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## The Logic and Practical Path of Higher Education Curriculum Reform Based on Cognitive Psychology

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### Abstract

Based on cognitive psychology theory, this study explores the doctrinal logic and practical path of higher education curriculum reform to enhance the effectiveness of higher education programs, with particular attention to improving students' psychological quality and learning effectiveness. The study uses the finite element method and digital waveguide technology to simulate and analyze the stringed musical instrument. Accurate simulation of the vibration characteristics of the musical instrument is realized through the vibration equations of an ideal string and the principles of the digital waveguide algorithm. The experimental results show that the applied simulation technique can effectively simulate the vibration characteristics of the resonance box of the musical instrument, such as the ideal string vibration and the cavity coupling effect. In addition, the study involves the mathematical expressions of forced vibration and resonance and the effects of various materials on the modal frequencies of the resonance box. The application of artificial intelligence technology in studying acoustic properties of musical instruments significantly improves the accuracy and efficiency of simulation. It provides essential theoretical support for the design and production of musical instruments.

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**Keywords:** Cognitive psychology theory; Higher education curriculum reform; Musical instrument vibration simulation; Students' psychological quality improvement.

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## 1 Introduction

Curriculum as the essence and core of university education, which centrally reflects the requirements of social development on university education, embodies the orientation of university education value, constrains the way of university education activities, and directly affects the physical and mental growth of college students and the improvement of the overall quality of education [1-3].

Comprehensive reform of higher education is a comprehensive reform initiated and implemented by the state in order to improve the level of higher education and guide universities to take the initiative to adapt to the national strategy and the needs of local economic and social development, with the aim of encouraging universities to carry out comprehensive reforms in the areas of education system, talent cultivation system, academic discipline and specialty construction, faculty, and education evaluation, and promoting the overall improvement of the quality of talent cultivation [4-6]. The main goal of the comprehensive reform of higher education is to improve the quality of talent training. The curriculum is the basic carrier for the implementation of talent training, and the reform of any part of the talent training process should be realized through the intermediary of the curriculum. As the basic unit and direct means of organizing and implementing teaching, the reform of the curriculum is directly related to the success or failure of the comprehensive reform of higher education, directly related to the quality and specifications of talent cultivation, affecting the improvement of the level of teaching and learning, and thus determining the degree of realization of the objectives of talent cultivation [7-8].

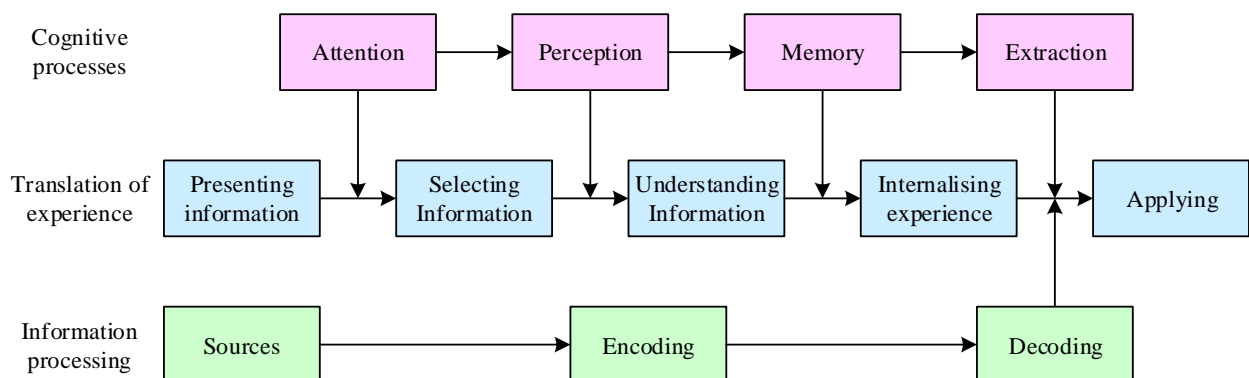
The main goal of the comprehensive reform of higher education is to improve the quality of talent cultivation, and the curriculum is the basic carrier for the implementation of talent cultivation, so the comprehensive reform must necessarily rely on the cornerstone of the curriculum. Curriculum reform in local colleges and universities is still characterized by an unsound curriculum management system, single evaluation mode, and poor practicality of curriculum content. Therefore, local colleges and universities should innovate the teaching mode of the curriculum, strengthen the construction of faculty, and improve the management and evaluation mechanism [9]. Literature [10] has thought about and studied the relationship between innovative training of talents and management system reform in colleges and universities, and based on the literature method, it is believed that traditional education concepts, education models, and other constraints restrict the cultivation of innovative talents. Literature [11] elaborated on ACUCC, pointing out that the initiative has a positive effect on the development of interdisciplinary education, research, and practice. Literature [12] studied and analyzed the outcome-oriented curriculum system in higher vocational colleges and its reform effect and found that the effect of the curriculum reform was unanimously recognized by teachers and students and could promote the improvement of teaching effectiveness. Literature [13] talked about a college in Chongqing, the “four-in-one” model of teaching reform and innovation, improving the influence of the financial and economic profession on the community and the ability to serve the community. Literature [14] discusses the relevance of reform and consulting technology and the development of an intelligent system for extracting terms from computer science (CS) knowledge and organizing knowledge domains, which demonstrates good performance and effectively promotes the reform of the curriculum. Literature [15] analyzed a survey of highly educated adults to learn that selective expression of bias, as well as resistance to faith transformation, exists in colleges and universities. Literature [16] analyzed the reform of nursing education curriculum model design based on cloud computing technology and concluded that there is still much room for progress in students’ professional attitudes and humanistic qualities. Literature [17] analyzed the class system reform and innovative forms of public physical education and health courses in colleges and universities in order to build a new and good physical education teaching system. Literature [18] explored the course design process of the undergraduate program of data science and big data technology, proposed a new

experimental method of teaching reform, and suggested that the reform should be oriented to the implementation of graduate employment, practical ability, big data technology, and tools.

