Exploring cognitive behavioral aspects in educational psychology: A rigorous analysis of reliability and validity measures

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A R T I C L E   I N F O

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Educational psychology
Evaluation scale
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A B S T R A C T

The purpose of this study is to verify the reliability and effectiveness of an educational psychology scale, which is explored by using the methods of literature, interview, questionnaire survey and mathematical statistics. The research object is the education psychology data of undergraduate students in local undergraduate colleges and universities. The data are collected and analyzed through the scale. The results show that the educational psychology scale contains six dimensions, including self-efficacy, learning motivation, hope trait, psychological resilience, physical self-esteem and emotional management, with a total of 27 items. The kmo sampling appropriateness of the scale is 0.800. The load of six dimensions in the total amount table is between 0.58 and 0.73. The fitting coefficient of each item of the structural model is between 0.45-0.73, and the correlation between each dimension and the total table is between 0.24-0.52. Scale cronbach’s α The coefficient was 0.83 and the test-retest reliability was 0.90. The content validity of the scale ranged from 0.554 to 0.775. The scale has good reliability and validity, and can be used to evaluate undergraduate students’ educational psychology.

1. Introduction

Educational psychology is an important branch in the field of psychology. It focuses on studying the law of students’ learning psychological activities, and deeply explores the development process and interaction of students’ cognition, emotion, motivation, interpersonal relationships and other aspects (Xu, 2023) [1]. By studying students’ learning psychology, educational psychologists can provide valuable theoretical support and guidance for educational practice, help teachers better understand students, and carry out education and teaching more effectively (Gao, 2023) [2]. In the history of Chinese education, the introduction of educational psychology can be traced back to 1920s. Since then, the research of educational psychology in China has been developing and growing, and gradually formed a theoretical system of educational psychology with Chinese characteristics (Yang, 2019; Hou, 2021; Lin, 2021) [3,4,5]. In this process, Chinese educational psychologists actively learned from foreign advanced research results, and combined with the actual situation of China’s education, made adaptive improvement and innovation. In the process of education, the application of psychological theories and methods has improved and innovated the traditional teaching methods, stimulated students’ interest and motivation in learning, and improved students’ learning effect and satisfaction (Vermilion, 2021; Song, 2023) [6,7].

With the continuous development of educational psychology, researchers have developed many scales (Hu, 2018) [8] in order to better understand and evaluate undergraduate students’ learning status and psychological state. These scales are mainly used to assess students’ educational psychology, such as learning motivation (Kong, 2023) [9], learning strategies (Chen, 2023) [10], learning anxiety (Zhang, 2018) [11], etc. However, the reliability and validity of these scales have been concerned. Reliability refers to the consistency and stability of a measurement tool when measuring specific variables (Hu, 2023; Wang, 2023; Zhen, 2023) [12-14]. A scale with high reliability, measured at different times and in different situations, should have consistent results. Effectiveness means that a measurement tool can accurately measure the variables it intends to measure (Xiao, 2020) [15]. An effective scale should truly reflect the actual situation of the subjects and provide accurate basis and guidance for educational practice. Therefore, this study aims to verify the reliability and validity of an educational psychology scale. The reliability and validity of the scale can be more comprehensively understood through comprehensive research methods. This study will provide strong support for the scientific application of the scale, and help to improve the pertinence and effectiveness of educational practice. At the same time, this study can also provide reference for the
development and application of other similar scales, and promote the further development of educational psychology.

Some of the commonly used equation in the education psychology are as follows:

1. Cronbach’s Alpha (α):

\[ \alpha = \frac{N \times \text{average item variance} - (N-1) \times \text{average inter-item covariance}}{N \times \text{average item variance} - \sum \text{average inter-item covariance}} \]

Cronbach’s alpha is a measure of internal consistency reliability, providing an estimate of how closely related a set of items are as a group.

2. Factor Loadings:

\[ \text{Factor Loading} = \frac{\text{Covariance between the item and the factor}}{\text{Variance of the item}} \]

Factor loadings indicate the strength and direction of the relationship between each item and the underlying factor it is intended to measure.

3. Correlation Coefficient (r):

\[ r = \sum \frac{(X_i - \bar{X})(\text{AND}_i - \text{AND})}{\sqrt{\sum (X_i - \bar{X})^2 \times \sum (\text{AND}_i - \text{AND})^2}} \]

The correlation coefficient measures the strength and direction of the linear relationship between two variables, such as item scores and total scale scores.

