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Measuring the effectiveness of a comprehensive evaluation of mental health education for college students in the new media environment

Chuan Liang[1,*]
[1] Mental Health Education Center, Shangqiu Medical College, Shangqiu, Henan, 476000, China
Corresponding authors: (e-mail: kittyliang2011@163.com).

Abstract The arrival of the new media era presents new challenges and opportunities for college students' mental health education. Modern college students face multiple pressures such as academics, employment and interpersonal relationships, and psychological problems are becoming increasingly obvious. This study assessed the implementation effect of college students' mental health education in the new media environment based on regression analysis. Data were collected through a questionnaire survey, 250 questionnaires were distributed and 226 valid questionnaires were collected, with a recovery rate of 90.4%. The evaluation model was constructed using principal component analysis and multiple linear regression analysis, and three common factors were extracted from 13 independent variables: teacher factor, basic factor and teaching factor, and mental health enhancement factor, with a cumulative variance contribution rate of 81.692%. Regression analysis showed that the R^2 of the model was 0.658, the adjusted R^2 was 0.584, and the F value was 20.825, which verified the validity of the model. The results of the assessment showed that the overall rating of the implementation of mental health education in the sample universities was 78.62, with the highest score at level 2023 (82.33), the second highest at level 2022 (79.71), and the lowest at level 2021 (74.46). It was found that the variables X3 (mental health and quality), X7 (evaluation of the teaching process), and X8 (professional competence of teachers) statistically significantly affect the educational effectiveness. Based on the results of the study, countermeasure suggestions such as innovating teaching methods, taking students as the main body, utilizing new media tools, carrying out practical activities, improving the quality of teachers and improving the evaluation system are proposed to provide reference for the improvement of the implementation effect of mental health education in colleges and universities.

Index Terms College students, mental health education, implementation effect, principal component analysis, multiple linear regression, new media environment

I. Introduction

In recent years, mental health disorders have become a “global disease” plaguing all countries, and China is no exception, especially mental health problems have gradually extended from adult groups to student groups [1], [2]. Mental health education is to improve the psychological quality of college students, promote their physical and mental health and harmonious development of education, is an important part of the talent training system in colleges and universities, but also an important content of moral education in colleges and universities [3], [4]. In recent years, under the background of new media and new technologies that profoundly change the way of learning and living of college students, mental health education in colleges and universities is also facing new opportunities and challenges.

Under the new media environment, the frequency of college students' application of the Internet has gradually increased, and the mixed quality of Internet information resources has brought both positive and negative impacts on college students' mental health [5]. The revolutionary development of new media technology has reconfigured the psychological growth environment of college students, and its positive empowering effect is not only reflected in the behavioral level of convenience, but also profoundly affects the internal mechanism of psychological development [6], [7]. For example, new media breaks the spatial and temporal limitations of traditional social interaction, constructs a social network ecology that interweaves reality and reality, provides college students with a more elastic psychological support system, helps college students to locate themselves in a wider social network, and alleviates the cognitive narrowing caused by the limitation of physical space [8]-[11]. In addition, the development of new media technology has also changed the paradigm of mental health knowledge dissemination, making it shift from traditional one-way indoctrination in the classroom to multi-dimensional, immersive and precise penetration [12]-[14]. However, the current mental health education in colleges and universities at the level of new media application still exists problems such as fragmentation of resources, formalization of interaction, and insufficient precision of intervention [15]-[17]. In the face of the new characteristics and new needs of the psychological development of college students in the new media era, how to break the time and space limitations of the traditional education model with the help of technological empowerment, and build a more era-adaptive mental health education system has become an important issue in the field of higher education that needs to be solved urgently [18]-[21].