By integrating cognitive psychology theories and higher education curriculum practices, this study aims to explore and realize a more effective path of educational reform. The study focuses on analyzing the information processing process of students and the internalization mechanism of learning resources and then designing a higher education curriculum that conforms to the principles of cognitive psychology, including the enhancement of positive psychological qualities, the implementation of personalized teaching methods, and interactive models. Through these methods. Enhancement of students' psychological qualities, learning motivation, and overall educational effectiveness.

## 2 Cognitive psychology's doctrinal logic in the reform of higher education programs

Cognitive psychology, in the narrow sense, is the psychology of information processing, which is a process problem. The process of cognitive psychology is shown in Figure 1, and this process happens to be a matter of the strategies that humans employ in accepting new things. Information in education is expressed in the curriculum content, that is, the learner learning is presented with all the learning resources; it has a tangible and intangible point; the former is a variety of symbolic representations of information or verbal information, the latter is non-verbal information, no matter what form of that kind of information in the form of representation has to be through the process of the cognitive mechanism of human beings in order to achieve the internalization of their own experience. In fact, the scientific definition of information in information theory is uncertain, but Shannon's definition of information is the most representative. Information is the amount of uncertainty reduction, i.e., the difference between two uncertainties. In the system of information processing, the learner is out of the central link, and every link involves the learner, who first selects the information (attention), understands and interprets it (perception), internalizes it into his or her own experience (memory), and applies it (extraction of memory).



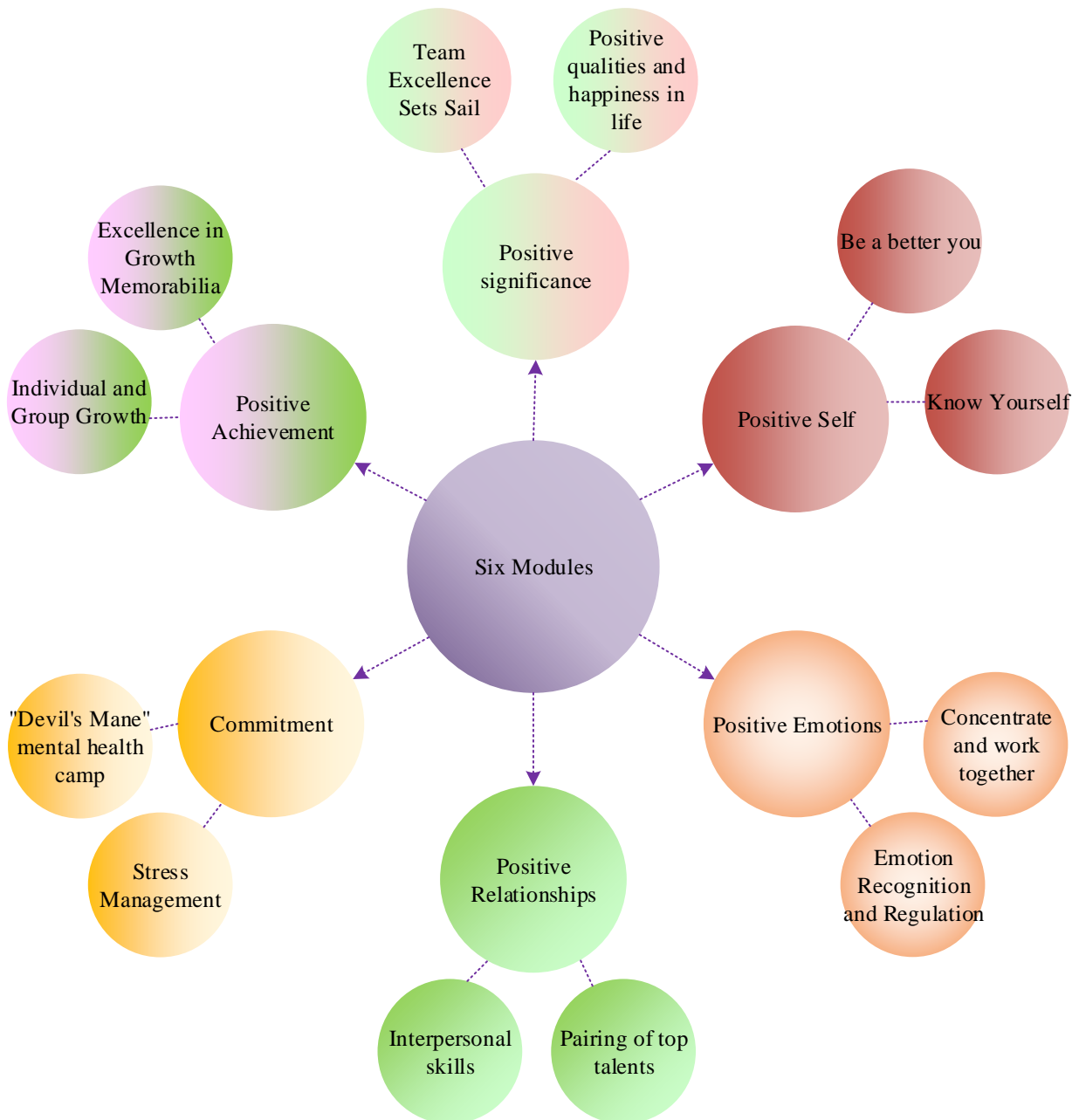
**Figure 1.** Cognitive psychology process

The reform of the higher education curriculum takes as its starting point the satisfaction of society's demand for the psychological qualities of highly skilled personnel and focuses on the organization and implementation of a higher education course on the enhancement of the positive psychological qualities of top-notch students.