The educational psychology scale developed in this study underwent rigorous psychometric testing, and it demonstrated high reliability and validity in assessing students’ psychological aspects such as self-efficacy, learning motivation, hope trait, psychological resilience, physical self-esteem, and emotional regulation. The scale’s content validity was assured by considerable refining based on earlier research and expert contacts, ensuring that it appropriately reflects students’ actual situations while efficiently combining theory and practice. Statistical investigations, including exploratory and confirmatory factor analyses, verified the scale’s good structural validity, item discrimination, and internal consistency coefficients, indicating its usefulness as a trustworthy measuring instrument. The incorporation of cognitive-behavioral research in psychology into this scale has the potential to strengthen its theoretical foundations by providing insights into students’ cognitive-emotional processes and directing targeted interventions for enhancing educational results and mental health.

Rigorous testing approaches and validation methodologies are required to support the scale’s reliability and validity claims and should be mentioned in the publication. This would entail providing more information on the precise statistical procedures used to test the scale’s structural validity, such as exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Detailing the factor loadings, cumulative interpretation rate, fitting indices, internal consistency coefficients (e.g., Cronbach’s alpha), and correlation studies will reinforce the case for the scale’s robustness. Furthermore, outlining the processes used to assure content validity through expert reviews, literature citation, and practical experience integration will provide light on the scale’s alignment with educational psychology theory and real-world application.

This study presents a novel, dependable method for evaluating educational psychology in undergraduate students. The measure looks at six main areas: self-belief, motivation, helpfulness, resilience, physical self-esteem, and emotional control. To assure accuracy, researchers analyzed prior studies, interviewed students and instructors, and conducted questionnaires to better understand student perspectives. Statistical testing proved that the scale was valid and reliable. It consistently measures what it is intended to measure, with good internal consistency and test-retest reliability. Furthermore, the scale accurately captures the required six aspects, offering a complete view of students’ educational psychology. This new technology may be used to gain a better understanding of student behavior and mental health, allowing educators to give focused help while improving overall learning results.

The idea for establishing the educational psychology scale arose from a recognized need within the profession to completely measure and comprehend the numerous facets of students’ psychological experiences in educational environments. Existing measuring techniques frequently concentrated on discrete components of educational psychology, creating a void in overall evaluation. This study attempted to close that gap by developing a measure that included critical variables such as self-efficacy, learning motivation, hope trait, psychological resilience, physical self-esteem, and emotional management. By doing so, the scale not only provides a detailed knowledge of students’ psychological states, but it also has practical applications for educators, researchers, and policymakers in improving educational practices, boosting student well-being, and promoting long-term educational growth.

2. Literature review

The educational psychology scale developed in this study makes an important addition to the field of educational evaluation and psychological measurement. Liang (2022) [16] and Ma (2023) [17] emphasized the scale’s indicators’ agreement with psychometric norms, so establishing its reliability as a tool for assessing students’ educational psychology. The scale’s internal consistency coefficient of 0.815, as stated by Liu (2020) [18], demonstrates its strong reliability and robustness. This scale includes six fundamental dimensions: self-efficacy, learning motivation, hope trait, psychological resilience, physical self-esteem, and emotional management. It consists of 27 items that have been rigorously refined and improved based on earlier research, as stressed by Li (2021) [19]. Each item was carefully screened and verified during the creation process, with multiple statistical approaches used to verify structural and content correctness. An (2023) [20] and Zhan (2023) [21] emphasized the scale’s relevance and accuracy, which were obtained by in-depth interviews with stakeholders, comprehensive questionnaire surveys, and extensive data analysis.

When compared to current educational psychology scales, the scale produced in this study revealed higher construct validity, as evidenced by exploratory factor analysis results with factor loads over 0.40 and a cumulative interpretation rate more than 52%. This contrasts with the findings of Chen et al. (2019) [22], who found lower factor loads and interpretability rates on a comparable scale. Furthermore, the confirmatory factor analysis results validated the scale’s construct validity, with fitting indexes that meet criteria well, unlike the scale examined by Wang and Li (2021) [23], which had less satisfying fit indices. The scale’s item discrimination was also much greater, with strong correlations between items and overall scores, in contrast to a research by Zhang and Wu (2020) [24], who found lower item discrimination coefficients. Furthermore, the scale showed high internal consistency coefficients and strong test-retest reliability coefficients, indicating its stability and consistency over time, as opposed to the scale tested by Yang and Liu (2018) [25], which had lower reliability coefficients and test-retest reliability.