Today's society is developing rapidly, and college students, as the main body of higher education, are faced with many challenges such as learning pressure, employment competition, and interpersonal relationships, and mental health problems are becoming more and more prominent. Mental health education in colleges and universities plays an important role in promoting the overall development of students and cultivating a sound personality. The wide application of new media technology has brought new opportunities and challenges to mental health education, and the traditional mental health education model has been difficult to adapt to the psychological characteristics and needs of contemporary college students. Evaluation of the implementation effect of mental health education in colleges and universities has become a key link to optimize the education process and improve the quality of education. At present, scholars at home and abroad focus on the research of college students' mental health education in terms of educational content, educational methods and educational modes, and there is a relative lack of research on quantitative assessment of the implementation effect of education. Existing research is generally characterized by unsystematic assessment indicators, a single assessment method, and a lack of targeted recommendations in the assessment results. Scientific assessment of the implementation effect of mental health education, identifying the influencing factors and formulating targeted strategies are of great theoretical and practical significance to improve the mental health education system in colleges and universities. The new media environment provides new teaching methods and channels for mental health education, and how to improve the effect of mental health education with the help of new media technology is a hot issue in current research. The evaluation of the effect of mental health education involves multiple dimensions and factors, which need to be analyzed by scientific statistical methods. Principal component analysis can effectively reduce the dimensionality and extract the key factors; multiple linear regression analysis can reveal the degree and significance of the influence of each factor on the educational effect, and provide data support for the improvement of educational practice.

Based on the above background, this study takes a university as an example, collects data by questionnaire survey method, and constructs an assessment model of the implementation effect of mental health education by using principal component analysis and multiple linear regression analysis. First, a questionnaire containing 14 survey questions was designed, from which 13 independent variables and 1 dependent variable were extracted to establish the evaluation index system; second, principal component analysis was used to extract the common factors and simplify the data structure; third, a multiple linear regression model was established to analyze the influence of each factor on the implementation effect of mental health education; finally, based on the evaluation results, strategic suggestions were proposed to improve the effectiveness of mental health education. This study objectively assesses the implementation effect of mental health education through quantitative analysis methods, explores the influencing factors, provides theoretical basis and practical guidance for the reform of mental health education in colleges and universities, and has practical application value for promoting the development of college students' mental health.

II. Survey research and empirical design

II. A. Questionnaire design

In order to evaluate the course teaching effect of mental health education for college students, this paper designed a questionnaire including whether the mental health education course of college students improved students' mental health awareness, whether they were satisfied with the teaching attitude of the teachers towards students, and whether they were satisfied with the teaching effect of the course, and a total of 250 questionnaires were distributed, and the survey subjects were mainly students in 2021, 2022 and 2023 of a university, and finally 226 valid questionnaires were collected, with a recovery rate of 90.4%. A total of 226 samples were finalized.

II. B. Reliability test

The article uses questionnaire survey method to collect samples and data, so it is necessary to analyze the reliability of the questionnaire design and reliability, according to the results of the reliability test, the alpha coefficient of the questionnaire design is 0.915, and the closer the alpha coefficient is to 1, it means that the questionnaire design is more reliable. Therefore, the questionnaire design of the article is reliable and reasonable, and the extracted data is reasonable, which can provide the basis for the next test.

II. C.System of evaluation indicators

Based on the results of the above questionnaire survey, combined with the characteristics of the course, the article extracted 13 independent variables and 1 dependent variable from 14 survey questions, and the evaluation index system of the implementation effect of college students' mental health education is shown in Table 1. 13 independent variables are the indicators of the implementation of college students' mental health education courses, and 1 dependent variable is the effect of the implementation of college students' mental health education.

Table 1: The evaluation index system of the effect of college students' mental health education

	Evaluation index	Symbol
Independent variable	Mental health awareness	X1
	Curriculum practical ability	X2
	Mental health and quality	X3
	Practical use of mental health knowledge	X4
	Teaching arrangement	X5
	Teaching attitude	X6
	Teaching process appraisal	X7
	Teacher's professional ability	X8
	Teachers' basic ability	X9
	Teacher attention	X10
	Teaching method	X11
	Student interest	X12
	Teaching material	X13
Dependent variable	Course implementation effect	Y

II. D.Research methodology

The article takes a school's mental health education program as an example, and uses the principal component analysis method and multiple linear regression analysis to evaluate the implementation effect of its college students' mental health education program.

II. D. 1) Principal component analysis methods

Principal Component Analysis (PCA) is a data dimensionality reduction technique, which can effectively decompose the original linearly correlated high-dimensional variables to obtain a set of linearly uncorrelated low-dimensional variables, each of which can reflect a certain feature of the original data. By extracting some of the low-dimensional variables, the required important information can be obtained from the data and feature extraction can be realized.

The essence of PCA algorithm is to obtain a set of basis vectors through transformation, which is a linear combination of basis vectors of the original data in the original space, and the i th principal component Y_i can be expressed as:

$$Y_i = a_i^T X \tag{1}$$

where X is the original data, the key to solve the principal components is to solve the basis vector a_i.