Based on the theory of cognitive psychology, the course is mainly dominated by introspective methods such as empirical evidence, empathy, and realization, and based on the concepts of respect, integration, symbiosis, and coexistence, the course puts the focus of cultivation on the non-intellectual

factors that are mainly responsible for improving the positive psychological qualities of top-notch students, and adopts the super-intuitive and interactive mode of teaching and learning and establishes unique cultivation methods such as “participatory experience, immersive interaction, inspirational lecture, and perceptive reinforcement,” forming a unique cultivation method of positive psychological qualities improvement. The unique cultivation method of “participatory experience, immersive interaction, inspiring lectures, and perception-based reinforcement” has been established, forming an education and cultivation mode of positive mental quality enhancement with two wings.

With full respect for individual differences, focusing on integration and coexistence, innovative research, development, and design of a new form of higher education curriculum, six psychological quality growth modules are designed with a focus on cultivating collaborative leadership, critical thinking and innovation, strategic execution, planning and development, and stress-resistant ability. As shown in Figure 2, the structure of the high education program is designed to address the six dimensions of positive mental character, namely, positive meaning, positive self, positive emotions, positive relationships, engagement and immersion, and positive achievement. The Positive Meaning Module addresses the cognitive dimension of positive mental qualities and is set up to provide an excellent team-building experience activity equipped with lectures on positive qualities and life happiness. The Positive Self Module is designed to address the emotional dimension of positive mental qualities and is equipped with a self-awareness activity called “Being a Better Self” and a lecture on “Knowing Yourself.” The Positive Relationships Module focuses on the interpersonal dimension of positive mental qualities and is set up to provide group counseling and interpersonal skills for top-notch talents. For the transcendence dimension of positive mental qualities, the immersion module is set up with the “Devil’s” heart training camp - team breakthrough experiential activities equipped with stress “heart” management. The Positive Achievement Module is designed to address the justice dimension of positive mental attributes and is equipped with a Memorial Book of Excellence - a self-assessment and others’ evaluation of the student’s self and group summaries of their growth.



**Figure 2.** Structure of higher education curriculum design

### 3 Decision Tree and Rough Set Based Data Analysis Method for Higher Education Courses

The decision tree algorithm is applied to analyze the performance of students in different course types to find out the potential factors affecting students' performance so that the students can better maintain a good learning state, thus providing decision-support information for the reform of higher education curriculum, which will lead to better teaching and improve the quality of teaching. Rough set theory is applied to analyze the course results after the reform of the higher education curriculum to find out the most important factors affecting the overall performance of students so as to provide the basis for improving the overall quality of teaching, thus providing technical support for further improving the reform of the higher education curriculum.

### 3.1 Decision Tree Based Data Mining for Higher Education

#### 3.1.1 Attribute selection metrics

##### 1) ID3 algorithm

A test attribute is selected at each node of the tree using an information gain metric. This metric is called the attribute selection metric or split goodness metric. The attribute with the highest information gain is selected as the test attribute for the current node. Doing so minimizes the information required to classify the samples in the resulting division and reflects the minimal randomness of the division. This information-theoretic approach minimizes the number of tests required to classify an object and ensures that the tree found is as simple as possible.

Let  $S$  be the set of  $s$  data samples, and assume that the class labeling attribute has  $m$  distinct values, defining  $m$  distinct classes  $C_i (i=1, 2, \dots, m)$ . Let  $S_i$  be the number of samples of class  $C_i$  in  $S$ . The desired information required to classify a given sample is given by equation (1):

$$I(s_{1j}, s_{2j}, \dots, s_{mj}) = -\sum_{i=1}^m p_{ij} \log_2 p_{ij} \quad (i=1, 2, \dots, n) \quad (1)$$

Where  $p_i$  is the probability that any sample belongs to 2 and is estimated using  $S_i/S$ . Where the logarithm uses  $C_i$  as the base, this is because the information is encoded using binary. Let attribute  $A$  have  $v$  different values  $(a_1, a_2, \dots, a_n)$ .