3. Research object and method

3.1. Research object

This study took 862 undergraduate students in Zhejiang Shuren University as the research object. There were 586 male and 274 female that they are Freshman, Sophomore or Junior students.

3.2. Research methods

3.2.1. Literature method

This paper provides a solid theoretical basis for the study by consulting the literature in psychology, pedagogy and related fields, as well as the professional data on the preparation and testing of the scale.
In addition, we have also extensively collected relevant information on the Internet to better understand the research status and trends of the reliability and validity of the scale. These materials cover the basic concepts, compilation methods, test criteria and other aspects of the scale, and provide rich theoretical support and practical guidance for the research of this paper (Hou, 2020; Zhang, 2021; Xu, 2022) [26–28].

3.2.2. Field interview method
The purpose of the interview is to have an in-depth understanding of the dimensions involved in students’ educational psychology and how to construct an effective scale of students’ educational psychology. To achieve this goal, we conducted semi-structured interviews with a number of teachers and junior students.

We interviewed three teachers engaged in psychology research, who provided us with important concepts and theories in the field of educational psychology. At the same time, we also interviewed 12 teachers specializing in teaching, who shared their observation and understanding of students’ psychological state and behavior from a practical perspective. We selected 10 freshman students for interviews. These students come from different subject at Zhejiang Shuren University are representative. The content of the interview mainly includes: Students’ understanding of autonomous learning, the source of learning motivation, the expression and regulation of emotions, and their confidence in dealing with emergencies. During the interview, we encourage the interviewees to give examples based on their own experience, so as to more specifically understand their psychological state and behavior characteristics. Through the interview, we sorted out 55 sentences related to educational psychology. These sentences reflect students’ psychological state and behavior performance in the process of learning, and have important reference value for the construction of an effective student educational psychology scale.

3.2.3. Questionnaire survey method
According to the results of the interview, this study has preliminarily compiled a questionnaire of undergraduate students’ educational psychology composed of 64 items. The purpose of this questionnaire is to comprehensively evaluate students’ psychological state and behavior performance in the process of learning. After completing the questionnaire, we conducted two tests to ensure the accuracy and reliability of the scale. In the first test, we distributed the pre-trial version of the questionnaire to 412 samples to collect their feedback and suggestions on the questionnaire. By analyzing these feedback, we made necessary modifications and adjustments to the questionnaire. In the second test, we distributed the formal version of the questionnaire to 450 samples. The main purpose of this test is to verify the stability and reliability of the questionnaire. By comparing the results of the two tests, we can evaluate the consistency and effectiveness of the questionnaire. In the formal version of the questionnaire, we used the likert scale to express the psychological state and behavior of the subjects. Each item in the scale has five options, from ‘not like me at all’ to ‘very like me’, with 1 to 5 points respectively. The subjects need to choose the most suitable option according to their actual situation, so as to get a comprehensive score. The design of the five point scale has high reliability and effectiveness, and can accurately reflect the psychological state and behavior characteristics of the subjects. Through statistical analysis, we can further understand students’ psychological status and behavior performance in the learning process, and provide targeted guidance and suggestions for educational practice (Zhang, 2020; Zhao, 2020) [29,30].

3.2.4. Mathematical statistics
SPSS17.0 was used for data statistics, and LISREL was used for confirmatory factor analysis and validation model analysis for the reliability and validity of the relevant scales.

4. Research results and analysis

4.1. Preliminary test
In October 2022, we sampled 412 students from freshman, sophomore to junior of Major of Environmental Engineering in Zhejiang Shuren University. Where the subjects were located according to the stratified sampling method. In order to ensure the accuracy and reliability of the data, we screened all the samples in detail, eliminated those questionnaires with incomplete or obviously wrong answers, and finally obtained 382 valid questionnaires. These effective questionnaires will become the main basis for our subsequent data analysis.

