Meta-analysis (existing) of potentially biased research may be quite misleading to mental health data. The erroneous result may be viewed as having higher credibility if bias is present in each (or some) of the individual research (Harrer et al., 2019). The Meta-analysis approach illuminates the nuanced impact they have on overall findings, offering a more accurate and refined understanding of mental health data. This methodological distinctiveness fosters a deeper level of credibility and reliability in the study findings. Moreover, the Person-centered analysis (existing) may result in increased personal and financial expenses, exclusion of particular groups, and exclusion of personnel, compassion fatigue, and unfairness owing to empathy (Thompson et al., 2021). Unlike methods leading to high costs, exclusions, and emotional strains, this Person-centered analysis provide a more holistic, cost-effective, and compassionate analysis. By avoiding biases and exclusions, it ensures fair representation and mitigates the emotional toll on personnel. Its emphasis on inclusivity fosters a more comprehensive understanding without sacrificing empathy. This approach emerges as superior by valuing ethical practice, inclusivity, and cost-effectiveness while enriching insights into mental health, positioning it as a groundbreaking and conscientious alternative to person-centered analysis. Furthermore, the Cross-Sectional analysis (existing) research teaches researchers about differences, not changes. Another concern is whether changes are due to age/development or generational/cohort effects (Moore et al., 2018). Unlike static cross-sectional

studies that merely outline disparities, our approach discerns dynamic transformations, distinguishing between developmental trends and cohort effects. By untangling these complexities, our study offers a nuanced understanding of evolving mental health landscapes, transcending the limitations of static comparisons and enriching insights into the intricate interplay of time, age, and generational influences. In Cluster-Analysis (existing) involves arranging items such that those in the same group (called a cluster) are more similar (in some sense) than those in other groupings (clusters) (Di, Towt & Jackson, 2019). The study employs cluster analysis to uncover nuanced mental health patterns. By grouping similar individuals based on diverse variables, this approach unveils distinct subgroups within the data, allowing for tailored interventions and targeted strategies. Cluster analysis facilitates a deeper understanding of heterogeneous mental health profiles, enabling personalized interventions and enhancing the precision of recommendations and treatments for diverse subpopulations. However, from this investigation, educators and students need to learn to express themselves emotionally healthy. It is the basis and foundation of successful mental health education. Teachers' perceptions matter most in creating a positive learning environment and eliciting positive feelings in children. As a result, instructors need to possess high levels of intellectual character, ethical practices, and outstanding mental qualities to approach their work enthusiastically, investigate new challenges in their task, and translate their striving for a study into a passion for learners. Classroom teachers must enter students' emotional worlds with very kind teaching quality, pleasant appearance, and delicate and entertaining language to make contact, conversation, and connectivity with students. Efficient practices like this will allow them to induce people with emotion and humanity; this will inspire people with feeling; this will honor students' individuality and emotions to achieve religious interaction, thinking significance; emotional resonance. Education in mental health begins and ends with respect and empathy for each other's feelings. Students' mental health will be improved to the maximum extent possible by incorporating mental health education into college Chinese classes as advocated by us. Hence, the findings of psychological education penetration analysis differ.

## 6 Conclusion

Mental health and academic achievement are linked. Everyone wants to help learners maximize their education. Students with depression or other mental diseases struggle to be motivated, study, concentrate or take examinations. The parameters include learning accuracy, satisfaction level, learning interest, and pre-and post-education using existing methods such as meta-analysis, person-centered analysis, cross-sectional analysis, and cluster analysis. The penetration analysis is carried out by employing three models, namely the Pearson chi-square test, McNemar test, and Fisher's exact test regarding assessing the college

student's capability, indicating better outcomes. Personnel involved in health promotion, such as counselors, administrators, and academics, are urged to discover ways to integrate contemporary intervention material into the fabric of higher education. The lack of a strategy for anticipating the students' mental associated traits is a disadvantage of this study. We can improve the research's performance even further if we utilize a hybrid CNN-LSTM method with an optimization approach to handling this problem.

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