Attribute  $A$  can be used to partition  $S$  into  $v$  subsets  $(S_1, S_2, \dots, S_v)$ ; where  $S_j$  contains some such samples in  $S$  that have value  $a_j$  on attribute  $A$ . If  $A$  is used as a test attribute, these subsets correspond to branches grown from nodes containing set  $S$ . Let  $S_{ij}$  be the number of samples of class  $C_i$  in subset  $S_j$ . The entropy or expected information of the subset after division according to  $A$  is:

$$E(A) = \sum_{j=1}^v \frac{(s_{1j} + s_{2j} + \dots + s_{mj})}{s} I(s_{1j}, s_{2j}, \dots, s_{mj}) \quad (2)$$

Term  $\frac{(s_{1j} + s_{2j} + \dots + s_{mj})}{s}$  acts as the weight of the  $j$ nd subset and is equal to the number of samples in the subset divided by the number of samples in  $s$  of  $S$ . The smaller the entropy value, the higher the purity of the subset division. Where for a given subset  $S_j$ :

$$I(s_{1j}, s_{2j}, \dots, s_{mj}) = -\sum_{i=1}^m p_{ij} \log_2 p_{ij} \quad (i=1, 2, \dots, n) \quad (3)$$

Where  $p_{ij} = \frac{s_{ij}}{s_j}$  is the probability that a sample in  $s_j$  belongs to class  $C_i$ . The information gain that will be obtained if branching on  $A$  is shown in (4):

$$Gain(A) = I(s_1, s_2, \dots, s_m) - E(A) \quad (4)$$

$Gain(A)$  is the desired compression of entropy due to knowing the value of attribute  $A$ . The algorithm calculates the information gain for each attribute. The attribute with the highest information gain is used as the test attribute for the given set  $S$ . A node is created and labeled with that attribute, branches are created for each value of the attribute, and the samples are divided as a result.

## 2) C4.5 algorithm

C4.5 is only suitable for datasets that can reside in memory, and the program cannot run when the training set is too large to fit in memory.

Thus, it has been proposed to use the information gain rate as the basis for test attribute selection, which is defined as:

$$gainratio(s_i) = \frac{Gain(s_i)}{spliti(s_i)} \quad (5)$$

$$spliti(s_i) = - \sum_{j=1}^k \frac{p_j}{m} \log \left( \frac{p_j}{m} \right) \quad (6)$$

### 3.1.2 Selection strategy based on data distribution

A test attribute is selected at each node of the tree using an information gain metric. This metric is called the attribute selection metric or split goodness metric. The attribute with the highest information gain is selected as the test attribute for the current node. Doing so minimizes the information required to classify the samples in the resulting division and reflects the minimal randomness of the division. This information-theoretic approach minimizes the number of tests required to classify an object and ensures that the tree found is as simple as possible.

Assuming that training set  $T$  contains  $n$  samples that belong to  $m$  classes, where class  $i$  occurs in  $T$  at a rate of  $P_i$ , then the Gini Index formula for  $T$  is defined as:

$$Gini(T) = 1 - \sum_{i=1}^m p_i^2 \quad (7)$$

Suppose attribute  $A$  divides set  $T$  into  $V$  subsets  $\{T_1, T_2, \dots, T_v\}$ , where the number of samples in  $T_i$  is  $n_i$ , then the Gini Index of this partition is:

$$Gini(A) = \sum_{i=1}^v \frac{n_i}{n} Gini(T_i) \quad (8)$$

The feature selection strategy for the Gini Index is to select the attribute with the smallest Gini Index value after splitting, which is suitable for training sets with a small variety of categories and is biased towards generating subsets of similar size.

## 3.2 Application of rough sets in quality evaluation of higher education programs

### 3.2.1 Improved algorithms

The improved algorithm in this paper mainly involves knowledge points such as attribute similarity, attribute importance, attribute approximation, and attribute granularity similarity.

#### 1) Decision-making information system

The quaternion  $S = (U, C \cup D, V, f)$  is called a decision information system. Where  $U$  is the set of all objects.  $C$ ,  $D$  are the sets of conditional and decision attributes, respectively, and  $C \cap D = \emptyset$ .  $V = \bigcup_{a \in C \cup D} V_a$ ,  $V_a$  are the value domains of attribute  $a$ .  $f: U \times C \cup D \rightarrow V$  is an information function that assigns to each object the value of an attribute under some property, i.e.,  $f(x, a) \in V_a$  for any  $a \in C \cup D$ ,  $x \in U$ .

#### 2) Equivalence and division

$$[x]_P = \{y \mid \forall x, y \in U, \langle x, y \rangle \in P\} \quad (9)$$

Then  $[x]_P$  is said to be a  $P$ -equivalence class on  $x$  divided by  $P$ .

Let  $P$  be an equivalence relation on  $U$ , for any  $x \in U$ , if:

$$U/P = \bigcup [x]_P \quad (10)$$

Then  $U/P$  is said to be a division of  $P$  over  $U$ . It can be shown that for any two equivalence relations  $P_1$  and  $P_2$  on  $U$  such that  $U/P_1 = U/P_2 \Leftrightarrow P_1 = P_2$ , i.e., equivalence relations and divisions are one-to-one correspondences.

Let  $P$  and  $Q$  be two equivalence relations on  $U$ . For any  $x \in U$ , if  $P \subseteq Q$ , there is  $U/Q \subseteq U/P$ , i.e.,  $[x]_Q \subseteq [x]_P$ . In the special family, if  $U/P = U/Q$ , there is  $[x]_P = [x]_Q$ .

#### 3) Attribute importance

Let  $P$  be an equivalence relation on  $U$ , and  $U/P$  be a division of  $P$  on  $U$ , for any set  $X \subseteq U$ ,  $Y \in U/P$ :

$$\underline{P}X = \bigcup \{Y \mid Y \subseteq X\} \quad (11)$$

Then  $\underline{P}X$  is said to be the set of lower approximations of  $X$ .