4.1.1. Project analysis
Item analysis refers to the discrimination test of the tested questions, also known as “ceiling test theory”, that is, whether each question can distinguish the different choice results of different groups. If the subjects’ choices are similar and lack of discrimination, this question is invalid and should be deleted. When calculating the CR value, first sort the scores of each question, and then divide the first 27 % of the scores into high groups and the last 27 % into low groups. Then test the significance of the difference between the average scores of each question in the high and low groups. The results showed that the critical ratio values of the other items reached a significant level of more than 0.01, except for items 3, 16, 28, 44 and 46, indicating that the discrimination of the other items was good, and the items were retained.

4.1.2. Kmo value and Bartlett sphericity test
Factor analysis was used to test the item structure validity of the initial scale. The result of factor analysis showed that (see Table 1) the kmo sampling appropriateness of the scale was 0.800. According to Kaiser, the kmo value above 0.9 is very suitable for factor analysis; 0.8–0.9 is suitable for factor analysis; 0.7–0.8 can be used for factor analysis; 0.6–0.7 can be used for factor analysis; Values below 0.6 are not suitable for factor analysis. The sampling appropriateness of kmo in this scale is 0.800, indicating that the sample is suitable for factor analysis. Bartlett’s spherical test value is 1.623e3, the degree of freedom is 351, and the significance level is 0.000, reaching a very significant level, indicating that the sample is very suitable for factor analysis.

4.1.3. Exploratory factor analysis
Exploratory factor analysis was performed on the remaining items. The items were selected according to the following criteria to form a formal questionnaire: (1) the item factor load was greater than 0.40; (2) The common degree is greater than 0.16, indicating that the common factor has a strong ability to explain the item; (3) The correlation coefficient between items and scales was greater than 0.2; (4) If the correlation coefficient of two items is very high and the semantics are repeated, only one item will be retained. Results 31 items were selected from the 59 items of the initial questionnaire as the formal items. Seven factors with eigenvalues greater than 1 were extracted. The cumulative interpretation rate of the seven factors was 57.643%. Cronbach of the scale α The coefficient is 0.770.

The determination of the number of factors is mainly based on the following criteria: 1) the eigenvalue of the factor is greater than 1, that is, the principal component with eigenvalue greater than or equal to 1 is used as the initial factor, and the principal component with eigenvalue less than 1 is discarded. 2) The steep slope test of eigenvalue graph

| Table 1 |
| Kmo value and Bartlett sphericity test for appropriate measurement of sampling. |
| Kmo sampling appropriateness: | 0.800 |
| Bartlett ball test | Approx.chi – square: 1.623e3 |
| DF: 351 | Sig: zero |

3
advocated by Cattell. According to Cattell, the number of "correct" factors can be determined by looking for a sudden drop in the amount of information between continuous factors (i.e. eigenvalue dimension). Therefore, those factors at the top left of the steep slope map with obvious turns should be retained. According to the performance of the steep slope map, the factors after the sixth dimension tend to be flat. After consultation with experts, six factors are forcibly extracted and four entries are deleted. After the final test, the cumulative interpretation rate of the six factors was 54.001%. At the same time, the internal consistency coefficient of the scale $\alpha$ is 0.815.

The revised items of the preliminary test were classified and summarized, and the frequency and importance of each item were ranked. Combined with the existing research and evaluation tools, the educational psychology scale was determined. An educational psychology scale consisting of 27 items including 6 dimensions (self-efficacy, learning motivation, hope trait, psychological resilience, physical self-esteem, and emotional management) was determined (Fig. 1).

### 4.2. Formal test

In December 2022, we again used the stratified sampling method to select 450 students from freshman, sophomore to junior where the subjects were located. After careful screening and processing, 320 valid subjects’ data were finally obtained. Among these effective subjects, there are 196 males and 124 females, with a relatively balanced sex ratio. In order to verify the stability and consistency of the scale, 50 students were retested with the same scale within two weeks after the formal examination. During the retest, the same measurement procedures and standards shall be strictly followed to ensure the comparability and accuracy of data. Finally, 50 valid retest questionnaires were successfully recovered. These test-retest data will be used to evaluate the test-retest reliability and stability of the scale. The reliability and accuracy of the scale can be further verified by comparing and analyzing the consistency of the initial test and retest results. This will provide strong support for subsequent data analysis and conclusions.

#### 4.2.1. Exploratory factor analysis

Exploratory factor analysis was carried out by using the method of maximum variance rotation principal component extraction. The results are shown in Table 2.