There are two main principles used in PCA algorithm to solve the basis vector a_i, which are the principle of variance maximization and the principle of covariance being zero. Its variance expression is:

$$D(Y) = D(aX) = a^T \Sigma a \tag{2}$$

where Σ is the covariance matrix of the original data.

Since a_i is a unit eigenvector, $a_i^T a_i = 1$. Therefore, solving the basis vector a_i of the first principal component can be transformed into an extremum problem, i.e., finding the maximum value of the variance $D(Y_1)$ under the constraint $a_1^T a_1 = 1$, with the expression:

$$\varphi(a_1) = D(Y_1) - \lambda(a_1^T a_1 - 1) = a_1^T \Sigma a_1 - \lambda(a_1^T a_1 - 1) \tag{3}$$

The expression is obtained by using the Lagrange multiplier method to derive a_1 and λ in turn:

$$\begin{cases} \dfrac{\partial \varphi}{\partial a_1} = 2(\Sigma - \lambda I)a_1 = 0 \\ \dfrac{\partial \varphi}{\partial \lambda} = a_1^T a_1 - 1 = 0 \end{cases} \tag{4}$$

where $a_1 \neq 0$, so in solving the problem of the system of equations $(\Sigma - \lambda I)a_1 = 0$, it can be converted into a process of solving for the eigenvalues of the covariance matrix, λ_i, with respect to the unit eigenvectors, a_i. Let the derived eigenvalue be λ_i and its corresponding unit eigenvector be a_i, it is obvious that the optimal solution of the system of equations is when λ_i takes the maximum value. Assuming that the maximum eigenvalue is λ_i, the corresponding unit eigenvector is a_1, which can be obtained by substituting into the variance equation:

$$a_1^T \Sigma a_1 = a_1^T \lambda_1 a_1 = \lambda_1 a_1^T a_1 = \lambda_1 \tag{5}$$

From equation (5), the variance of the first principal component $a_1^T x$ is the same as the largest eigenvalue of the covariance matrix. In order to reflect as much information of the original data as possible, any two principal components are required to be uncorrelated. The degree of linear correlation between two variables a_i and a_j can be described by the correlation coefficient $\rho_{a_i a_j}$, which is expressed as:

$$\rho_{a_i a_j} = \frac{Cov(a_i, a_j)}{\sqrt{D(a_i)}\sqrt{D(a_j)}} \tag{6}$$

where $Cov(a_i, a_j)$ represents the covariance of the variables a_i and a_j, which corresponds to the non-diagonal elements in the covariance matrix of the multidimensional data, with the expression:

$$cov(a_i, a_j) = a_i^T \Sigma a_j \tag{7}$$

When $Cov(a_i, a_j) = 0$, the correlation coefficient $\rho_{a_i a_j} = 0$, and the two principal components are uncorrelated, a principle known as the principle of covariance zero. Therefore, the constraints needed to solve for the second principal component are $a_1^T a_2 = 0$ and $a_2^T a_2 = 1$, and the Lagrangian function is:

$$\varphi(a_2) = a_2^T \Sigma a_2 - \lambda(a_2^T a_2 - 1) - \phi a_2^T a_1 \tag{8}$$

Deriving and making 0 for a_2 yields:

$$2a_2 - 2\lambda a_2 - \phi a_1 = 0 \tag{9}$$

Multiply the equation left by a_1^T to obtain:

$$2a_1^T \Sigma a_2 - 2\lambda a_1^T a_2 - \phi a_1^T a_1 = 0 \tag{10}$$

Since the first two terms are 0 and $a_1^T a_1 = 1$, we can see that $\phi = 0$, which can be obtained by substituting and organizing in the above equation:

$$(\Sigma - \lambda I)a_2 = 0 \tag{11}$$

As with solving for the first principal component, assume that the second largest eigenvalue derived is λ_2, the corresponding unit eigenvector is a_2, and the second principal component is $a_2^T x$, with the same variance as the eigenvalue λ_2. And so on, the i th principal component is $a_i^T x$ with variance λ_i.

Through the above analysis can be found out each principal component, because the purpose of principal component analysis is data dimensionality reduction so as to achieve feature extraction, so generally choose to retain the first k principal components to simplify the problem, so as to retain the effective information of the original data.