Let  $U/D$  be the division of  $D$  over  $U$  if:

$$POS_C(D) = \bigcup_{X \in U/D} \underline{C}X \quad (12)$$

Then  $POS_C(D)$  is said to be the  $C$ -positive domain of  $D$ . It can be shown that  $POS_C(D)$  is the set of objects whose equivalence class in  $U/C$  is contained in the equivalence class in  $U/D$ . Clearly the minimal set of  $POS_C(D)$  is the empty set and the maximal set is  $U$ .

Let  $POS_C(D)$  be the  $C$ -positive domain of  $D$  if:

$$\gamma_C(D) = |POS_C(D)|/|U| \quad (13)$$

Then  $\gamma_C(D)$  is said to be the dependence of  $D$  on  $C$ , i.e.,  $D$  depends on  $C$  by the magnitude of  $\gamma_C(D)$ , which can be known as  $\gamma_C(D) \in [0,1]$ . In particular,  $D$  is said to be completely independent or dependent on  $C$  when  $\gamma_C(D)$  is 0 or 1.

For any set of attributes  $P \subseteq C$ , any attribute  $a \in P$ , let:

$$Sig_P(a) = \gamma_P(D) - \gamma_{P-\{a\}}(D) \quad (14)$$

Then  $Sig_P(a)$  is said to be the attribute importance of attribute  $a$  in  $P$ . Clearly,  $Sig_P(a)$  has a range of  $[0,1]$ .

When  $Sig_P(a) = 0$ , it means that attribute  $a$  is not important in  $P$ , when  $a$  is an unnecessary attribute in  $P$ . Otherwise ( $Sig_P(a) > 0$ ) states that  $a$  is a necessary attribute in  $P$ .

For any set  $P \subseteq C$  of attributes,  $P$  is said to be independent if for any attribute  $a \in P$ , there is  $Sig_P(a) > 0$ , otherwise  $P$  is said to be dependent.

#### 4) Attribute simplification and kernel set

Attribute parsimony is one of the important research contents of rough set, and its principle is to delete unnecessary attributes in the original attribute set while the classification ability of the new attribute set remains unchanged, i.e., to reduce the unnecessary attributes in the original attribute set in order to realize attribute dimensionality reduction.

For any set of attributes  $P \subseteq C$ ,  $P$  is said to be an attribute approximation of  $S$  if  $\gamma_P(D) = \gamma_C(D)$  and for any attribute  $a \in P$ , both have  $\gamma_P(D) \neq \gamma_{P-\{a\}}(D)$ .

Since there is more than one set of attributes that satisfy the above definition, attribute approximations are not unique. However, all approximations are related as follows.

Let  $Red(S_i)$  be the  $i$ th approximate simplicity in  $S$ , if we make:

$$Core(S) = \bigcap Red(S_i) \quad (15)$$

Then  $Core(S)$  is called the kernel set of  $S$ . It can be seen that the kernel set is the intersection of all simplices, and the corresponding attribute simplices can be formed by adding appropriate attributes to the kernel set.

### 3.2.2 Attribute similarity

For any set of attributes  $P \subseteq C$ , any object  $x \in U$ , order:

$$dis([x]_P, [x]_D) = \begin{cases} 1 & [x]_P \subseteq [x]_D \\ 0 & \text{Other} \end{cases} \quad (16)$$

Call  $dis([x]_P, [x]_D)$  the similarity between the  $x$ -equivalent class of  $P$  and the  $x$ -equivalent class of  $D$ .

Clearly, if  $dis([x]_P, [x]_D) = 1$ , it means that the  $x$ -equivalence class of  $P$  is a subset of the  $x$ -equivalence class of  $D$ .

For any set of attributes  $P \subseteq C$ ,  $|U|$  is the number of plenary objects, let:

$$DIS(P, D) = \frac{\sum_{i=1}^{|U|} dis([x_i]_P, [x_i]_D)}{|U|} \quad (17)$$

Then  $DIS(P, D)$  is said to be the similarity of the conditional attribute set  $P$  with respect to the decision attribute set  $D$ .

Clearly,  $0 \leq DIS(P, D) \leq 1$ .

For any attribute set  $P \subseteq Q \subseteq C$ , then there is  $DIS(P, D) \leq DIS(Q, D)$ .

Since  $P \subseteq Q$ ,  $U/Q \subseteq U/P$ , i.e., for any object  $x \in U$ , then there is  $[x]_Q \subseteq [x]_P$ . The following can be discussed in three ways, where the number of objects of the domain  $U$  is set to be  $|U| = k + m + n$ , where the specific meanings of  $k$ ,  $m$ , and  $n$  are as follows.

- 1) If there exists  $k$  distinct object  $x \in U$  such that  $[x]_P \subseteq [x]_D$ , then there must be  $[x]_Q \subseteq [x]_P \subseteq [x]_D$ , which follows:

$$dis([x]_Q, [x]_D) = dis([x]_P, [x]_D) = 1 \quad (18)$$

$$DIS_1(P, D) = DIS_1(Q, D) = (k * 1) / |U| = k / |U| \quad (19)$$

- 2) If there exists  $m$  distinct object  $x \in U$  such that  $[x]_Q \subseteq [x]_D$ ,  $[x]_P \not\subseteq [x]_D$ , it is known:

$$dis([x]_Q, [x]_D) = 1, dis([x]_P, [x]_D) = 0 \quad (20)$$

$$DIS_2(P, D) = 0, DIS_2(Q, D) = (m * 1) / |U| = m / |U| \quad (21)$$

- 3) If there exists  $n$  distinct object  $x \in U$  such that,  $[x]_Q \subseteq [x]_D$ ,  $[x]_P \not\subseteq [x]_D$ , can be known:

$$dis([x]_Q, [x]_D) = 0, dis([x]_P, [x]_D) = 0 \quad (22)$$

$$DIS_3(P, D) = DIS_3(Q, D) = 0 \quad (23)$$

Where 1 is the 3rd eigenvalue, an eigenvector pair of 2. Another sample variance:

$$DIS(P, D) = DIS_1(P, D) + DIS_2(P, D) + DIS_3(P, D) = k/|U| + 0 + 0 = k/|U| \quad (24)$$

$$DIS(Q, D) = DIS_1(Q, D) + DIS_2(Q, D) + DIS_3(Q, D) = k/|U| + m/|U| + 0 = (k+m)/|U| \quad (25)$$

Obviously, if  $m=0$ , then  $DIS(P, D) = DIS(Q, D)$ , and if  $m \neq 0$ , then  $DIS(P, D) < DIS(Q, D)$ , and combining the two, we get  $DIS(P, D) \leq DIS(Q, D)$ .

### 3.2.3 Attribute Importance

For any property  $a \in C$  in  $S$ , order:

$$Sig_C(a) = DIS(C, D) - DIS(C - \{a\}, D) \quad (26)$$

Call  $Sig_C(a)$  the importance of attribute  $a$  with respect to  $C$ , which measures the change in distinguishability of the set of conditional attributes after removing attribute  $a$  from  $C$ .

For a given decision information system, the magnitude of the value of  $Sig_C(a)$  determines the importance of attribute  $a$  in  $C$ . The larger the value, the more important  $a$  is to  $C$ , otherwise  $a$  is less important to  $C$ . Obviously,  $Sig_C(a) \in [0, 1]$ .

In addition to this,  $Sig_C(a)$  can be used to determine the necessity or non-necessity of attribute  $a$ . For any attribute  $a \in C$  in  $S$ , attribute  $a$  is said to be a necessary attribute of  $C$  if  $Sig_C(a) > 0$ , otherwise attribute  $a$  is said to be an unnecessary attribute of  $C$ . These necessary attributes form the kernel set  $Core(S)$  of the decision information system.

For algorithmic purposes, the measure of attribute importance after adding attributes is given below. For any set of attributes  $P \subseteq C$ , any attribute  $a \in C - P$ , let:

$$Sig_{P \cup \{a\}}(a) = DIS(P \cup \{a\}, D) - DIS(P, D) \quad (27)$$

Call  $Sig_{P \cup \{a\}}(a)$  the importance of attribute  $a$  with respect to  $P \cup \{a\}$ , which measures the change in distinguishability of the conditional attribute set after the addition of a non  $P$  attribute  $a$  to  $P$ .

For a given decision information system, the larger the value of  $Sig_{P \cup \{a\}}(a)$ , the greater the change in distinguishability of the set of conditional attributes after the addition of non  $P$  attributes  $a$  to

$P$ , the greater the importance of attribute  $a$  to  $P$ , and conversely, the less important attribute  $a$  is to  $P$ . Clearly,  $0 \leq \text{Sig}_{P \cup \{a\}}(a) \leq 1$ .

In particular, when  $\text{Sig}_{P \cup \{a\}}(a) = 0$ , it is shown that the addition of the non  $P$  attribute  $a$  to  $P$  did not cause a change in the distinguishability of  $P$ , when  $a$  is said to be a nonessential attribute with respect to  $P$ .

### 3.2.4 Attribute Granularity Similarity

Since attribute parsimony is not unique, when searching for parsimony using kernel set-based heuristic parsimony algorithms, it is possible that there is more than one non-kernel attribute that satisfies the conditions, and then the question arises as to how to select attributes to be added to the kernel set. Most algorithms use the method of selecting any one of them, but the selection is random and fails to efficiently select the relative most parsimonious parsimony. Combined with the concept of knowledge granularity, the concept of attribute granularity similarity is given below.

For an arbitrary set of attributes  $P \subseteq C, U/P = \{X_1, X_2, \dots, X_m\}$ ,  $U/D = \{Y_1, Y_2, \dots, Y_n\}$ , and  $U/(P \cup D) = \{Z_1, Z_2, \dots, Z_k\}$  are the divisions of  $P$ ,  $D$ , and  $P \cup D$  on  $U$ , respectively, such that:

$$G-DIS(P, D) = \frac{\sum_{i=1}^k |Z_i|^2}{\sqrt{\sum_{i=1}^m |X_i|^2} \sqrt{\sum_{i=1}^n |Y_i|^2}} \quad (28)$$

Call  $G-DIS(P, D)$  the granularity similarity of conditional attribute set  $P$  with respect to decision attribute set  $D$ , where  $|\cdot|$  is the number of objects in a given set.

The granularity similarity examines the similarity of  $P$  with respect to  $D$  from a granularity point of view, and can find out the subtle differences between different sets of conditional attributes with respect to the set of decision attributes so as to find the most parsimonious parsimony.