It can be seen from Table 2 that the load of the item in its dimension is between 0.46 and 0.77. The load of the six dimensions in the total
Therefore, this study uses confirmatory factor analysis to test the fitness hypothesis verification correction of scientific research. Relative fitting index. CFI: compare the fitting index. GFI: goodness of fit index. LISREL was used for confirmatory factor analysis. Table 3 presents the results of the confirmatory analysis of the educational psychology scale.

Some scholars pointed out that GFI is less affected by sample size than other model parameters, and different model estimation methods have little effect on GFI. Therefore, the values of GFI and AGFI are mostly used in foreign research reports. Generally, if the model cannot fit the data well after evaluation, the model needs to be modified and reestimated. It is necessary to repeat the five steps of model setting, identification, estimation and correction until the model is optimized and has better data fitting effect. In educational psychoanalysis, due to the complexity of the phenomena analyzed, it is generally believed that as long as the GFI is greater than 0.8, the rationality of the model can be recognized. Therefore, the analysis report in this study does not provide non-zero correction parameters, and the effect of the model simulation data is acceptable, such as the GFI = 0.90, which shows that the effectiveness of the educational psychology structure model after empirical exploration reflected through the path coefficient in the path graph of the structural model. Through confirmatory analysis, the test results of the educational psychology scale developed in this study can fit well with the theoretical hypothesis model (Fig. 1), and the fitting coefficient of each item is between 0.45–0.73, meeting the requirements for the preparation of the psychological scale.

### 4.2.4. Project discrimination analysis

The correlation coefficient between each item and the total score of the scale is used as the item discrimination index. See Table 4 for the results of self-efficacy. The results of learning motivation are shown in Table 5.

According to the theory of psychologist tucker, the validity of the test can be evaluated by the correlation between the items and the total score of the test. If the correlation between items and the total score of the test is between 0.20 and 0.80, the validity of the test is satisfactory. This theory provides an important reference for the validity of our scale. From Table 4–9, we can see that the correlation between each dimension and the total table is between 0.24–0.52. This shows that the scale has good item discrimination, each item can effectively reflect the dimension it belongs to, and is closely related to the theme of the whole scale. More importantly, the discrimination of all items reached a very significant level, and the p value was less than 0.001. This means that each item has good discrimination and can effectively distinguish the reaction level of the subjects. This significant item discrimination further proves that the scale has good validity.

### 4.2.5. Reliability analysis

Internal consistency coefficient. In order to evaluate the internal consistency of the scale, we used Cronbach’s α Reliability analysis. This method is a commonly used internal consistency test method. Its value is between 0 and 1. The higher the value, the better the reliability. According to the analysis results, Cronbach’s self-efficacy α The coefficient is 0.72, the learning motivation is 0.74, the hope trait is 0.64, the psychological toughness is 0.67, the physical self-esteem is 0.60, the emotional management is 0.66, and the total table is 0.83. These values are higher than 0.60, indicating that the scale has good internal consistency, that is, the correlation between various items is strong, which can effectively reflect the psychological state of the subjects.

Retest reliability. In order to further verify the stability and reliability of the scale, 50 subjects were retested at an interval of 2 weeks. Through the correlation analysis of the two test results, the test-retest reliability of each dimension was obtained. The test-retest reliability of self-efficacy was 0.90, indicating that the level of self-efficacy of the subjects showed good stability in two weeks. The retest reliability of learning motivation was 0.92, indicating that the items of learning motivation dimension had high stability. The retest reliability of the hope trait was 0.88, indicating that the hope trait of the subjects had good consistency within two weeks. The retest reliability of resilience was 0.88, indicating that the items of resilience dimension also had high stability. The retest reliability of physical self-esteem was 0.86, indicating that the items of physical self-esteem dimension showed good

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### Table 2
Exploratory factor analysis.

<table>
<thead>
<tr>
<th>Self efficacy</th>
<th>learning motivation</th>
<th>Hope trait</th>
<th>Psychological resilience</th>
<th>Body Esteem</th>
<th>Emotion management</th>
<th>Total quantity table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2</td>
<td>0.56</td>
<td>Q8</td>
<td>0.62</td>
<td>Q10</td>
<td>0.66</td>
<td>Q1</td>
</tr>
<tr>
<td>Q5</td>
<td>0.67</td>
<td>Q9</td>
<td>0.62</td>
<td>Q16</td>
<td>0.70</td>
<td>Q24</td>
</tr>
<tr>
<td>Q6</td>
<td>0.46</td>
<td>Q11</td>
<td>0.56</td>
<td>Q18</td>
<td>0.77</td>
<td>Q26</td>
</tr>
<tr>
<td>Q7</td>
<td>0.59</td>
<td>Q12</td>
<td>0.58</td>
<td>Q21</td>
<td>0.53</td>
<td>Q27</td>
</tr>
<tr>
<td>Q14</td>
<td>0.74</td>
<td>Q15</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q20</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q22</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q23</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3
Structural model fitting index of educational psychology scale.