In order to more accurately determine whether the number of principal components selected meets the requirements, the method based on the eigenvalue is generally used to calculate the contribution of principal components to the original data. Define the contribution rate of the k th principal component to the original data as:

$$\eta_k = \frac{\lambda_k}{\sum_{i=1}^{m} \lambda_i} \tag{12}$$

Then the sum of the contributions of the first L principal components, i.e., the cumulative contribution, can be expressed as:

$$\eta_L = \frac{\sum_{i=1}^{L} \lambda_i}{\sum_{i=1}^{m} \lambda_i} \tag{13}$$

In practice, different variables may have different magnitudes, and directly solving for principal components sometimes produces unreasonable results. To avoid that effect, each random variable can be normalized before linear transformation.

Let $x = (x_1, x_2, \cdots, x_m)^T$ be an m-dimensional random variable, x_i be the i th random variable, $i = 1, 2, \cdots, m$, and let:

$$x_i^* = \frac{x_i - E(x_i)}{\sqrt{D(x_i)}} \tag{14}$$

where $E(x_i), D(x_i)$ are the mean and variance of the random variable x_i, respectively, when x_i^* is the normalized variable of x_i. In order to perform an effective principal component analysis, the operation is usually performed on the covariance matrix of the normalized variables. The specific operation steps are:

(1) Calculate the mean and variance of the original data, and subsequently use these statistics to normalize the original data to obtain the normalized data matrix.

(2) Calculate the covariance matrix of the normalized data matrix, and find the eigenvalues and eigenvectors of the covariance matrix to determine the number of principal components L.

(3) Construct L principal components based on the eigenvectors and the original data.

To recover the original data, a PCA inverse transformation is required to retain the first L columns of the eigenvectors in the matrix G consisting of the eigenvectors and set the other columns to zero, so the PCA inverse transformation can be expressed as:

$$\tilde{x} = (G^T)^{-1} y = Gy \tag{15}$$

where $\tilde{x}$ denotes the reconstructed dataset. Above is the principle and operational steps of PCA feature extraction method.

II. D. 2) Multiple linear regression method

Linear regression is a statistical method that utilizes statistical principles to explore how one or more variables affect an outcome, and can also be interpreted as a method of statistical analysis that examines the interrelationships between variables. And according to the number of variables, it can be divided into one-way linear regression and multiple linear regression.

Univariate linear regression refers to the fitting of a linear equation to the relationship between a variable and an outcome in a set of data, whereby the relationship between an independent variable (i.e., the independent variable) and a dependent variable (i.e., the dependent variable) is analyzed to find the most appropriate regression coefficient. Univariate linear regression analysis can be used to discover and describe complex equations between variables, to estimate parameters, and to construct predictive models. And both the independent and dependent variables follow a one-way linear equation:

$$y = ax + b \tag{16}$$

Multiple linear regression, refers to a linear equation to fit the relationship between variables and outcomes in a set of data, by which the relationship between multiple independent variables (i.e., multiple independent variables) and a dependent variable (i.e., dependent variable) is analyzed, and the most appropriate regression coefficients are calculated according to the requirements, and multiple linear regression is essentially an extension of univariate linear regression, which can be expressed as follows:

$$y = a_1 x_1 + a_2 x_2 + \cdots + b \tag{17}$$

Regression coefficients can be determined in a number of ways, the most prevalent of which is the least squares method, which centers on the idea of calculating the smallest sum of squares of the residuals. That is, to find:

$$S=\sum_{i=1}^{n}(y_i-\hat{y}_i)^2 \tag{18}$$

where S takes the minimum value. Assume that the sample regression function is:

$$\hat{y}_i=b+ax \tag{19}$$

The sample regression model is:

$$y=\hat{y}+\hat{u}=b+ax+\varepsilon \tag{20}$$

Then s is minimized under least squares:

$$\text{Min}S=\sum_{i=1}^{n}\left[y_i-(b+ax)\right]^2 \tag{21}$$

It is solved by taking partial derivatives of b and a and joining the two partial derivatives to obtain a regular system of equations:

$$\begin{cases}\dfrac{\partial S}{\partial b}=\sum_{i=1}^{n}-2[y_i-(b+ax_i)]=0\\ \dfrac{\partial S}{\partial a}=\sum_{i=1}^{n}-2x_i[y_i-(b+ax_i)]=0\end{cases} \tag{22}$$