## 4 Practical Analysis of Higher Education Curriculum Reform Based on Cognitive Psychology

### 4.1 Impact of Higher Education Curriculum Reform on Students' Mental Health Status

Higher education curriculum reform before and after the change in the mean value of the scores in the dimensions as shown in Table 1, students scored higher than before the curriculum reform, the mean value of the scores have different degrees of improvement, of which the largest change in the mean value of the scores is grateful for life (7.83), followed by stress frustration coping (4.94), and the smaller change is the psychological aspects of the love affair, in addition, students in the psychological aspects of learning, subjective well-being, and interpersonal relationship regulation scores changed more significantly, with mean changes of 3.8, 3.1, and 3.35, respectively.

**Table 1.** Change of mean value before and after higher education curriculum reform

	N	Pre-test	After-test	Mean change
Self-knowledge	175	35.14	36.53	1.39
Career Planning	175	28.38	29.18	0.8
Psychology of Learning	175	27.51	31.31	3.8
Emotional regulation	175	28.96	30.05	1.09
Human Relations	175	32.92	36.27	3.35
Love psychology	175	34.68	34.93	0.25
Coping with stress and frustration	175	34.30	39.24	4.94
Appreciate life	175	34.61	42.44	7.83
Subjective well-being	175	37.19	40.29	3.1
Adaptability	175	35.47	37.12	1.65

The results of the significance test are shown in Table 2, which shows that students' mental health in the seven dimensions of self-concept, learning psychology, interpersonal relationships, stress and frustration coping, gratitude for life, subjective well-being, and adaptability before and after the curriculum reform were improved to different degrees ( $p < 0.05^*$ ), indicating that after the reform of the higher education curriculum based on cognitive psychology, the students' mental health in the above seven dimensions was improved as a whole is more obvious. It is worth noting that the improvement of students' mental health status level in 5 dimensions of learning psychology, interpersonal relationship, stress and frustration coping, gratitude for life and subjective well-being is very significant ( $p < 0.01^{**}$ ). However, the test results of students' 3 dimensions of career planning, emotion regulation and relationship attitude showed no significant difference.

**Table 2.** Results of paired T-test

	N	Mean change	t	Sig.(Double tail)
Self-knowledge	175	1.39	2.384	0.022*
Career Planning	175	0.8	0.433	0.768
Psychology of Learning	175	3.8	4.746	0.006**
Emotional regulation	175	1.09	0.195	0.734
Human Relations	175	3.35	5.822	0.003**
Love psychology	175	0.25	0.042	0.835
Coping with stress and frustration	175	4.94	3.573	0.001**
Appreciate life	175	7.83	17.305	0.000**
Subjective well-being	175	3.1	3.641	0.003**
Adaptability	175	1.65	2.015	0.037*

## 4.2 Evaluation of Higher Education Programs

### 4.2.1 Correlation analysis

The four indicators for evaluating the effectiveness of the course (course construction, teacher teaching, student subjectivity, and student gains) were paired in two combinations, and the correlation of each group was explored separately using the statistical method of product-difference correlation.

The correlation statistics between the four evaluation indicators were obtained after the test and organized as shown in Table 3. The results of data analysis show that there is a linear correlation between students' evaluation of the blended mental health course. Curriculum reform, teacher teaching and student subjectivity all have a very significant impact on student gains, and in terms of the degree of impact, student subjectivity has the greatest impact on student learning gains, with a correlation coefficient of  $r=0.964^{**}$ , and teacher teaching has the second greatest impact, with a correlation coefficient of  $r=0.949^{**}$ . In addition, course construction and teacher teaching also have a significant effect on the play of students' subjectivity, with course construction having the greatest effect on it, with a correlation coefficient of  $r=0.948^{**}$ , and teacher teaching having a relatively small effect on it,  $r=0.934^{**}$ . At the same time, course construction itself also affects teacher teaching with a correlation coefficient of  $r=0.956^{**}$ .

The synthesis of the results of the research data above shows that the play of students' subjectivity is the biggest factor affecting the harvest of the course, followed by teachers' teaching, and curriculum reform has a relatively small impact on it. Students' subjectivity play in the course is susceptible to the influence of curriculum reform, and the evaluation of teachers' teaching has less influence. Students' evaluation of teachers' teaching is easily influenced by the evaluation of curriculum reform. Therefore, in order to promote the improvement of students' course gains in the teaching of higher education courses, it is necessary to ensure that students give full play to their initiative and mobility in the classroom. At the same time, the students' subjectivity to play by the significant impact of the reform of the higher education curriculum, and thus the need to refine the curriculum design, especially the arrangement of online and offline teaching activities, the need to carry out in-depth knowledge modeling, the design of practical teaching activities and enhancement of motivation design, so that the reform of the higher education curriculum based on cognitive psychology can maximize the guarantee that the students give full play to their subjectivity in the classroom.

**Table 3.** Correlation analysis among the four evaluation indicators

		Curriculum reform	Teacher teaching	Student subjectivity	Student harvest
Curriculum reform	Pearson	1	0.956**	0.948**	0.940**
	Sig.(Double tail)		0.000	0.000	0.000
Teacher teaching	Pearson	0.956**	1	0.933**	0.949**
	Sig.(Double tail)	0.000		0.000	0.000
Student subjectivity	Pearson	0.948**	0.934**	1	0.964**
	Sig.(Double tail)	0.000	0.000		0.000
Student harvest	Pearson	0.940**	0.949**	0.964**	1
	Sig.(Double tail)	0.000	0.000	0.000	

#### 4.2.2 Impact of sub-capacities

Taking the English course in high education as an example, we analyze the impact of the high education curriculum reform based on cognitive psychology on students' sub-competence by comparing the writing scores before and after the curriculum reform in the five aspects of article content, article organization, article vocabulary, article language, and writing specification.