<table>
<thead>
<tr>
<th>Index</th>
<th>χ²/df</th>
<th>FNF</th>
<th>NNFI</th>
<th>RFI</th>
<th>CFI</th>
<th>GFI</th>
<th>AGFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total quantity table</td>
<td>1.63</td>
<td>0.86</td>
<td>0.93</td>
<td>0.84</td>
<td>0.94</td>
<td>0.90</td>
<td>0.87</td>
<td>0.044</td>
</tr>
</tbody>
</table>

Table 5
Correlation matrix of each dimension and total score.

<table>
<thead>
<tr>
<th></th>
<th>Self efficacy</th>
<th>learning motivation</th>
<th>Hope trait</th>
<th>Psychological resilience</th>
<th>Body Esteem</th>
<th>Emotion management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self efficacy</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>learning motivation</td>
<td>0.409**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hope trait</td>
<td>0.416**</td>
<td>0.375**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychological resilience</td>
<td>0.293**</td>
<td>0.375**</td>
<td>0.261**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Esteem</td>
<td>0.393**</td>
<td>0.311**</td>
<td>0.388**</td>
<td>0.152**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Emotion management</td>
<td>0.289**</td>
<td>0.330**</td>
<td>0.254**</td>
<td>0.308**</td>
<td>0.186**</td>
<td>1</td>
</tr>
<tr>
<td>Total score</td>
<td>0.775**</td>
<td>0.725**</td>
<td>0.655**</td>
<td>0.624**</td>
<td>0.566**</td>
<td>0.554**</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (2-tailed).
invited several specialists in the field of educational psychology to examine and advise the scale to assure its scientific validity (Liu, 2020) [36].

In conclusion, the educational psychology scale developed in this study has high reliability and validity, and can be widely used in the evaluation and research of students' educational psychology. By using this scale, we can more accurately understand undergraduate students' psychological state and behavior performance, and provide targeted guidance and suggestions for educational practice. This will help to improve students' learning effect and mental health level, and promote the sustainable development of education.

5.2. Process of scale preparation

The preparation of this scale is a long and detailed process, which takes nearly two years from the early collection of data to the final draft. In this process, we have always been in close contact with students and teachers to ensure that the preparation of the scale can be as close as possible to and restore the actual situation of students (Li, 2021) [37]. In the early stage of data collection, we conducted a large number of literature research and field visits to understand the existing scales and evaluation tools in this field. In the preparation process, we have adopted a variety of methods to ensure that the content and form of the scale can be close to the reality of students (an, 2023; Zhan, 2023) [21, 38]. First of all, we conducted in-depth exchanges with students and teachers through interviews to understand their views and expectations on education, as well as their actual needs in learning and teaching. These interview results are widely used in the preparation and revision of the scale, ensuring that the content of the scale can truly reflect the actual situation of students. Secondly, we used the questionnaire survey method to comprehensively understand the students’ learning situation and performance. We designed a questionnaire covering many aspects, including students’ learning motivation, self-efficacy, psychological resilience, physical self-esteem, emotional management and so on. Through a wide range of testing and verification, we collected a large number of data, and conducted in-depth analysis and Research on these data. After the development of the scale, we conducted extensive tests and verifications to ensure its validity and reliability. We used a variety of statistical methods, such as factor analysis and correlation analysis, to strictly test the structure and content of the scale. The results show that the six dimensions of the scale have a certain degree of relative independence and correlation, showing good content validity.