Solution:

$$\begin{cases}b=\dfrac{\sum x_i^2\sum y_i-\sum x_i\sum x_iy_i}{n\sum x_i^2-(\sum x_i)^2}\\ a=\dfrac{\sum x_i^2\sum y_i-n\sum x_iy_i}{(\sum x_i)^2-n\sum x_i^2}\end{cases} \tag{23}$$

If the order:

$$\overline{x}=\frac{\sum x_i}{n},\overline{y}=\frac{\sum y_i}{n} \tag{24}$$

Then the solution can be written:

$$\begin{cases}b=\overline{y}-a\overline{x}\\ a=\dfrac{\sum(x_i-\overline{x})(y_i-\overline{y})}{\sum(x_i-\overline{x})^2}\end{cases} \tag{25}$$

Multiple linear regression is an extension of one-dimensional linear regression and is similar to one-dimensional linear regression, but requires the introduction of matrix operations.

Its sample regression function:

$$\hat{y}=b_1+b_2x_2+b_3x_3+\cdots+b_kx_k \tag{26}$$

The sample regression model is:

$$y=\hat{y}+\hat{u}=b_1+b_2x_2+b_3x_3+\cdots+b_kx_k+\varepsilon \tag{27}$$

The residual sum of squares is:

$$S=\sum(y_i-\hat{y})=\sum\left[y_i-(b_1+b_2x_{i2}+b_3x_{i3}+\ldots+b_kx_{ik})\right] \tag{28}$$

In order to find the minimum residual sum of squares, i.e., to find the partial derivative of b_j:

$$\begin{cases} \frac{\partial Q}{\partial \dot{\beta}_1} = -2\sum\left[y_i - \left(b_1 + b_2 x_{i2} + \ldots + b_k X_{ik}\right)\right] \\ \frac{\partial Q}{\partial \dot{\beta}_2} = -2\sum\left[y_i - \left(b_1 + b_2 x_{i2} + \ldots + b_k X_{ik}\right)\right] x_{i2} \\ \vdots \\ \frac{\partial Q}{\partial \dot{\beta}_k} = -2\sum\left[y_i - \left(b_1 + b_2 x_{i2} + \ldots + b_k X_{ik}\right)\right] x_{ik} \end{cases} \tag{29}$$

Let the partial derivative be zero, i.e:

$$\begin{cases} -2\sum\left[y_i - \left(b_1 + b_2 x_{i2} + \ldots + b_k X_{ik}\right)\right] = 0 = \sum \varepsilon_i \\ -2\sum\left[y_i - \left(b_1 + b_2 x_{i2} + \ldots + b_k X_{ik}\right)\right] x_{i2} = 0 = \sum \varepsilon_i x_{i2} \\ \vdots \\ -2\sum\left[y_i - \left(b_1 + b_2 x_{i2} + \ldots + b_k X_{ik}\right)\right] x_{ik} = 0 = \sum \varepsilon_i x_{ik} \end{cases} \tag{30}$$

expressed in terms of a matrix:

$$\begin{pmatrix} \sum \varepsilon_i \\ \sum \varepsilon_i x_{i2} \\ \vdots \\ \sum \varepsilon_i x_{ik} \end{pmatrix} = \begin{pmatrix} 1 & 1 & \cdots & 1 \\ x_{12} & x_{22} & \cdots & x_{i2} \\ \vdots & \vdots & \ddots & \vdots \\ x_{12} & x_{12} & \cdots & x_{ik} \end{pmatrix} \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_k \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ \vdots \\ 0 \end{pmatrix} \tag{31}$$

If:

$$X^T = \begin{pmatrix} 1 & 1 & \cdots & 1 \\ x_{12} & x_{22} & \cdots & x_{i2} \\ \vdots & \vdots & \ddots & \vdots \\ x_{12} & x_{12} & \cdots & x_{ik} \end{pmatrix} \tag{32}$$

Then:

$$\varepsilon = Y_i - Y_i = Y_i - (b_i + b_i x_{i2} + b_i x_{i3} + \ldots + b_k x_{ik}) = Y - Xb \tag{33}$$

Solve b to get:

$$b = (X^T X)^{-1} X^T Y \tag{34}$$

III. Empirical analysis

III. A. Principal component analysis

III. A. 1) Common factor extraction

The principle of extracting the common factor is that the eigenvalue of the factor is greater than 1. The article adopts principal component analysis to extract the common factor, and calculates the correlation coefficient matrix, variance contribution and cumulative variance contribution after rotation. The variance contribution of the common factors is shown in Table 2. Three male factors were extracted by principal component analysis, and their eigenvalues were 4.506, 4.013 and 2.101, and the variance contribution rates after rotation were 34.662%, 30.869% and 16.162%, respectively, and the cumulative variance contribution rate was 81.692%, which was more than 80%, indicating that the first three male factors could explain the majority of the factors' influence on the college students' mental health education courses' teaching effectiveness.