Table 4 shows the descriptive statistics in various aspects before and after the course reform, it can be seen that in terms of content, there is a slight difference between the pre- and post-tests, the mean of the pre-measurement is 2.94 lower than the achievement post-test mean of 3.52, from the

magnitude of the value can be seen, there is a slight difference between the two, but whether it reaches the level of statistical difference.

**Table 4.** Pairs of sample statistics

		N	Mean	Standard deviation	Standard error
Content	Pre-test	175	2.73	1.241	0.029
	After-test	175	3.67	1.079	0.190
Structural aspects	Pre-test	175	2.74	1.116	0.111
	After-test	175	3.64	0.868	0.212
Vocabulary	Pre-test	175	3.00	1.152	0.117
	After-test	175	3.80	0.878	0.232
Language	Pre-test	175	2.97	0.930	0.131
	After-test	175	3.14	0.719	0.158
handwriting	Pre-test	175	3.27	0.870	0.120
	After-test	175	3.36	0.677	0.148

The results of the paired samples test comparing the pre and post-tests are shown in Table 5. Regarding article content, it can be seen that the post-test score of 3.67 is much higher than its pre-test score of 2.73, and the paired samples t-test result, which is much less than 0.05, also proves that there is a significant difference between before and after the reform of the course, so it can be seen from the two data that the application of cognitive psychology to the reform of the English language curriculum in higher education has a significant increase in the ability of students in the area of article content. Regarding article organization, the pre-test scores were lower than the post-test scores by 0.9, and the sig value of 0.002 proved that the scores of the writing test changed significantly before and after the curriculum reform. Regarding article vocabulary, the score of 3.8 in the posttest is not only much higher than the pretest, but So it can be seen from the data that cognitive psychology applied to the reform of higher education English curriculum has significantly improved students' ability in terms of article content, organization, and vocabulary.

In terms of article language and writing standardization, although the Sig value is greater than 0.5, showing that there is no significant change before and after the experiment, the mean difference between these two items is positive. It shows that curriculum reform using cognitive psychology has a positive effect on students in both article language and writing standardization.

**Table 5.** Pairwise sample test

	Paired difference					t	df	Sig.(Double tail)
	Mean value	Standard deviation	Standard error	95% confidence interval for the difference				
				Floor limit	Upper limit			
Content	-0.832	0.607	0.074	-0.987	-0.613	-9.214	166	0.002
Structural aspects	-0.924	0.726	0.082	-1.111	-0.665	-8.657	166	0.000
Vocabulary	-1.005	0.549	0.076	-1.162	-0.842	-13.048	166	0.001
Language	-0.011	0.974	0.137	-0.305	0.240	-0.155	166	0.714
Handwriting	-0.020	0.654	0.090	-0.207	0.147	-0.159	166	0.825

### 4.2.3 Student evaluation

The results of the student's evaluation of the cognitive psychology-based higher education course are shown in Table 6. The lowest score was "the course objectives are set in a challenging way that motivates me to learn" ( $3.90 \pm 0.86$ ). The item with the highest score is "I can form equal communication and dialog with the teacher in the classroom" ( $4.42 \pm 0.89$ ). The results of the data show that students are more positive about the formation of equal communication and dialog between teachers and students in the reformed curriculum.

It can be seen that higher education courses based on cognitive psychology are relatively useful in stimulating equal communication between teachers and students, but they need to be improved in terms of the challenging nature of the learning objectives. The students were more positive about the teaching of the course, the course content, the practice of the course, and the embodiment of subjectivity in the course.

**Table 6.** Evaluation statistics of higher education curriculum reform

Item	M $\pm$ SD
The teaching content of the course is clear and clear, the focus is prominent, and the hierarchy is clear.	4.28 $\pm$ 0.76
The course content is cutting-edge.	4.24 $\pm$ 0.79
The course objectives are challenging, which can stimulate my learning motivation.	3.90 $\pm$ 0.86
Curriculum design theory and practice teaching arrangement is reasonable.	4.18 $\pm$ 1.01
They can form equal communication and dialogue with teachers in class.	4.42 $\pm$ 0.89
The knowledge learned in the course can effectively help to solve the psychological problems in life.	4.04 $\pm$ 0.94
The teaching form of the course can meet the learning needs.	4.27 $\pm$ 0.81
The teaching process of the course effectively reflects the objectives of the course.	4.17 $\pm$ 1.07
The course teaching fully embodies the student's main position.	4.31 $\pm$ 0.89
The overall classroom learning atmosphere is good.	4.53 $\pm$ 0.90
Some teaching cases in the course will give me a feeling of empathy.	4.26 $\pm$ 0.81
Higher education curriculum reform	46.60 $\pm$ 9.73

## 5 Conclusion

This study shows that cognitive psychology-based curriculum reform in higher education significantly improves students' mental health and learning outcomes. After the curriculum reform, students' scores on several mental health dimensions were significantly improved, especially in the areas of gratitude for life and stress and frustration coping. Meanwhile, the analysis of course evaluation reveals that there is a significant linear correlation between course construction, teacher teaching, student subjectivity, and student gains, indicating that student subjectivity plays a decisive role in course gains. Taken together, the curriculum reform based on cognitive psychology effectively promotes the overall development of students in terms of mental health and learning effectiveness and provides valuable theoretical and practical guidance for the design of future higher education courses.

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