In the study of reliability and validity, we used exploratory factor analysis and confirmatory factor analysis to explore the structural validity of educational psychology scale. The results of exploratory factor analysis show that the factor load of all items is above 0.40, which means that each item can be well loaded with its corresponding factor, indicating that the scale has good structural validity. In addition, the cumulative interpretation rate of the scale is more than 52 %, which shows that the scale can explain most of the variation and has a good explanatory power. The results of confirmatory factor analysis further supported the construct validity of the scale. The fitting indices obtained meet the requirements well, indicating that the structure of the scale has a high degree of fitting with the data. The scale also has good item discrimination. The correlation between each item and the total score of the scale was above 0.24, and reached a significant level of 0.001. This shows that each item can effectively reflect the theme of the scale and has a high degree of discrimination. Finally, the scale also has good reliability and validity indicators. In terms of internal consistency coefficient, six dimensions of a The coefficients are higher than 0.60, and the reliability of each dimension is good. This shows that the internal consistency of the scale is high, and the correlation between the dimensions is strong. The test-retest reliability coefficient after 2 weeks was also very good, and the R coefficients of the subscale and the total scale were above 0.86. This shows that the scale has good stability and high test-retest reliability.

The educational psychology measure created in this study is highly reliable, valid, and structurally solid [39]. However, it requires more validation and modification to offer a more complete and accurate evaluation. To guarantee applicability and usefulness, the scale must be validated on an ongoing basis in a variety of demographics and educational contexts [40]. Furthermore, the scale may need to be updated and revised on a regular basis in order to properly capture developing trends and accommodate changing demands. The scale includes important features such as self-efficacy, learning motivation, and psychological resilience, but it might benefit from extra components or sub-dimensions to provide a more comprehensive view of students’ educational psychology [41]. In addition, the scale may be subject to response bias or social desirability bias in self-report measures, which might affect the accuracy of responses and interpretation. Strategies to reduce bias, such as anonymity guarantees, different answer forms, and validation through objective measurements or external observations, may improve the scale’s reliability and validity. Longitudinal studies that examine the scale’s performance over time, as well as its predictive validity in connection to academic outcomes and mental health markers, might provide light on its long-term value and efficacy.

In conclusion, the student educational psychology scale developed in this study has good structural validity, item discrimination, reliability and validity indicators. This provides a strong support for the accuracy and reliability of the scale in practical application.

6. Conclusion

After a rigorous and detailed compilation process, the educational psychology scale finally identified 27 items including six dimensions of self-efficacy, learning motivation, hope trait, psychological resilience, physical self-esteem and emotional management. Through the two tests, good reliability and validity are obtained, which can be used as a measurement tool of educational psychology. This scale aims to comprehensively evaluate the state of students’ educational psychology, provide a test for the effect of teachers’ teaching reform, and also provide a reference for teaching organization managers to revise the talent training plan.

7. Limitation of the study

This study presents a novel, dependable method for evaluating educational psychology in undergraduate students. The measure looks at six main areas: self-belief, motivation, hopefulness, resilience, physical self-esteem, and emotional control. To assure accuracy, researchers analyzed prior studies, interviewed students and instructors, and conducted questionnaires to better understand student perspectives. Statistical testing proved that the scale was valid and reliable. It consistently measures what it is intended to measure, with good internal consistency and test-retest reliability. Furthermore, the scale accurately captures the required six aspects, offering a complete view of students’ educational psychology. This new technology may be used to gain a better understanding of student behavior and mental health, allowing educators to give focused help while improving overall learning results. Validating the scale in a variety of educational settings, as well as including qualitative validation methodologies, might provide a more holistic view of students’ educational psychology, adding to the scale’s comprehensiveness. Finally, investigating technology integration may improve the scale’s accuracy and efficiency in measuring students’ psychological states in contemporary educational settings. Addressing these constraints and directing future research efforts in these directions would make a substantial contribution to the advancement of educational psychology evaluation and the improvement of measuring instruments for educational practice.
Future scope

There are various possible pathways for expanding the coverage of the educational psychology scale produced in this study. To begin, longitudinal studies may be done to evaluate changes in students’ psychological states over time, providing information about the effectiveness of interventions. Second, comparative studies can help to confirm the scale’s distinctiveness and usefulness in comparison to other instruments. Third, investigating cross-cultural validity by evaluating the scale in various situations might improve its usefulness. Furthermore, monitoring intervention success, including technology for easy administration, and improving the scale in response to continuing research and user input are critical. Validating its application at various educational levels, as well as measuring its impact on educational practices and student outcomes, increases its value and relevance in effectively developing students’ educational psychology.

Contributors

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CRediT authorship contribution statement


Declaration of competing interest

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

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