III. A. 2) Naming of common factors

Next, the maximum variance orthogonal rotation was performed on the three public factors to obtain the rotated public factor loading matrix as shown in Figure 1, and the naming of the public factors was carried out, in which the public factor 1 has the largest loading coefficients on X6, X8, X9, and X10, with the loading values of 0.803, 0.792, 0.783, and 0.714, which examined the teaching process of the teacher's own competence and his/her attention to the students' attention, so it can be named teacher factor (F1). Common factor 2 has the largest loading coefficient on X2, X4, X5, X7, X11, X12, and X13, with loading values of 0.747, 0.705, 0.647, 0.635, 0.675, 0.746, and 0.763, respectively, and these factors are mainly centered on the students' basic professional abilities and the arrangement of the teaching process, and thus can be taken as the basic factor and the teaching factor (F2). Common factor 3 has the largest loading coefficient on X1 and X3, with loading values of 0.707 and 0.844, respectively, and these factors represent the subsequent outcomes and expectations of teaching and learning, and therefore can be named Mental Health Enhancement (F3).

Table 2: Common factor variance contribution

Total variance interpretation		1	2	3
Initial eigenvalue	Total	6.749	2.718	1.153
	Variance%	51.915	20.908	8.869
	Cumulation%	51.915	72.823	81.692
Extracting the load of the load	Total	6.749	2.718	1.153
	Variance%	51.915	20.908	8.869
	Cumulation%	51.915	72.823	81.692
Rotational load squared	Total	4.506	4.013	2.101
	Variance%	34.662	30.869	16.162
	Cumulation%	34.662	65.531	81.692

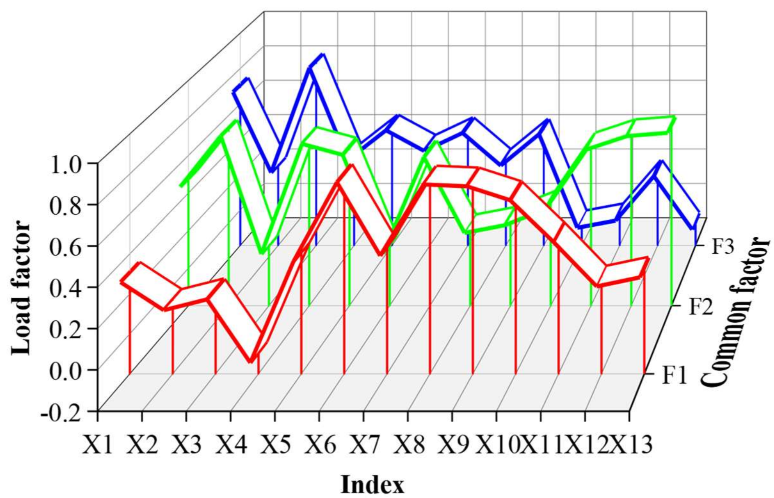

Figure 1: Male factor load matrix

Table 3: Factor score coefficient matrix

Index	Common factor		
	F1	F2	F3
X1	-0.094	0.015	0.436
X2	-0.141	0.303	0.006
X3	-0.037	-0.192	0.631
X4	-0.263	0.305	0.208
X5	0.033	0.118	0.076
X6	0.347	-0.222	0.079
X7	0.079	0.107	-0.037
X8	0.347	-0.158	0.021
X9	0.272	-0.106	0.052
X10	0.293	0.012	-0.233
X11	0.118	0.194	-0.216
X12	-0.097	0.297	-0.017
X13	0.012	0.336	-0.284

III. A. 3) Factor scores

Using the results of the factor analysis to obtain the score coefficient matrix, the results of the factor score coefficient matrix are shown in Table 3, which can be calculated as a male factor evaluation function:

F1=-0.094*X1-0.141*X2-0.037*X3-0.263*X4+0.033*X5+0.347*X6+0.079*X7+0.347*X8+0.272*X9+0.293*X10+0.118*X11-0.097*X12+0.012*X13

F2=0.015*X1+0.303*X2-0.192*X3+0.305*X4+0.118*X5-0.222*X6+0.107*X7-0.158*X8-0.106*X9+0.012*X10+0.194*X11+0.297*X12+0.336*X13

F3=0.436*X1+0.006*X2+0.631*X3+0.208*X4+0.076*X5+0.079*X6-0.037*X7+0.021*X8+0.052*X9-0.233*X10-0.216*X11-0.017*X12-0.284*X13

III. B. Linear regression analysis

The linear regression equations of evaluation index (X) and dependent variable college students' mental health education implementation effect (Y) are established, and multiple linear regression is carried out on the independent variable (X) and dependent variable (Y), and the results of multiple linear regression are shown in Table 4, with ***, **, and * denoting the 1%, 5%, and 10% significance levels, respectively. The following model can be established:

Y=-0.451-0.128*X1+0.063*X2+0.151*X3+0.039*X4+0.164*X5-0.032*X6+0.196*X7+0.248*X8+0.164*X9+0.160*X10+0.029*X11+0.068*X12-0.022*X13

The regression results show that the R^2 and adjusted R^2 are 0.658 and 0.584, respectively, and in the ANOVA, the F value is 20.825 and the P value is 0.000, which is a relatively good fit and the significance test is passed.The D-W value is 1.674, which indicates that the regression equation is not autocorrelated. Combining the above results, it can be seen that the regression results are more satisfactory and have stronger explanatory power.

The maximum value of Variance Inflation Factor (VIF) is 3.632, which is less than 10. Generally, VIF less than 10 can indicate that there is no multicollinearity in the regression model. Summarizing the above results, it can be concluded that the linear regression is valid and from the regression results, it can be found that X3, X7, X8, X5, X10, and X9 pass the test at 1%, 5%, and 10% significance levels, respectively, while the significance of the rest of the variables is not significant.

Table 4: Results of multivariate linear regression

Variable	Regression coefficient	T statistic	VIF
C	-0.451	-1.448	—
X1	-0.128	-2.289	3.632
X2	0.063	1.632	1.764
X3	0.151***	2.303	3.036
X4	0.039	1.723	2.275
X5	0.164**	2.298	1.93
X6	-0.032	-0.709	3.104
X7	0.196***	1.903	2.942
X8	0.248***	1.323	1.957
X9	0.164*	1.334	3.031
X10	0.160**	2.553	2.304
X11	0.029	0.307	2.354
X12	0.068	0.984	1.483
X13	-0.022	-0.403	2.933
R^2:0.658 Adjusted R^2:0.584 F value/D-W value:20.825/1.674 Prob(F-statistic)P value:0.000			

III. C. Effectiveness of mental health education

In summary, the established multiple linear regression model was chosen to calculate the comprehensive score of the implementation effect of mental health education for college students in the sample colleges and universities, and based on the idea of data visualization, the scatter diagram of the evaluation results was obtained using Matlab software. The results of the evaluation of mental health education effectiveness are shown in Figure 2.In the evaluation of the implementation effectiveness of mental health education in grades 2021, 2022 and 2023, the overall score of mental health education effectiveness in grade 2023 is the highest at 82.33, followed by grade 2022 with a score of 79.71, and the overall score of grade 2021 is the lowest at 74.46. Overall, the implementation of mental health education in the sample colleges and universities belongs to a good level, with an overall evaluation result of 78.62 points, which still has much room for improvement.

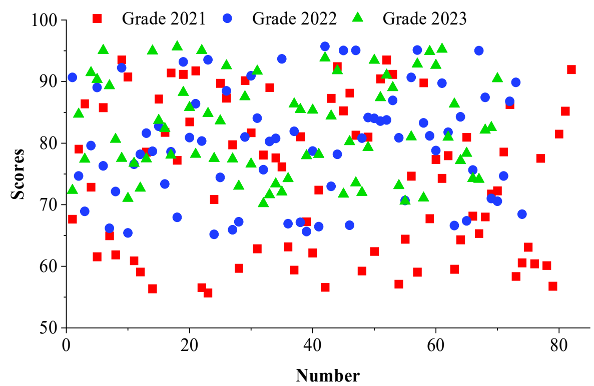

Figure 2: Evaluation of the effect of mental health education

IV. Strategies for improving the effectiveness of mental health education for university students

IV. A. Innovative teaching methods

The teaching mode is relatively traditional and single, and the teaching methods are not novel and interesting enough to mobilize students' enthusiasm and initiative. Therefore, teachers should improve their teaching ability and level, conduct in-depth research on mental health teaching, change the traditional single-mode teaching methods, and constantly innovate teaching methods.

IV. B. Student-oriented

Teachers should change the teaching thinking in the lesson, take the students as the main body, return the classroom to the students, realize the student's main position, play the student's subjective initiative, make the classroom become lively and interesting. For example, teachers can take the flipped classroom approach to teaching, so that students in the process of their own pre-preparation to prepare for the class materials, the subjective consciousness of the mental health knowledge subconsciously absorbed, to enhance the state of mental health of college students as well as the psychological quality of college students, and to promote the development of college students' mental health.

IV. C. New media tools to assist

Teachers can use new media teaching tools to support the teaching of mental health education, through the psychological frequency software, so that students fully understand their own personality characteristics and deep psychological health, can help students measure the psychological tolerance and psychological quality level, improve students' knowledge and understanding of self.

IV. D. Provide a variety of practical activities

In the teaching process, teachers need to constantly enrich the teaching content, carry out a variety of practical teaching activities, through colorful and interesting teaching activities to stimulate students' interest in learning, and through psychoeducational examples to guide college students to a positive state of mind, to enhance the mental health of college students, and promote the better development of college students.

IV. E. Improvement of teachers' pedagogical quality

Schools should provide regular training and re-education for psychology teachers, constantly enhance the theoretical knowledge of mental health teachers, improve their professional ability, and enhance their teaching ability and level, in addition to organizing teachers to regularly discuss typical cases of students, conduct joint study and research, give different insights through the different perspectives of different teachers, and carry out mutual learning among teachers, and enhance the teaching ability and level of teachers through discussion. Teachers can enhance their teaching ability and level through discussion, and improve their teaching quality.

IV. F. Improvement of the teaching evaluation system

In the evaluation system of mental health teaching, teachers and schools should carry out reform and improvement, in the original final examination method based on the addition of the overall performance evaluation during the study period, the main body of the evaluation should also be increased from the original teacher evaluation to the students' self-assessment and students' mutual evaluation, the students will participate in practical activities every time the performance of the records and evaluations, a more objective and fair evaluation of the students. At the same time, teachers should communicate with students, understand students' problems and feedback, make appropriate adjustments to the teaching direction and mode of teaching, and let students evaluate teachers objectively, improve their own deficiencies, create a good teacher-student relationship, and comprehensively improve the quality and efficiency of teaching.

V. Conclusion

This paper scientifically assessed the implementation effect of college students' mental health education in the new media environment through principal component analysis and multiple linear regression methods. The study extracted three common factors, teacher factor, foundation and teaching factor, and mental health enhancement factor, from 13 independent variables, with a cumulative variance contribution rate of 81.692%, indicating that these three factors can explain the influence of most variables on the effect of education. The regression results showed good model fit with an R^2 value of 0.658, an F value of 20.825, and a D-W value of 1.674, which verified the validity and reliability of the model. The assessment found that the effectiveness of the implementation of mental health education in all grades of the sample colleges showed a trend of improvement year by year, and the score of grade 2023 was 82.33, which was 7.87 points higher than the score of 74.46 in grade 2021, and the overall evaluation was 78.62, which was at a good level but still had room for improvement. The study shows that the variables of mental health and quality (X3), evaluation of teaching process (X7), and teachers' professional competence (X8) have a significant impact on educational effectiveness. In response to the assessment results, six enhancement strategies are proposed: innovate teaching methods to break through the traditional single mode; establish the students' main body status to stimulate the learning initiative; use new media tools to assist teaching and enhance the interactivity of teaching; carry out diversified practical activities to improve students' participation; strengthen the construction of the teaching team to enhance the professionalism; and improve the teaching evaluation mechanism to form a diversified evaluation system. These strategies have practical guidance significance for promoting the development of high quality of college students' mental health education, and provide theoretical references and implementation paths for the reform of mental health education in colleges and universities.

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